Economic Analysis of the Proposed Dust Testing and Clearance Amendments to the TSCA Lead Renovation, Repair, and Painting Program 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.

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Executive Summary

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 proposed LRRP Clearance Rule changes the LRRP program by requiring renovators to perform dust wipe testing for a subset of renovation jobs, and requiring them to re-clean and re-test for a second subset of renovation jobs if the tests show that lead dust levels exceed the established clearance standards.

Background

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.

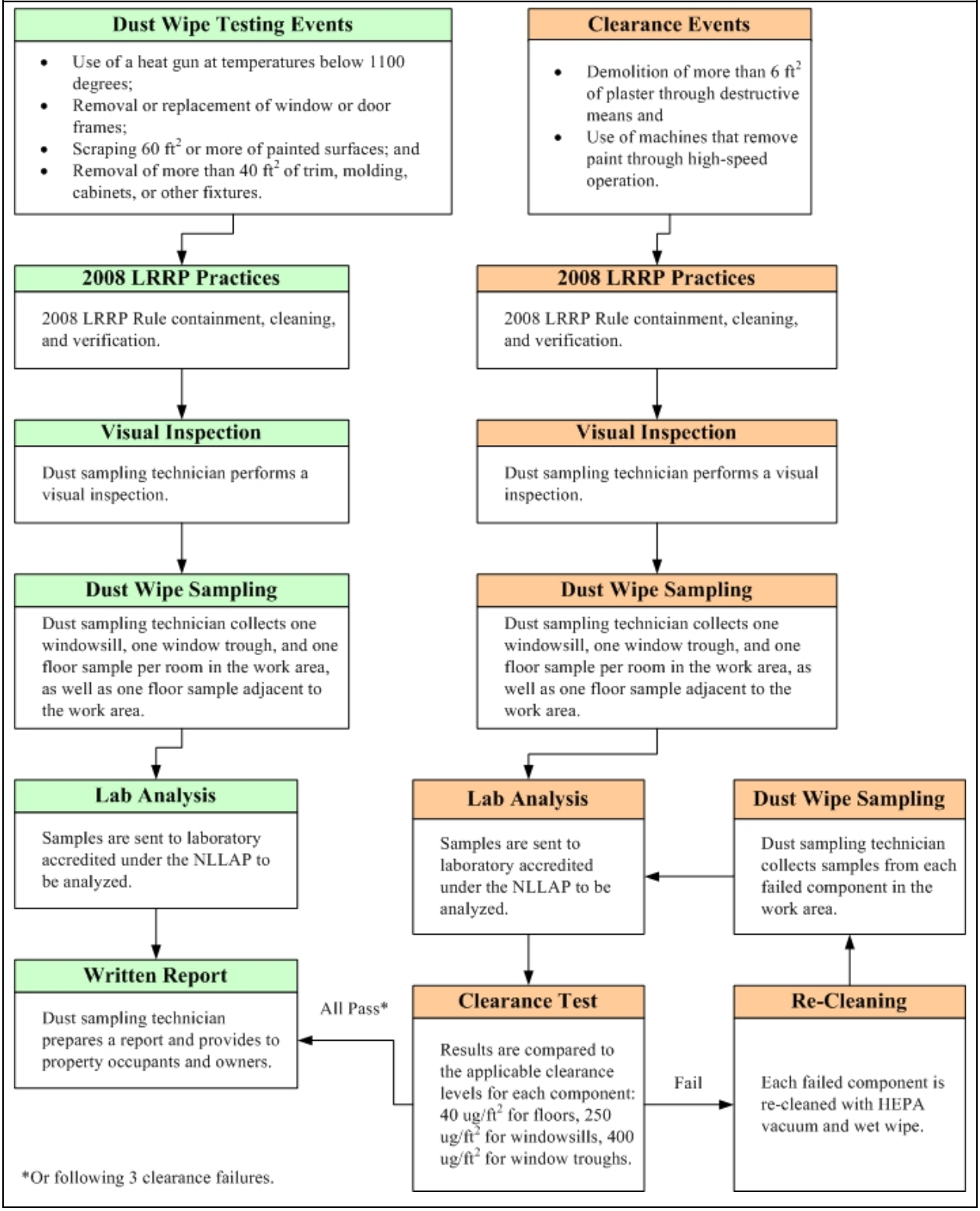
The LRRP rule for target housing and COFs was promulgated in 2008 (73 FR 21692) and is codified in Part 745 of Title 40 of the Code of Federal Regulations (CFR). The rule was promulgated under the authority of §402(c) of the Toxic Substances Control Act (TSCA). The existing LRRP regulations require entities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

Overview of the LRRP Clearance Rule

Figure ES-1 provides a summary of the dust wipe testing and clearance requirements of the proposed rule, and their relationship with the requirements of the 2008 LRRP rule. The proposed LRRP Clearance Rule would require dust wipe testing on uncarpeted floors and on window sills and troughs after the following types of renovations that disturb lead-based paint: removing more than 40 ft^2 of trim, molding, cabinets, or other fixtures; removing or replacing of window or door frames; scraping 60 ft^2 or more of painted surfaces; or using a heat gun at temperatures below 1100 degrees Fahrenheit[1]. Renovations using machines that remove lead-based paint through high speed operation (such as power sanders or abrasive blasting), or involving demolition or removal of more than 6 ft^2 of plaster walls with lead-based paint through destructive means, would require firms to demonstrate – through dust wipe testing – that they have met clearance standards before the renovation will be considered complete. (For interior surfaces, the clearance standards are 40 $\mu g/ft^2$ on floors, 250 $\mu g/ft^2$ on interior windowsills, and 400 $\mu g/ft^2$ on window troughs.) If any of the dust wipe test results exceed the interior clearance standards, the firm will have to re-clean and re-test the area that failed. The proposed rule allows renovation firms to stop after the second failed clearance test, regardless of the result, if the renovation firm did not agree to refinish the surface that is failing clearance as part of the renovation contract. In such instances, the renovation firm would only have to re-clean and test the surface again, no matter what the second dust wipe testing result is. In contrast, the economic analysis assumes that if the second dust wipe testing result fails the clearance test, the renovation firm would have to re-clean the surface a second time and test the surface a third time. Therefore, the economic analysis overestimates the cost of the clearance requirement.

[1] Under the 2008 LRRP rule at 40 CFR 745.85(a)(3)(iii), operating a heat gun on lead-based paint is permitted only at temperatures below 1100 degrees Fahrenheit.

Figure ES-1: Summary of Required Activities for Performing Dust Wipe Testing and Clearance



Options Analyzed

This economic analysis considers several regulatory options, which are described below and summarized in Table ES-1 and Table ES-2.

1. **Low Threshold Option**
   - Dust wipe testing is required for renovations that disturb more than 6 square feet of lead-based paint through removing trim, molding, cabinets, or other fixtures; removal or replacement of window or door frames; scraping painted surfaces; or the use of a heat gun.
   - Clearance is required for renovations that disturb lead-based paint through:
     - High-speed machine removal of paint larger than 6 square feet; or
     - Plaster removal using destructive means, larger than 6 square feet.

2. **Proposed Rule Threshold Option**
   - Dust wipe testing is required for renovations that disturb lead-based paint through:
     - Removal of more than 40 square feet of trim, molding, cabinets, or other fixtures;
     - Scraping more than 60 square feet of paint;
     - Using a heat gun to remove more than 6 square feet of paint; or
     - Removing a window frame or door frame.
   - Clearance is required for renovations that disturb lead-based paint through:
     - High-speed machine removal of more than 6 square feet of paint; or
     - Demolition or removal using destructive means of more than 6 square feet of plaster.

3. **High Threshold Option**
   - Dust wipe testing is required for renovations that disturb lead-based paint through:
     - Removal of more than 80 square feet of trim, molding, cabinets, or other fixtures;
     - Scraping more than 120 square feet of paint;
     - Using a heat gun to remove more than 60 square feet of paint; or
     - Disturbing paint by removing a window frame or door frame.
   - Clearance is required for renovations that disturb lead-based paint through:
     - High-speed machine removal of more than 60 square feet of paint; or
     - Demolition or removal using destructive means of more than 60 square feet of plaster.

4. **Third Party Sampling Option**
   - Applies to the same renovations and size thresholds as the proposed rule.
   - Dust wipe testing and clearance are required in the same instances as the proposed rule option but dust wipe sampling must be performed by an independent third party.

5. **Dust Wipe Testing Only Option**
   - Applies to the same renovations and size thresholds as the proposed rule.
   - Achieving clearance is not required.

6. **Clearance Only Option**
   - Applies to the same renovations and size thresholds as the proposed rule.
   - Clearance must be achieved in all of these renovations.

Table ES-1: Options Included in Economic Analysis			
Option	**Size Threshold**	**Dust Wipe Testing and Clearance**	**Third Party Requirement**
Low Threshold Option	Size thresholds are lower or equal to proposed rule	Dust wipe testing is required for: 1. cabinet and trim events 2. scraping of paint 3. heat gun removal of paint 4. Window frame or door frame removal events Clearance is required for: 1. high-speed machine removal of paint 2. plaster removal using destructive means	No
Proposed Rule	Size thresholds are as proposed		No
High Threshold Option	Size thresholds are higher or equal to proposed rule		No
Third Party Sampling Option	Same as Proposed.	Dust wipe testing and clearance are required in the same instances as proposed but dust wipe sampling must be performed by an independent third party.	Yes
Dust Wipe Testing Only Option	Same as Proposed.	Dust wipe testing is required in instances where dust wipe testing or clearance is required under the proposed option.	No
Clearance Only Option	Same as Proposed.	Clearance is required in instances where dust wipe testing or clearance is required under the proposed option.	No

Table ES-2: Size Thresholds of the Options Included in Economic Analysis				
		Threshold (square feet)		
Activity	**Event Type**	**Low**	**Proposed**	**High**
Dust Wipe Testing Only	Trim/Molding/Cabinet Removal	6	40	80
	Window / Door Frame Removal	n/a	n/a	n/a
	Painting w/ Scraping	6	60	120
	Painting w/ Heat Gun	6	6	60
Both Dust Wipe Testing and Clearance	Paint Removal w/ High-Speed Machines [a]	6	6	60
	Plaster Removal w/ Destructive Means	6	6	60

[a] Under the 2008 LRRP rule at 40 CFR 745.85(a)(3)(ii), the use of machines that remove lead-based paint through high speed operation such as sanding, grinding, power planing, needle gun, abrasive blasting, or sandblasting, is prohibited unless such machines are used with HEPA exhaust control.

Number of Events

The proposed rule would affect approximately 1.6 million renovations per year. By comparison, the LRRP program applies to 18.7 million renovations each year, of which 7.4 million use lead-safe work practices (because they test positive for lead-based paint, and are conducted in compliance with the rule). [2]

Table ES-3 indicates the estimated number of renovation events affected by the different options by type of renovation and threshold size. In about 1.5 million renovations (96% of those affected by the proposed rule), dust wipe testing would be required without a requirement to achieve clearance. The most common

[2] The number of events is estimated under a baseline scenario where the opt-out provision of the 2008 LRRP rule has been eliminated, as was proposed in October 2009 (74 FR 55506).

single event activities covered by the rule are window or door frame removal, followed by trim, molding, or cabinet removal. But the most common regulated activity overall involves multiple regulated activities occurring during the course of a single job (e.g., a renovation with both window frame removal and trim removal).

Table ES-3: Thousands of Regulated Events by Event Type and Option[a] – First Year

Activity	Event Type	Low Threshold	Proposed Threshold	High Threshold
Dust Wipe Testing Only	Heat gun, < 1000 degrees	4	4	<1
	Window/door frame removal	484	514	545
	Scraping	40	2	<1
	Trim, molding, cabinet removal	687	437	207
	Multiple activity events[b]	607	572	449
	Subtotal, dust wipe testing	*1,822*	*1,528*	*1,201*
Both Dust Wipe Testing and Clearance	High speed machines	4	4	2
	Plaster demolition through destructive means	21	29	31
	Multiple activity events[b]	44	36	25
	Subtotal, clearance events	*69*	*69*	*58*
Total, All Event Types		**1,891**	**1,597**	**1,259**

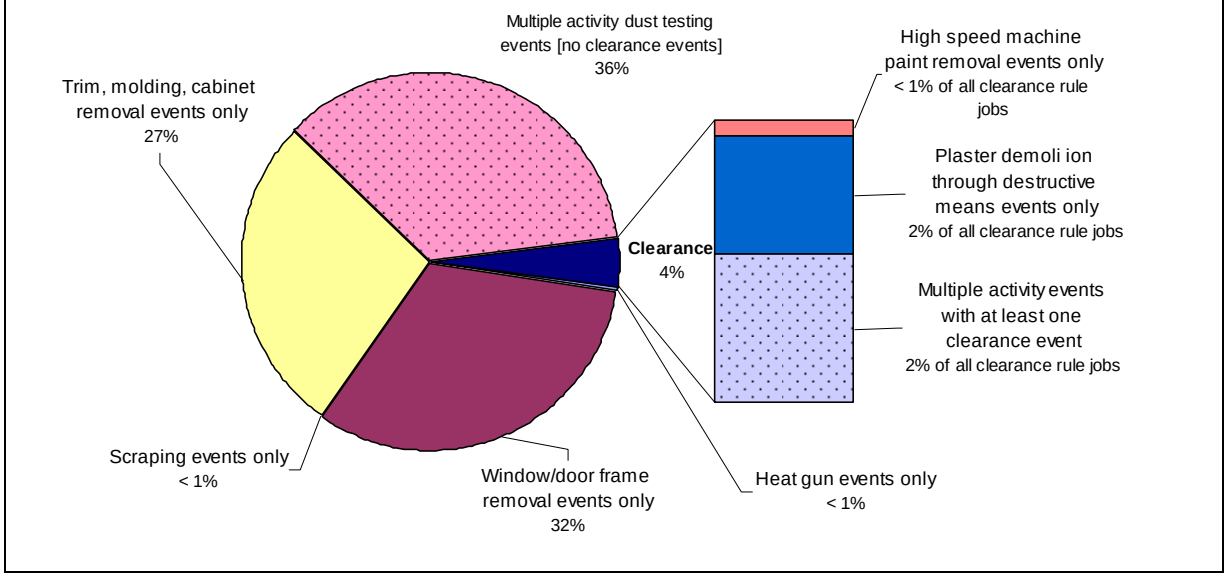
Totals may not add due to rounding.

[a] The third party sampling option, the dust wipe testing only option, and the clearance only option impact the same total number of events as the proposed threshold option.

[b] Multiple event types occurring during the course of a single job (e.g., a renovation with both window frame removal and trim removal). Because the probability of multiple-activity events varies with the size threshold, the number of events for single-event activities is not consistent across size thresholds.

Figure ES-2 shows the distribution of events by event type for the proposed threshold.

Figure ES-2: Total First Year Events by Type - Proposed Threshold



Renovations requiring clearance make up about 4% of the renovations affected by the proposed rule (and 1% of all renovations using lead-safe work practices under the LRRP program). Multiple activity events (including combinations of clearance events and dust wipe testing only events) are the most common activities requiring clearance, followed by the demolition or removal of plaster through destructive means, and using machines that remove paint through high speed operations.

There are an estimated 1.9 million regulated events per year under the low threshold option and 1.3 million regulated events per year under the high threshold option. The distribution of event types under these alternate options (in terms of the relative frequency of different single and multiple event activities) is similar to the proposed threshold option. There are an estimated 1.6 million regulated events per year under the third party sampling option, the dust wipe testing only option, and the clearance only option, the same as under the proposed threshold option.

Costs of the Proposed Rule

Dust wipe testing costs are expected to vary according to the number of samples taken, which depend on the number of rooms in the work area and whether or not the room is carpeted. For a typical one-room renovation event, four samples would be required (window sill, window trough, workroom floor, and adjacent room floor). For a renovation event where both the renovated room and the adjacent room are carpeted, only two samples would be required (window sill and window trough). Each additional room inside the work area will add two to three dust wipes depending on whether or not the room is carpeted and whether or not there are windows in the work area. However samples are not required for more than four rooms in a unit's work area.

All entities that conduct renovations covered by the proposed Clearance Rule will have to use a trained dust sampling technician to take dust samples and have them tested. (A trained dust sampling technician is an individual who has successfully completed a dust sampling technician course accredited by EPA or an EPA-authorized State or Tribal program.) Renovators can either hire a third-party dust sampling technician or have themselves or one of their employees trained as a dust sampling technician. Which approach they choose may depend on several factors, including the number of renovations they perform each year covered by the proposed rule.

The average cost for a renovation firm to hire a third-party lead evaluation firm to take the dust wipe samples, send them to a lab for testing, and provide a one-page report is estimated to be a fixed cost of $158 and a variable cost of $26 per sample. Thus, the cost to hire a third party to take four dust samples, send them to a lab for analysis, and provide a short report is estimated to be $262. Given that some covered renovations take place in more than one room (so that more than four samples may be required, depending on whether uncarpeted floors and windows are present), the average cost of the dust testing requirement is nearly $300 per job if a third party dust sampling technician is used.

Firms performing multiple renovations a year where dust wipe testing is required can save money by having the renovator or a worker trained as a dust sampling technician. This requires taking an eight hour initial training course (and a four hour refresher course every five years thereafter), at an estimated annualized cost of $146 per year. For renovators that perform multiple covered renovations per year, the savings from using their own dust sampling technician are much greater than the annualized cost of the dust sampling technician training. Dust testing for these samples will cost these renovators an average of approximately $170 per job (including training costs), a savings of $130 per job compared to using a third party dust sampling technician. The analysis assumes that over 233,000 renovators will choose to become trained as dust sampling technicians so that they can collect samples for their own renovations. The proposed rule does not require them to become trained, but many renovators may find it more economical to do so rather than hiring a third party to take the samples.

The cost of dust wipe testing for a job will vary based on the number of surfaces that must be tested, and whether the dust sampling is done in-house or by a third-party firm. Overall, typical costs are estimated to vary from $120 to $340 per job. A typical renovator will have 3 to 38 jobs per year requiring dust wipe sampling, with an average of 7 such jobs per year.

For clearance events (use of a high-speed paint removal machine or demolition or destructive removal of over 6 sq. ft. of plaster), renovators would incur similar dust wipe testing costs, in terms of the cost per test. Re-cleaning and re-sampling are only necessary for a subset of events in which a surface fails the first round of clearance testing. In the event of a failed clearance test, only the component(s) that failed the tests must be re-cleaned. For example, if the window sill sample failed clearance but the window troughs and the floors passed, the window sill must be re-cleaned but the window troughs and the floors do not need to be re-cleaned. These re-cleaning costs vary from job to job, depending on the number and type of components that failed and the size of the space that must be cleaned. Overall, re-cleaning costs are estimated to vary from $43 to up to $5,172 per job, although the costs for a typical job are expected to be at the very low end of the range. (The high end of the range reflects a COF where 14 rooms are renovated and where all floor, sill and trough samples fail two rounds of clearance testing and are re-cleaned twice. This is an overestimate, since the rule does not require a second re-cleaning or a third round of testing.)

Table ES-4 summarizes the annualized work practice costs by event type for the three different threshold options. This table does not include training costs for renovators who choose to become trained as a dust sampling technician, since the training costs are not specific to individual event types.

Table ES-4: Total Incremental Annualized Work Practice Costs by Event Type (3 percent discount rate, million 2008$)

Activity	Event Type	Low Threshold	Proposed Threshold	High Threshold
Dust Wipe Testing	Heat gun, < 1000 degrees	<$1	$1	<$1
	Window/door frame removal	$70	$75	$79
	Scraping	$5	<$1	<$1
	Trim, molding, cabinet removal	$93	$59	$28
	Multiple activity events[a]	$99	$94	$75
	Subtotal, dust wipe testing	*$268*	*$228*	*$182*
Dust Wipe Testing and Clearance	High speed machines	$1	$1	$1
	Plaster demolition through destructive means	$4	$5	$6
	Multiple activity events[a]	$10	$9	$6
	Subtotal, clearance events	*$15*	*$14*	*$12*
Total, All Event Types		**$283**	**$242**	**$195**

Totals may not add due to rounding.

[a] Multiple event types occurring during the course of a single job (e.g., a renovation with both window frame removal and trim removal).

Table ES-5 shows the total costs (including both work practice costs and training costs) for all six options. Costs are higher in the first year to reflect the renovators who choose to become trained as dust sampling technicians in order to take their own dust wipe samples.

Table ES-5: Total Incremental Costs of Proposed LRRP Clearance Rule (millions 2008$)				
			Annualized Total	
Option	Year 1	Year 2	3%	7%
Low Threshold	$435	$321	$312	$336
Proposed Threshold	**$393**	**$279**	**$272**	**$293**
High Threshold	$343	$229	$224	$242
Third Party Sampling	$451	$449	$431	$459
Dust Wipe Testing Only	$388	$274	$268	$288
Clearance Only	$492	$377	$367	$394

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 proposed LRRP Clearance Rule would require dust wipe testing after many of the renovation, repair, and painting (RRP) activities regulated under the 2008 LRRP rule, and would require clearance after a smaller subset of RRP activities. The clearance requirements of the proposed LRRP Clearance Rule are expected to result in lower exposures to dust lead by reducing the amount of dust lead left behind after RRP activities. Two types of benefits are expected to be realized from the proposed dust wipe testing requirements. The first type is the direct benefits of the information to the owners and occupants, which includes the value of the information on dust lead levels remaining in the renovation work area. For building owners and occupants, this information is likely to improve their understanding and awareness of dust lead hazards. It will also greatly improve their ability to make further risk management decisions. This information is particularly critical where dust lead levels approach or exceed the regulatory hazard standards. The second benefit expected to be realized from the proposed dust wipe testing requirements stems from changed behavior on the part of renovation firms. EPA believes that dust wipe testing results will also provide valuable feedback to renovation firms on how well they are cleaning up after renovations. It is likely that the specific dust lead levels contained in dust wipe testing results will increase renovation firm cleaning efficiency. Renovation firms will be incentivized to lower the dust lead levels remaining after renovation jobs, even if the levels are at or near the regulatory standards. Because proper cleanup plays such a vital role in the minimization of dust lead hazards created by renovations, providing information on dust lead levels remaining after renovations to building owners and occupants will serve as an incentive for firms to perform post-renovation cleaning efficiently and thoroughly, reducing the amount of dust lead left behind after RRP.

The proposed rule will protect children and adults residing in target housing and attending a COF from exposure to lead dust from renovations in a variety of situations. It will 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. The proposed rule decreases the likelihood of lead hazards being present when new occupants move into the home. And the proposed rule will also benefit individuals visiting a friend, relative, or caregiver's house where a renovation has been performed.

The number of individuals residing in target housing and attending COFs with renovations affected under the different options is shown in Table ES-6. The proposed rule would protect 8.4 million such individuals per year, including 809,000 children under the age of 6 and 96,000 pregnant women. (This is 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.) The estimates are limited to residents in target housing and children attending COFs, and do not include other groups such as individuals who move into housing after a renovation has been performed, or who visit a friend or relative's house.

Table ES-6: Thousands of Occupants Per Year Protected Under Different Options					
Option	**Activity Performed**	**Children Under Age 6**	**Pregnant Women**	**Other Individuals Age 6 and Older**	**Total**
Low Threshold	Dust Wipe Testing	855	103	7,930	8,888
	Clearance	27	2	158	187
	Total	***882***	***105***	***8,088***	***9,075***
Proposed Threshold	Dust Wipe Testing	782	94	7,294	8,170
	Clearance	27	2	158	187
	Total	***809***	***96***	***7,451***	***8,356***
High Threshold	Dust Wipe Testing	682	81	6,377	7,140
	Clearance	24	2	130	156
	Total	***706***	***83***	***6,507***	***7,296***
Third Party Sampling	Dust Wipe Testing	782	94	7,294	8,170
	Clearance	27	2	158	187
	Total	***809***	***96***	***7,451***	***8,356***
Dust Wipe Testing Only	Dust Wipe Testing	809	96	7,451	8,356
Clearance Only	Clearance	809	96	7,451	8,356

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 proposed rule are small.

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.

Table ES-7 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 a total of approximately 203,000 small entities would be affected by the program, including nearly 203,000 small businesses with average impacts of 0.5 percent, about 200 small non-profits with average impacts of 0.1 percent, and over 100 small governments with average impacts of 0.004 percent. All of the small entity impact calculations assume that the small entities absorb all of the rule's costs, and that none of the costs are passed through to their customers.

Table ES-7: Aggregate Small Entity Impacts of the Proposed Rule		
	Total Number of Small Entities Affected (thousands)	**Average Impacts, All Small Entities**
Small Governments	0.1	0.004%
Non-Profit Organizations	0.2	0.1%
Small For-Profit Businesses	202.7	0.5%
Total	**203**	**0.5%**

The cost of the proposed rule to a typical small entity is estimated to average $1,200 per year, but will vary 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 average cost impact ranges from about 0.004 percent to 1.1 percent of revenues, depending on the industry sector.

Table ES-8: Typical-Year Number of Small Entities with RRP Events (Proposed Option)			
Description	**Entity Type**	**Number of Small Entities (thousands)**	**Average Cost-Impact Ratio**
Residential remodelers	Business	68.4	0.5%
Finish carpentry contractors	Business	48.6	0.8%
Tile and terrazzo contractors	Business	6.9	0.7%
Plumbing and HVAC contractors	Business	23.4	0.4%
Painting and wall covering contractors	Business	27.0	1.1%
Electrical contractors	Business	16.6	0.5%
Drywall and insulation contractors	Business	11.4	0.5%
Public School Districts	Government	0.1	0.004%
Private Schools	Non-Profit	0.1	0.08%
Daycare Centers	Non-Profit	0.1	0.2%
Non-Residential Landlords	Business	0.1	0.4%
Non-Residential Contractors (working in public or commercial building COFs)	Business	0.3	0.4%
Total		**203**	**0.5%**

Table ES-9 provides additional information on potential impacts on small residential construction establishments. 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-9, there are 151,000 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 $700 each. This represents 0.7% to 2.6% of reported revenues, depending on the industry sector.

Table ES-9: Cost-to-Revenue Ratios: Small Residential Construction Establishments (Proposed Option)				
Category	**NAICS**	**Industry Description**	**Number of Small Entities (thousands)**	**Avg. Cost-Impact Ratio**
Non-Employers	236118	Residential remodelers	48	1.9%
	238350	Finish carpentry contractors	41	2.1%
	238340	Tile and terrazzo contractors	6	1.7%
	238220	Plumbing and HVAC contractors	13	1.1%
	238320	Painting and wall covering contractors	23	2.6%
	238210	Electrical contractors	10	1.6%
	238310	Drywall and insulation contractors	10	0.7%
	Total, Small Construction Establishments		**151**	**1.7%**
Employers	236118	Residential remodelers	20	0.3%
	238350	Finish carpentry contractors	8	0.4%
	238340	Tile and terrazzo contractors	1	0.4%
	238220	Plumbing and HVAC contractors	10	0.3%
	238320	Painting and wall covering contractors	4	0.6%
	238210	Electrical contractors	6	0.4%
	238310	Drywall and insulation contractors	2	0.4%
	Total, Small Construction Establishments		**52**	**0.4%**
Employers and Non-Employers Combined	236118	Residential remodelers	68	0.5%
	238350	Finish carpentry contractors	49	0.8%
	238340	Tile and terrazzo contractors	7	0.7%
	238220	Plumbing and HVAC contractors	23	0.4%
	238320	Painting and wall covering contractors	27	1.1%
	238210	Electrical contractors	17	0.5%
	238310	Drywall and insulation contractors	11	0.5%
	Total, Small Construction Establishments		**202**	**0.5%**

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 LRRP Clearance Rule includes the following changes to the LRRP program: (1) a requirement to perform dust wipe testing for a subset of renovation activities, and (2) a requirement to perform dust wipe testing and achieve clearance for a second subset of renovation activities where the quantity and characteristics of the dust make it hard to clean up.

1.1 Purpose of the LRRP Rule Revisions

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.

The proposed rule will require renovation firms to perform dust wipe testing after certain types of renovation activities and to provide copies of the test results to the owners and occupants of the renovated buildings. These requirements will serve to inform the owners and occupants of the remaining post-renovation lead-dust levels. In instances when clearance must be achieved, owners and occupants would be provided with the information that the renovated areas met lead-dust level standards after cleaning. The increased information provided to owners and occupants of renovated buildings will further protect individuals (including children under age 6 and pregnant women), who visit, move into, or live adjacent to target housing or COFs renovated under the existing LRRP requirements, from exposure to lead hazards due to renovation 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 three primary options considered in this analysis only differ in the size thresholds that trigger the rule's requirements when performing certain renovation activities. Table 1-1 summarizes the options considered in this analysis; they are described in more detail below.

1. Low Threshold Option
   - All event types requiring dust wipe testing where the amount of lead-based paint disturbed is larger than 6 square feet.
   - Clearance is required for:
     - high-speed machine removal of paint larger than 6 square feet, and
     - plaster removal using destructive means, larger than 6 square feet.
2. Proposed Threshold Option
   - Dust wipe testing is required for:
     - cabinet and trim events larger than 40 square feet,
     - scraping of paint larger than 60 square feet,
     - heat gun removal of more than 6 square feet
     - Window frame or door frame removal events
   - Clearance is required for:
     - high-speed machine removal of paint larger than 6 square feet, and
     - plaster removal using destructive means, larger than 6 square feet.
3. High Threshold Option
   - Dust wipe testing is required for:
     - cabinet and trim events larger than 80 square feet,
     - scraping or heat gun removal of paint larger than 120 square feet, and
     - window frame or door frame removal events.
   - Clearance is required for:
     - high-speed machine removal of paint larger than 60 square feet, and
     - plaster removal using destructive means, larger than 60 square feet.

There are three alternative options in addition to the three primary options: (1) an option where third party dust wipe testing and clearance is required, (2) an option where dust wipe testing is required in lieu of the clearance required under the proposed option, (3) an option where clearance is required in lieu of the dust wipe testing required under the proposed option.

Table 1-1: Options Included in Economic Analysis			
Option	**Size Threshold**	**Dust Wipe Testing and Clearance**	**Third Party Requirement**
Low Threshold Option	Size thresholds are lower or equal to proposed rule	Dust wipe testing is required for: 1. cabinet and trim events 2. scraping of paint 3. heat gun removal of paint 4. Window frame or door frame removal events Clearance is required for: 1. high-speed machine removal of paint 2. plaster removal using destructive means	No
Proposed Rule	Size thresholds are as proposed		No
High Threshold Option	Size thresholds are higher or equal to proposed rule		No
Third Party Sampling Option	Same as Proposed.	Dust wipe testing and clearance are required in the same instances as proposed but dust wipe sampling must be performed by a third party.	Yes
Dust Wipe Testing Only Option	Same as Proposed.	Dust wipe testing is required in instances where dust wipe testing or clearance is required under the proposed option.	No
Clearance Only Option	Same as Proposed.	Clearance is required in instances where dust wipe testing or clearance is required under the proposed option.	No

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 the methodology for estimating the two general categories of costs incurred under the proposed rule: dust sampling technician training costs, and dust wipe testing and clearance 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 describes the benefits of the proposed rule in qualitative terms, including potential benefits to adults. Estimates of the number of children and adults who may experience reduced lead exposures due to the dust wipe testing and clearance requirements are also presented.

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.

On October 28, 2009, EPA issued a proposed rule to expand the coverage of the 2008 Lead Renovation, Repair and Painting Rule. The new rule proposed to eliminate a provision that exempted some housing from the rule's requirement that contractors be trained and certified and use lead-safe work practices when renovating, repairing or painting a pre-1978 home.

The proposed LRRP Clearance Rule includes additional revisions to the LRRP program, including: (1) a requirement for dust wipe testing for a subset of renovation activities, and (2) a requirement for dust wipe testing and clearance for a subset of renovation activities in which the quantity and characteristics of the dust make it difficult to clean up.

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 8 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 six 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
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
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
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, Commercial Building Construction contractors have the largest number of employees per establishment (19.2 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
238210	Electrical contractors	62,586	771,184	12.3
238220	Plumbing and HVAC contractors	87,501	974,368	11.1
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
	Total, All sectors	372,623	3,566,772	9.6

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, 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 3.6 million people work for the 372,623 establishments in the potentially affected industries. About 74 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

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

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 nvolved 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%
238210	Electrical Contractors	771,184	606,403	79%
238220	Plumbing and HVAC Contractors	974,368	712,452	73%
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%
Total		3,566,772	2,625,599	74%

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 over 1 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 8 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
238210	Electrical contractors	102,219	$3,834,347
238220	Plumbing and HVAC contractors	110,183	$5,920,986
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

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
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
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
	Total, all industries	**$385,495,354**	**372,623**	**$8,573**	**$125,499,416**	**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 Drywall and Insulation contractors industry netting the second largest value ($1,380,000). 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%
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%
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%
	Total				
Total	Revenues < $10 million	98%	68%	49%	58%
Total	Revenues > $10 million	2%	32%	51%	42%

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 eight NAICS codes is greatly skewed toward smaller establishments. In four out of eight 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 68 percent of employment overall. The distribution of the net

[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.

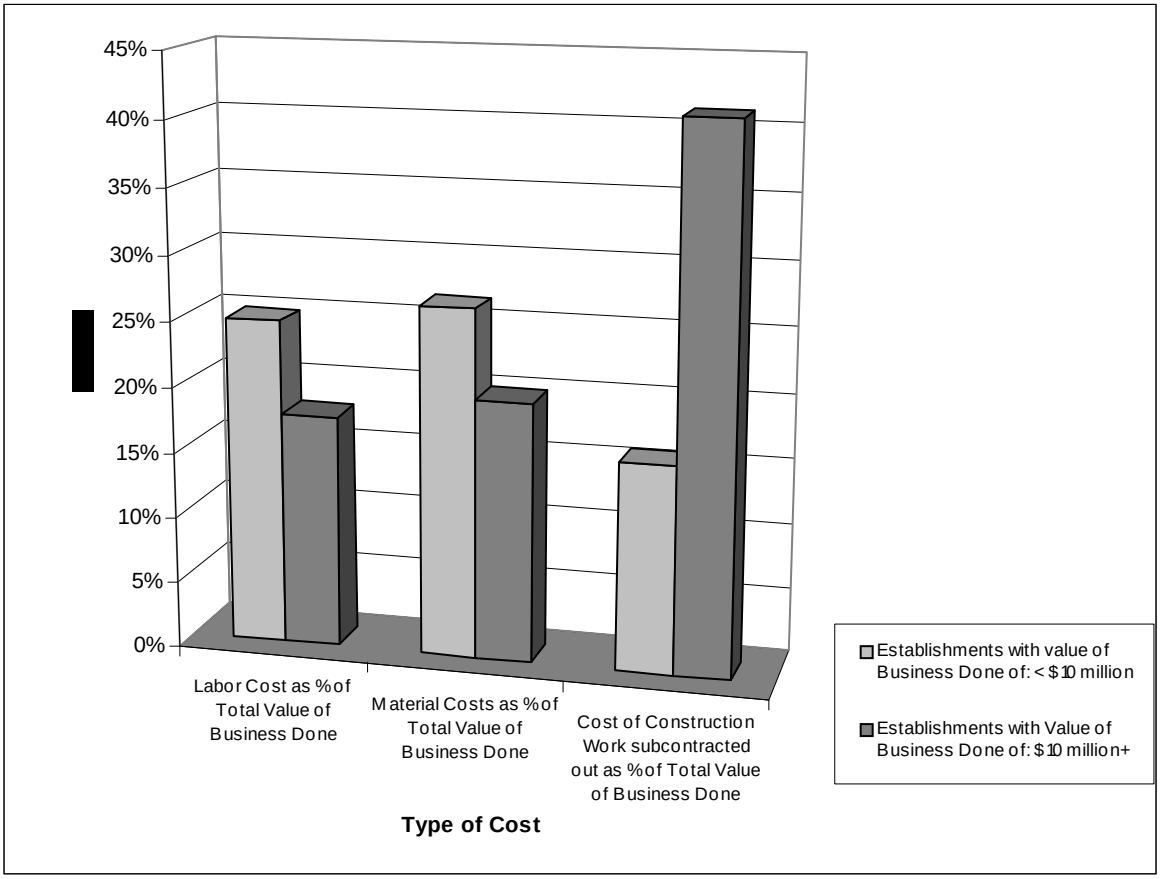
value of construction work and the total value of business done is skewed toward smaller establishments in a manner similar to the distribution of employees. Establishments with revenues of less than $10 million account for between 30 and 92 percent of the net value of construction work and between 24 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 60 percent of the net value of construction work and 60 percent 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.

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		

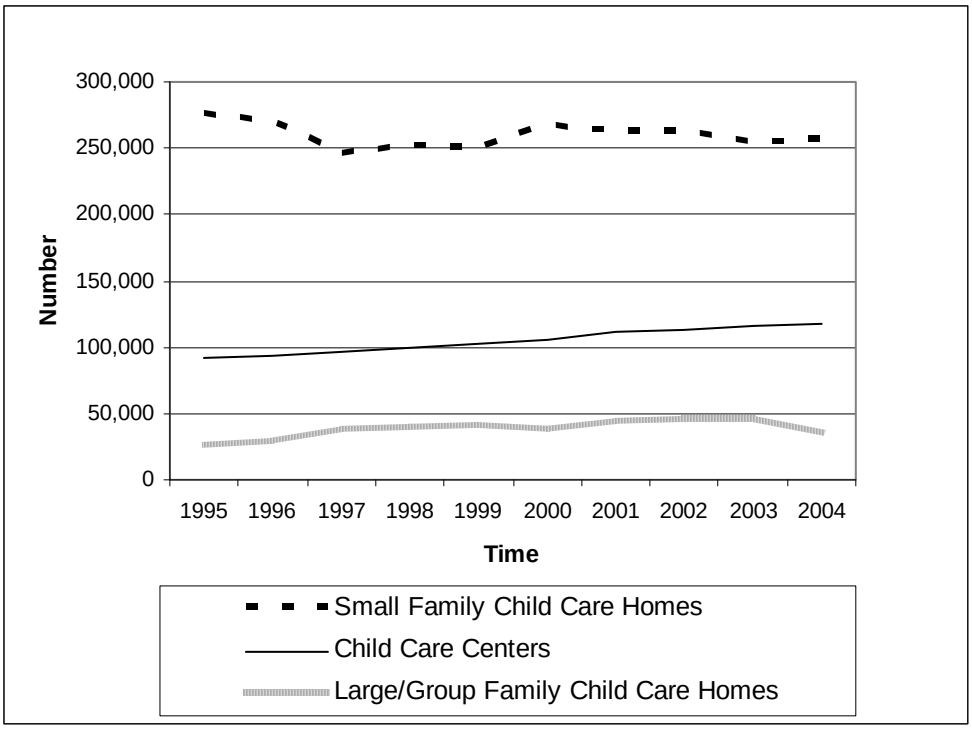
2.2.1.1 Daycare Center and Family Daycare Outlook

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).

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 EPA (2009). 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.[8] 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.

[8] 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.[9] 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.

[9] 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

	% LEAs with Data	Revenues		Percent of Revenues by Revenue Source		
		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.[10]

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.[11] 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

[10] 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.

[11] 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[12]; 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.

[12] 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).[13] 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).

[13] 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				

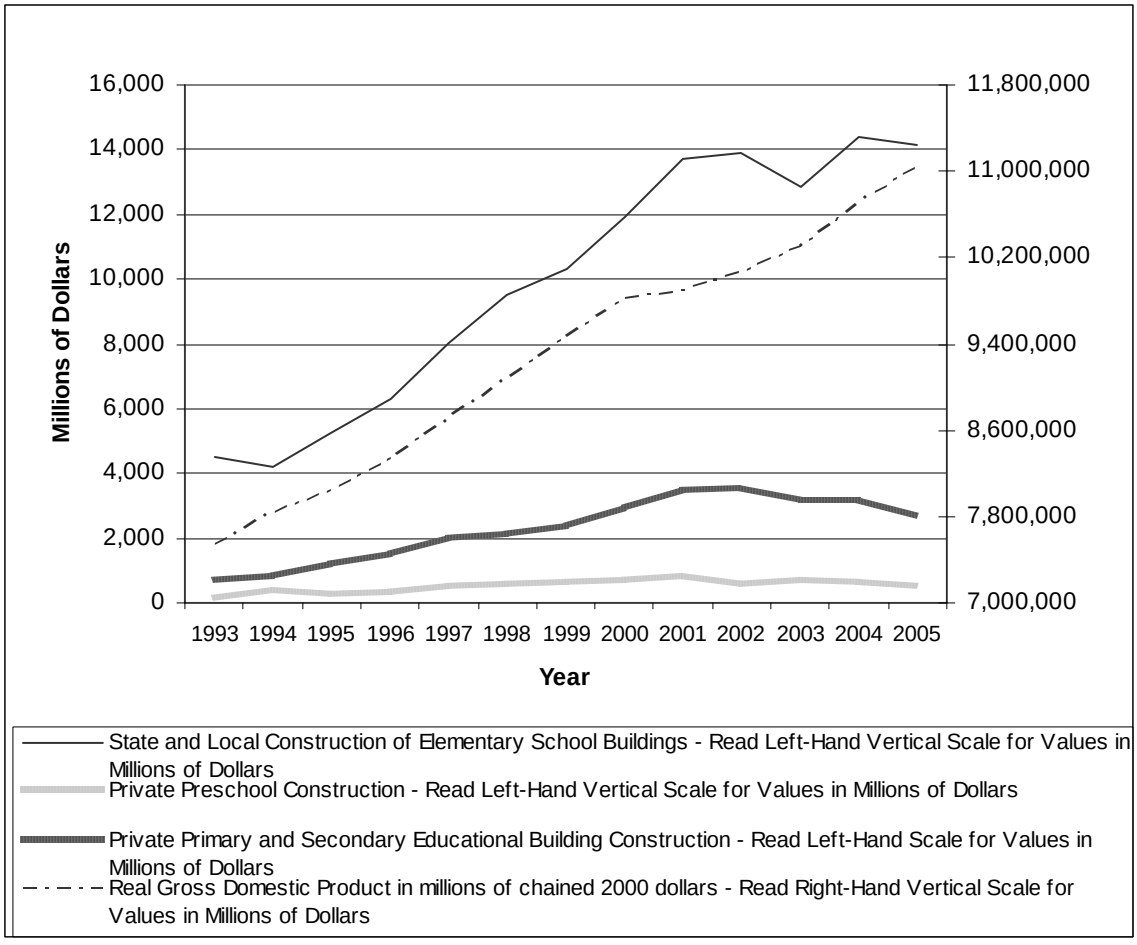
Based on 2002 data, 96 percent of NAICS 531120 firms and 81 percent of NAICS 531312 firms have revenues below $5 million and $1 million, respectively. In the Lessors of Nonresidential Buildings industry, these firms contribute 32 percent of the industry revenues while employing 73 percent of the workforce. 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).[14] 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,

[14] 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.

1989, and 1992. The U.S. Census defines improvements as "additions, alterations (renovations, 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).[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. 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

[15] 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).[16] 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[17] directory of 194 training providers.[18] 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.

[16] Effective July 31st, 2006.

[17] 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).

[18] 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 that would be covered by the LRRP rule if the proposed LRRP Opt-Out and Recordkeeping rule is finalized. These units include 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 assuming 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. 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 the Economic Analysis for the LRRP Opt-Out and Recordkeeping Proposed Rule (EPA 2009). EPA (2009) 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 EPA (2009), 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 Survey (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: Residential Lead-Based Paint Hazards and the Justification for Regulation

The purpose of this chapter is to provide background information on the existence of residential lead-based paint hazards and present an overview of the economic justifications for federal regulations to address these problems. Section 3.1 characterizes the residential lead contamination problem and discusses various sources of exposure. In Section 3.2, the regulatory background associated with residential lead-based paint hazards is presented. 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 proposed 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.

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).

3.2.1 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.

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

Market failure is one of the conditions that can justify government regulation. Market failures can result when one or more of the following conditions are met:

- 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 requiring dust sampling and clearance testing following certain renovation activities.

Economic efficiency suggests that in the absence of regulation dust sampling and clearance testing following 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: (1) because externalities exist, and (2) because of inadequate information.

Externalities and Public-Good Characteristics of Lead-Safe Renovation

One potential cause of market failure for dust sampling and clearance testing following renovations stems from externalities. An efficient outcome is achieved when the marginal willingness-to-pay for a service is equivalent to the marginal cost of providing that service. In the case of renovation in a rental unit, the primary beneficiaries of lead-safe renovation are the occupants; however, the decision about whether or not to pay for dust sampling or clearance testing is made by the property owners or managers who have an insufficient incentive to take the benefits to their occupants into account when making this decision.

Externalities also exist in the case of renovation events in owner-occupied homes. Because dust sampling and clearance testing following renovation in an owner-occupied unit 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 (tenants, neighbors, future occupants, etc.) would be willing-to-pay for the service. For example, a future occupant of a housing unit for sale may experience an increased exposure to lead if a renovation that creates a lead hazard is performed before they move in. While a future occupant might be willing to pay to reduce or eliminate this exposure, they would not be consulted by the property owner making the decision. As another example, children cannot express 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, leading to an inefficient process.

Another example of an externality is associated with an owner's decision regarding which contractor to hire to perform renovation in his or her housing unit. Contractors that perform dust sampling or clearance testing following a renovation are likely to charge more for their work than establishments that do not perform this testing. This testing may also increase the duration of the project because dust wipe testing takes time, and because contractors may need to perform additional cleaning. 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 perform dust sampling or clearance testing. Other parties (such as tenants, 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 the socially inefficient outcome of too little dust sampling and clearance testing services being purchased.

Inefficiencies also exist on the supply side of this market. Renovators that perform dust sampling or clearance testing incur higher costs than other contractors who are faced with 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 system is not perfect, the contractor's financial responsibilities (in terms of liability costs related to customer lead exposure) are not clear and consistently enforced. The same situation occurs with respect to a property owner's responsibilities to tenants, future occupants, visitors, and child-care customers. This situation is likely to result in an inefficient outcome of too little dust sampling and clearance testing services being consumed.

Inadequate Information

Another cause of market failure associated wth lead-safe work practices is due to inadequate information. Correct information is an important prerequisite to the demand for dust sampling or clearance testing following renovation projects. In deciding whether dust sampling or clearance testing are worth the extra cost, the property owner must 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, and how much these risk reductions cost. On the supply side, contractors may be unaware of the risks they are creating.

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 dust sampling or clearance testing and may be unwilling to pay additional costs for contractors to perform the testing. 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 contractors 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. Under the proposed LRRP Clearance Rule additional information will be available to property owners on the effectiveness of prospective contractors at minimizing risks from lead-based paint hazards. Specifically, property owners will be able to judge the

past performance of contractors through referrals from family, friends and neighbors, by checking references, and by reading contractor reviews available through online contractor referral websites. As a result of the proposed LRRP Clearance Rule, demand is likely to increase for those contractors who develop reputations for completing renovation work without leaving high levels of lead dust behind. Customer satisfaction is particularly important for the renovation industry, an industry where most firms report that over 50 percent of revenues are attributable to referrals and some firms report that up to 90 percent of their revenues are attributable to referrals (NARI, undated). Furthermore, if individual consumers are satisfied with a contractor's work, they are more likely to hire that same contractor for additional work in the future. If a contractor leaves behind high dust levels, the consumer may choose to hire a different contractor for future work.

The proposed LRRP Clearance Rule provides additional information to two groups: (1) renovation firms and their employees, and (2) owners and occupants of renovated structures. The proposed rule will provide additional information to renovation firms and their employees about the effectiveness of the containment and cleaning practices they are employing. Specifically, dust wipe test results that exceed dust hazard levels indicate that the containment and cleaning practices employed were inadequate while results showing no dust-lead hazards indicate that the containment and cleaning practices employed were adequate. Renovation firms can be expected to improve their effectiveness and efficiency for achieving dust wipe test results below dust-lead hazard levels as they receive feedback on the effectiveness of their work practices.

Property owners and occupants will also be provided with additional information under the proposed rule. The proposed LRRP Clearance Rule will enhance a consumer's ability to select a renovation firm with a record of achieving low dust-lead levels. For example, potential renovation consumers would be able to ask renovation firm references or the firms themselves about their record for achieving low dust-lead levels dust wipe test results, as demonstrated by dust wipe test results. After the work is completed property owners and occupants will be provided information about dust-lead levels after renovation work has been performed. This information will provide owners and occupants with a greater understanding and awareness of dust-lead levels, which has value because it provides owners and occupants with a greater ability to make further risk management decisions. In addition, owners and occupants are more likely to provide positive referrals for those contractors that completed the work without leaving behind high levels of lead dust, creating extra incentives for renovation firms to minimize lead dust levels.

Impacts of the Regulation on Demand for Lead-Safe Renovation Services

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 consumers' own characteristics. For the purpose of illustration, assume that all renovation services are identical except that some are performed using lead-safe containment and clean-up practices with dust sampling and some are not. Further assume that there is only one consumer and one supplier in the market. Of the services that are performed without 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

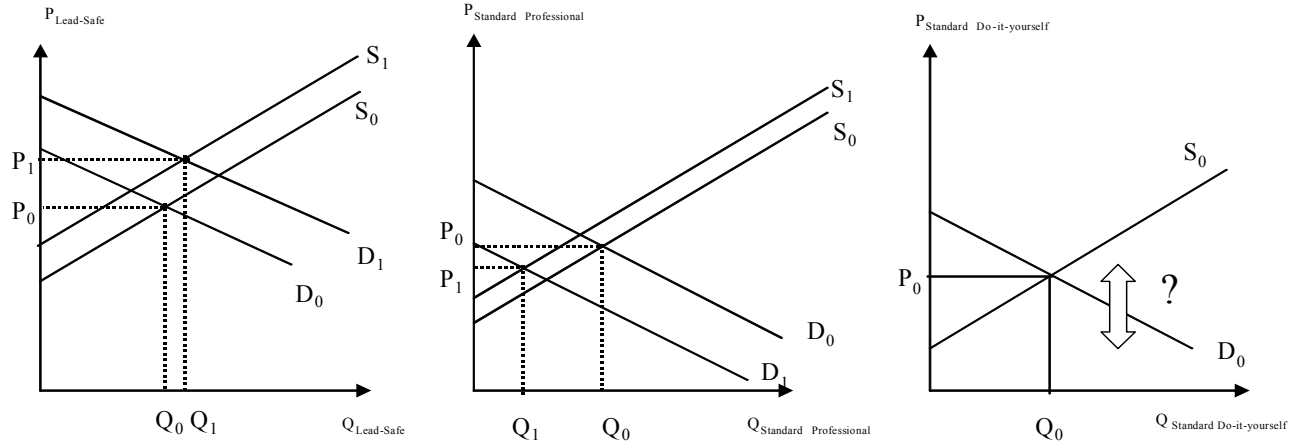


Figure (a) Market with Lead-Safe Work Practices

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

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

The proposed LRRP Clearance Rule alters the nature of these three markets by providing additional information to the consumer and contractor about the risk associated with lead-based paint renovation activities and by requiring that clearance standards are met following certain renovations. The implementation of the LRRP program will help to establish a more structured market for lead-safe renovation services. Prior to April 2010 when the LRRP program first took effect, 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 2008 LRRP rule, which is now part of the baseline for the renovation industry, provides some assurance to consumers about the quality of work provided by certified renovators, through the implementation of work practice standards and training/certification requirements. The proposed LRRP Clearance Rule builds on the 2008 rule to provide additional assurances to consumers about the quality of work provided by certified renovators, by providing quantitative information on the lead dust levels they leave behind.

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. Thus, demand for lead-safe renovation activities may shift with EPA's outreach campaign or due to the provision of information about lead hazards and risks before a consumer sign a contract with a renovator.

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 in the absence of the proposed LRRP Clearance Rule. 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. The

proposed LRRP Clearance Rule aims to reduce public uncertainty by providing quantitative information to consumers about prospective renovation firms' abilities to minimize dust lead levels. For example, before hiring a contractor a consumer can ask firm references or the firms themselves to provide information about their past performance in minimizing post-verification dust-lead levels. Consumers and firms might also choose to set contract terms or prices that are contingent on the post-verification dust-lead levels, reducing renovation firms' incentives to lower work practice costs in a manner that might increase the likelihood of leaving a dust lead hazard behind.

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 action 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 proposed LRRP clearance rule will increase both the cost of supplying lead-safe services and standard services. In Figures (a) and (b), S_1 represents the supply of services with the regulations. Many firms performing lead-safe renovations will incur additional costs associated with having third party dust sampling performed (or training dust sampling technicians and performing their own dust sampling), and may incur costs for re-cleaning where clearance is required. 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 section, due to inadequate information and the existence of externalities, the quantity of lead-safe RRP services currently provided is likely to be inefficiently low. Failure in the market for lead-safe RRP services is 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. From 1999 to 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 a ban on 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

[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.

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

The proposed rule revises the LRRP program by requiring dust wipe testing and clearance testing following certain renovations. 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 proposed 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, expanded notification requirements, and quantitative information about dust-lead hazards provided after dust wipe testing and clearance. 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 and perform dust wipe testing 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 firm 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 proposed rule addresses market failure due to inadequate information in two ways. First, it will enable consumers to more accurately judge the qualifications of renovation firms before entering into a contract because of additional information that will be available as a result of the rule. In addition, they will have more complete information about the quality of the work that was performed at the completion of the job. Owners and occupants who have more complete information about dust lead standards will have an enhanced ability to make further risk management decisions. Second, it provides a feedback mechanism for renovation firms that is expected to result in improvements in the effectiveness and efficiency of their containment and cleaning practices. Both of these information provision activities are described below.

Effect of Dust Wipe Testing and Clearance Requirements

The objective of requiring dust wipe testing and clearance following certain renovations 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. Requiring dust wipe testing and clearance following renovations will provide consumers with more complete information about the effectiveness of the lead safe work practices that were used. Under the proposed LRRP Clearance Rule additional information will be available to property owners on the effectiveness of prospective contractors at minimizing risks from lead-based paint hazards. Specifically, property owners will be able to judge the past performance of contractors through referrals from family, friends and neighbors, by checking references, and by reading contractor reviews available through online contractor referral websites. As a result of the proposed LRRP Clearance Rule, demand is likely to increase for those contractors who develop reputations for completing renovation work without leaving high levels of lead dust behind. Customer satisfaction is particularly important for the renovation industry, an industry where most firms report that over 50 percent of revenues are attributable to referrals and some firms report that up to 90 percent of their revenues are attributable to referrals (NARI, undated). In addition, renovation consumers and firms would have the option to set contract terms or prices that are contingent on the dust wipe test results at the end of a job. An example of the market failure stemming from inadequate information is presented in the previous section and is shown graphically in Exhibit 3-1.

The proposed rule will provide additional information to renovation firms and their employees about the effectiveness of the containment and cleaning practices that they are employing. This feedback mechanism is likely to result in more effective and efficient containment and cleaning practices.

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. 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.

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, therefore, 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, dust wipe testing, and clearance. Work practice requirements include the use of standard practices for the containment and cleanup of lead dust and debris generated during the project,

the prohibition or restriction of certain high-hazard techniques, and the use of standard requirements for performing dust wipe sampling and clearance.

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.

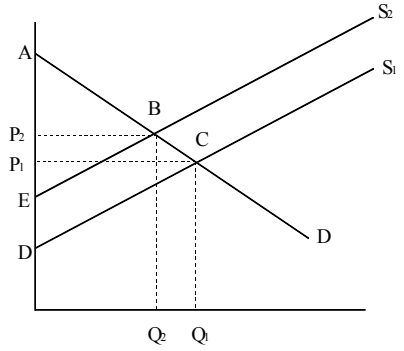
The own-price elasticity of demand is defined as the ratio of the percent change in quantity demanded to the percent change in price, and is reflected in the slope of the demand curve, similarly for the own-price elasticity of supply. By determining the level of change in price and quantity, the elasticities 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

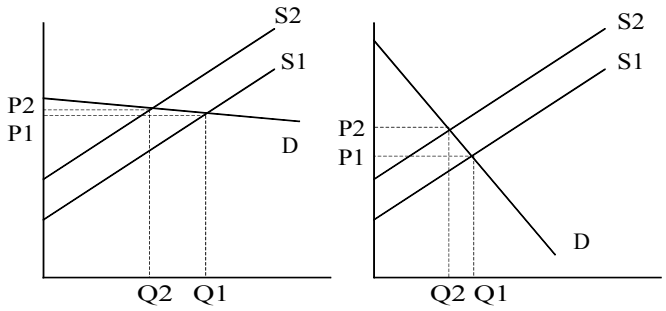
and quantity of Q_2. Note that producer surplus decreases from P_1CD to EBP_2 and the consumer surplus also decreases from ACP_1 to ABP_2. Thus, in the arbitrary case drawn in Figure 3A-1, the social costs of the regulation are born by both consumers and producers of the pollution-generating good. This 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): Effect of a change in input prices when demand is elastic	Figure 3A-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.

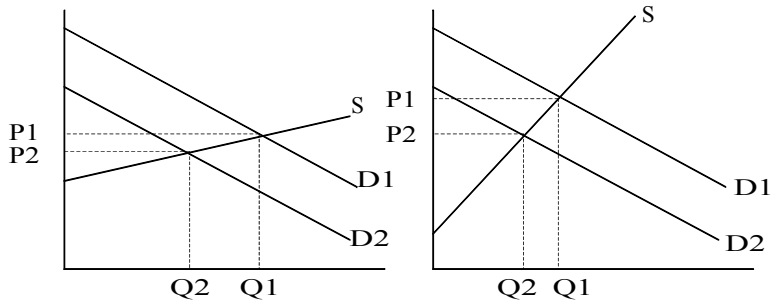
Figures 3A-2(a) and 3A-2(b) demonstrate the distributional affects of such a hypothetical shift in supply in markets with different elasticities of demand. The price increase is much higher (P1 to P2) and the decrease in quantity demanded is much lower (Q1 to Q2) with a given shift in supply when demand 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): Effects of a regulation-induced change in demand when supply is elastic	Figure 3A-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 easy for the purchaser to reduce the scale/scope of the project, postpone the project, or never do it.

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

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 proposed LRRP Clearance Rule includes the following changes to the LRRP program: (1) a requirement to perform dust wipe testing for a subset of renovation activities, and (2) a requirement to perform dust wipe testing and achieve clearance for a second subset of renovation activities where the quantity and characteristics of the dust make it hard to clean up. In particular, the proposed LRRP Clearance Rule would require dust wipe testing on uncarpeted floors and on window sills and troughs after the following types of renovations that disturb lead-based paint: use of a heat gun at temperatures below 1100 degrees Fahrenheit[1]; removal or replacement of window or door frames; scraping 60 ft^2 or more of painted surfaces; or removing more than 40 ft^2 of trim, molding, cabinets, or other fixtures. Renovations using machines that remove lead-based paint through high speed operation (such as power sanders or abrasive blasting), or involving demolition or removal of plaster walls with lead-based paint through destructive means will require firms to demonstrate – through dust wipe testing – that they have met clearance standards before the renovation will be considered complete.

The costs of the proposed LRRP Clearance Rule were estimated under a baseline scenario where the opt-out provision of the 2008 LRRP rule has been eliminated, as was proposed in October 2009 (74 FR 55506). This choice for the baseline scenario has the advantage that the cost impacts estimated in the Economic Analysis of the proposed Opt-Out Rule (EPA 2009) and those estimated in this analysis can be added together to estimate the combined impact of both rules.[2] Since the proposed LRRP Clearance Rule was developed before the LRRP Opt-Out Rule was finalized, the costs of the proposed LRRP Clearance Rule are also estimated for the alternative baseline scenario where the opt-out provision has not been eliminated (see section 4.7).

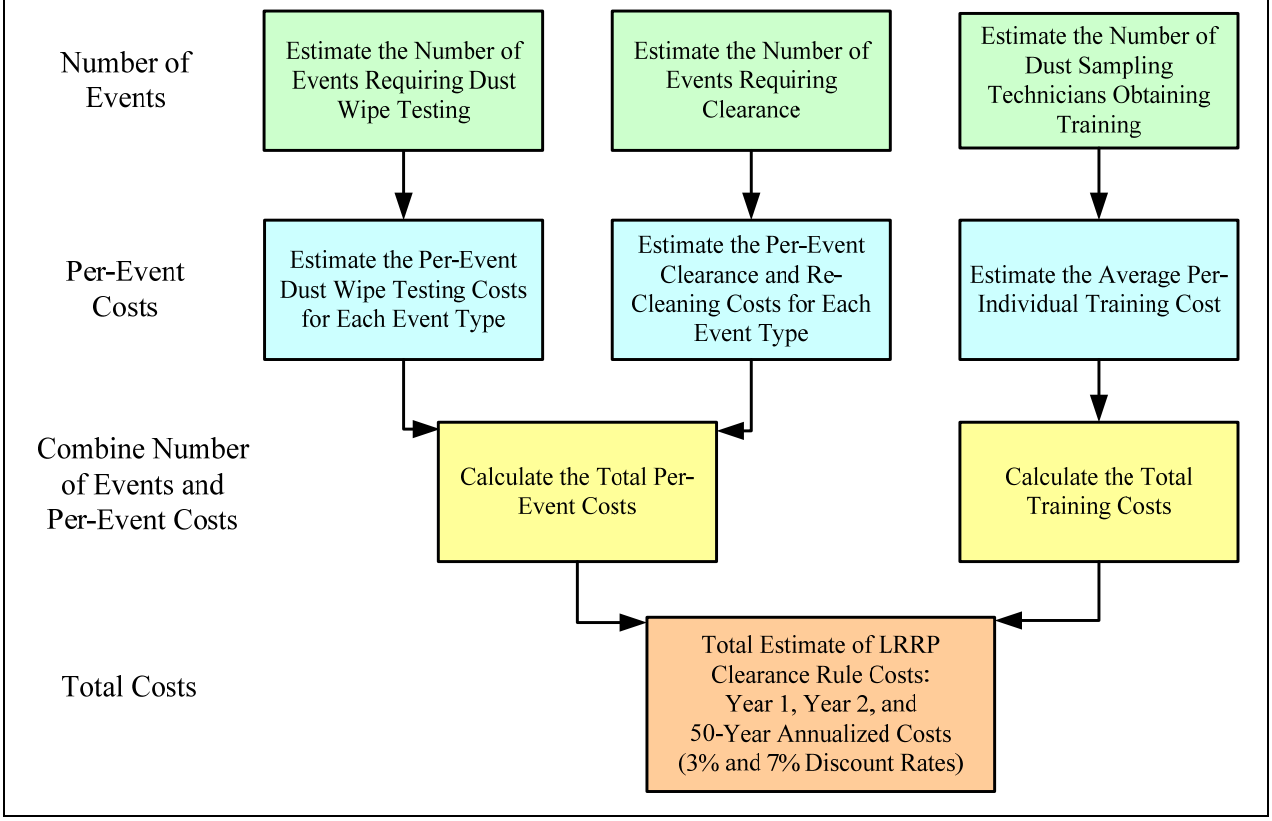
The costs associated with the revisions to the §402(c) Lead, Renovation, Repair, and Painting (LRRP) Rule are divided into three categories for the purposes of this analysis: (1) dust wipe testing costs, (2) clearance costs, and (3) training costs. The general approach of the analysis is to first estimate the number of affected activities or entities and then estimate the incremental regulatory cost per-activity or entity affected. Next, 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 and second 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. See Figure 4-1 for an illustration of the general approach used to estimate the costs of the proposed LRRP Clearance Rule.

The cost analysis uses the results of four different surveys of fewer than 10 firms each to estimate the annual frequencies for the different types of events covered by the proposed rule. The small sample sizes in the surveys (relative to the number of firms in the industry) may affect both the accuracy and precision of the estimates of the number of events requiring dust wiping or clearance, and thus the estimated cost of the proposed rule.

[1] Under the 2008 LRRP rule at 40 CFR 745.85(a)(3)(iii), operating a heat gun on lead-based paint is permitted only at temperatures below 1100 degrees Fahrenheit.

[2] Note that the two analyses differ in the current dollars that are used. In addition, both analyses use 50-year time horizons, but the Opt-Out analysis time period starts in 2010 and this rule's time period starts in 2011 – in a combined analysis they would have the same time horizon.

Figure 4-1: General Approach to Cost Analysis



The chapter is organized as follows: Section 4.1 defines the regulatory options considered in this analysis; Section 4.2 presents estimates of the number of regulated renovation, repair, and painting events where dust wipe testing or clearance will be required under the various regulatory scenarios; Section 4.3 presents the estimated costs of performing dust wipe testing and clearance, including the associated paperwork and recordkeeping costs; Section 4.4 presents the estimated number of Sampling Technicians seeking training and certification; Section 4.5 presents the costs of training Sampling Technicians; Section 4.6 presents the total costs of the proposed regulatory options. Section 4.7 presents the total costs of the proposed rule with an alternative baseline that excludes Opt-Out housing and also presents the costs of the rule under additional alternative options.

4.1 Definitions of Options

This economic analysis considers various regulatory options. The three primary options considered in this analysis only differ in the size thresholds that trigger the rule's requirements when performing certain renovation activities. The three threshold options considered in this analysis are:

1. Low Threshold Option
   - All event types requiring dust wipe testing where the amount of lead-based paint disturbed is larger than 6 square feet.
   - Clearance is required for:
     - high-speed machine removal of paint larger than 6 square feet, and
     - plaster removal using destructive means, larger than 6 square feet.
2. Proposed Threshold Option
   - Dust wipe testing is required for:
     - cabinet and trim events larger than 40 square feet,

- scraping of paint larger than 60 square feet,
- heat gun removal of more than 6 square feet
- Window frame or door frame removal events

- Clearance is required for:
  - high-speed machine removal of paint larger than 6 square feet, and
  - plaster removal using destructive means, larger than 6 square feet.

3. High Threshold Option
   - Dust wipe testing is required for:
     - cabinet and trim events larger than 80 square feet,
     - scraping or heat gun removal of paint larger than 120 square feet, and
     - window frame or door frame removal events.
   - Clearance is required for:
     - high-speed machine removal of paint larger than 60 square feet, and
     - plaster removal using destructive means, larger than 60 square feet.

Section 4.7 considers three alternative options in addition to the three primary options: (1) an option where third party dust wipe testing (including dust-wipe testing for clearance) is required; (2) an option that requires dust wipe testing for all of the renovation events covered by the proposed rule but does not require clearance for any of them; and (3) an option where clearance is required for all renovation events covered by the proposed rule.

All the primary and alternative options are analyzed under the baseline scenario where the opt-out provision of the 2008 LRRP rule has been eliminated as proposed. Since the proposed LRRP Clearance Rule was developed before the LRRP Opt-Out Rule was finalized, section 4.7 also presents the estimated costs for the proposed LRRP Clearance Rule under an alternative baseline using the regulated universe under the 2008 LLRP Rule (which excludes opt-out eligible housing from the universe). Table 4-1 summarizes the options presented in the economic analysis.

Table 4-1: Options Included in Economic Analysis

Option	Size Threshold	Dust Wipe Testing and Clearance	Third Party Requirement	Baseline
Low Threshold Option	Size thresholds are lower or equal to proposed rule	Dust wipe testing is required for: 1. cabinet and trim events 2. scraping of paint 3. heat gun removal of paint 4. Window frame or door frame removal events Clearance is required for: 1. high-speed machine removal of paint 2. plaster removal using destructive means	No	2008 + Opt Out
Proposed Threshold Option	Size thresholds are as proposed		No	2008 + Opt Out
High Threshold Option	Size thresholds are higher or equal to proposed rule		No	2008 + Opt Out
Third Party Option	Same as Proposed	Dust wipe testing and clearance are required in the same instances as proposed	Yes	2008 + Opt Out
Dust Wipe Testing Only Option	Same as Proposed	Dust wipe testing is required in instances where dust wipe testing or clearance are required under the proposed option	No	2008 + Opt Out
Clearance Only Option	Same as Proposed	Clearance is required in instances where dust wipe testing or clearance are required under the proposed option	No	2008 + Opt Out
Proposed Option with Alternative Baseline	Same as Proposed	Same as Proposed	No	2008

4.2 Number of Events with Dust Wipe Testing or Clearance Requirements

Two requirements of the clearance rule that will have cost implications are: (1) a requirement for dust wipe testing for a subset of renovation activities, and (2) a requirement for dust wipe testing and clearance for a second subset of renovation activities where the quantity and characteristics of the dust make it hard to clean up. In order to estimate the full extent of these costs, it is necessary to determine the total number of renovation events that will be affected by either of these additional requirements. This section identifies the event types where either dust wipe testing or clearance will be required, describes the methodology for estimating the frequencies of these events, and then presents the resulting estimates.

The events with additional requirements under the clearance rule are only a subset of the types of RRP events identified in EPA's analysis of the 2008 LRRP rule (EPA 2008). This analysis relies both on secondary sources and primary data collected from fewer than 10 firms to estimate the frequencies of these dust wipe testing and clearance events. Table 4-2 and Table 4-3 describe the events requiring dust wipe testing or clearance in the context of the 2008 event definitions and discuss the methodology used for estimating event frequencies.

Table 4-2: Proposed Dust Wipe Testing Renovation Events

Clearance Rule Events	Events Within Category from EPA 2008 (and building types events occur in)	Event Frequency Estimation Method
Interior Painting with Heat Gun	Interior Painting (TH & PCCOF	The results from a survey of <10 painting firms are used to estimate the frequency with which paint removal practices are used and the distribution of job sizes.
Interior Painting with Scraping		
Removal of Trim, Molding, Cabinets, or Fixtures	Bathroom Cabinet Replacement (TH)	1997 AHS data and HUD's 2001 NSLAH data are used to estimate the frequency of cabinet replacement. 58% of Kitchen renovations involve cabinet replacement (AHS 1997). Based on the number and size of cabinets according to HUD (2001), 100% of kitchen cabinet jobs are > 6 sq. ft., 89.5% > 40 sq. ft., and 62% > 80 sq. ft., and 42% of Bathroom renovations involve cabinet replacements, with an assumed 100% of these cabinet jobs greater than 6 sq. ft. and less than 40 sq. ft.
	Kitchen Cabinet Replacement (TH)	
	Trim/Molding replacement during: Bathroom, Kitchen, Wall-Disturbing, Addition, or Interior Painting Event (TH & PCCOF)	Based on survey of 6 carpentry firms and 3 general contractors about what type of jobs they are performing when they replace trim or molding (e.g., kitchen remodeling) and how frequently they do this during these job types.
Removal or Replacement of Windows or Door Frames	Window/Door Event (TH & PCCOF)	Based on survey of 6 carpentry firms and 3 general contractors about how often doors and windows are replaced without replacing the frames.

EPA 2008 = Economic Analysis for the TSCA Lead Renovation, Repair, and Painting Program Final Rule for Target Housing and Child-Occupied Facilities, March 2008.
TH = Target housing
PCCOF = Public or Commercial Building COF

Table 4-3: Proposed Clearance Renovation Events		
Clearance Rule Events	**Events Within Category from EPA 2008 (and building types events occur in)**	**Event Frequency Estimation Method**
Plaster – Demolish, or Remove through Destructive Means (e.g., sledgehammer, etc.)	Bathroom (TH)	1997 AHS data is used to estimate the frequency of repairing/replacing/removing plaster walls. The percentage of plaster wall repair/replacement/removal jobs, by size, that involve demolishing them with destructive means is estimated from a survey of 9 carpentry and general contractor firms.
	Kitchen (TH)	
	Wall-Disturbing (TH & Pub/Com COF)	
	Addition (TH)	
Interior Painting with High-Speed Machine Paint Removal	Interior Painting (TH & Pub/Com)	The results from a survey of <10 painting firms are used to estimate the frequency with which paint removal practices are used and the distribution of job sizes
EPA 2008 = Economic Analysis for the TSCA Lead Renovation, Repair, and Painting Program Final Rule for Target Housing and Child-Occupied Facilities, March 2008. TH = Target housing PCCOF = Public or Commercial Building COF		

4.2.1 Event Frequencies Based on Primary Data Collections From Fewer Than Ten Firms

This section includes the descriptions of the four questionnaires used to collect primary data from fewer than 10 firms. Following the survey descriptions, the survey results are presented along with the resulting estimated dust wipe testing and clearance event frequencies.

The four primary data collections include: (1) one questionnaire for nine painting contractors that is used to determine the frequency of interior painting jobs of various sizes that use certain paint removal techniques, (2) one questionnaire for six carpentry firms for determining: (a) the frequency of trim and molding removal, and (b) the frequency of window and door frame replacement, (3) one questionnaire for three general contractors that includes all the questions asked to carpenters in addition to questions that are used to estimate the frequency of destructive removal of plaster walls, and (4) one questionnaire for six general contractors used to estimate the frequency of destructive removal of plaster walls.

4.2.1.1 Contractor Firms Sample Universe

A geographically diverse sample of nine firms for each questionnaire was developed. First, nine states were randomly selected while limiting the sample to no more than one state per EPA region. Once the nine states were selected, lists of painting firms (for the paint removal survey), carpentry firms (for the carpenter survey), and general contractor firms (for the third and fourth survey) were obtained through Salesgenie.com, an online directory of businesses searchable by state and SIC code. The simple averages of the responses for each questionnaire were calculated in order to estimate the necessary parameters. For the interior painting questionnaire, which was administered to firms in SIC code 172101 (Painters), the following states were selected: Louisiana, West Virginia, Alabama, Maine, Idaho, Hawaii, Kansas, Utah, and Indiana. For the plaster questionnaire, which was administered to firms with SIC codes 152103, 152105, 152115, and 152139 (General Contractors, Home Improvements, Handyman Services, and Remodeling & Repairing Building Contractors), the following states were selected: Texas, Iowa, Michigan, Maine, California, Idaho, Alabama, Colorado, and New York. The carpentry questionnaire

used the same random set of states as the plaster survey as necessitated by the use of a combined survey for three of the firms. For six of the firms, entities with SIC codes of 175102, 175105, and 175110 (Carpenters, Window Replacement, and Doors - Hanging and Cutting), were asked the same carpentry questions.

4.2.1.2 Interior Painting Primary Data Collection (<10 Firms)

Interior Painting Survey Instrument

The script presented in Figure 4-2 was used to administer the phone interviews of representatives from nine interior painting firms. The introduction served to familiarize contractors with the objectives of the survey and the nature of EPA's analysis. Information collected from questions (2) through (5) was used to estimate the frequency of interior painting events of differing sizes using a scraper for paint removal.

Responses to questions (6) through (8) provide data on the frequency of heat gun usage for paint removal, and responses to questions (9) through (11) give similar data on the frequency of high-speed machine usage. Questions (12) and (13) specifically ask about alternatives to high-speed machine paint removal and the costs of such alternatives. And finally, information collected from questions (14) through (16) was used to estimate the frequency of removal of trim and molding (of various sizes) during interior painting jobs.

Figure 4-2: Interior Painting Survey Instrument

Introduction: Hello, I'm _____, calling from Abt Associates. We're an independent research firm that is doing contract work for the Environmental Protection Agency (EPA). We'd like to ask you a few questions in order to better understand how often different paint removal practices are used. Your responses will be treated as confidential and your name will not be provided to the EPA. There are 16 questions in our survey and we expect it to take about 5 minutes.

If asked why: EPA will be proposing to require dust sampling and/or clearance testing after certain paint removal practices are used where lead-based paint may be present. We will use the responses to our survey to estimate how costly these requirements would be.

1. Do you perform interior painting work in buildings built before 1978 for pay?

□ Yes □ No (end if no)

2. When you perform a painting job in a residence built before 1978, what percentage of the time do you use a hand scraper to remove old interior paint?

_____ % of the time.

3. When you use a hand scraper to remove old interior paint in a building built before 1978, what percentage of the time do you scrape more than 6 square feet per job of a painted surface?

_____ % of the time.

4. When you use a hand scraper to remove old interior paint in a building built before 1978, what percentage of the time do you scrape more than 60 square feet per job of a painted surface?

_____ % of the time.

5. When you use a hand scraper to remove old interior paint in a building built before 1978, what percentage of the time do you scrape more than 120 square feet per job of a painted surface?

Figure 4-2: Interior Painting Survey Instrument

_____ % of the time.

6. When you perform a painting job in a residence built before 1978, what percentage of the time do you use a heat gun to remove old interior paint?

_____ % of the time.

7. When you use a heat gun to remove old interior paint in a building built before 1978, what percentage of the time do you remove more than 6 square feet of paint per job of a painted surface?

_____ % of the time.

8. When you use a heat gun to remove old interior paint in a building built before 1978, what percentage of the time do you remove more than 60 square feet of paint per job of a painted surface?

_____ % of the time.

9. When you perform a painting job in a residence built before 1978, what percentage of the time do you use a high speed machine such as a power sander, grinder, or planer to remove old interior paint?

_____ % of the time.

10. When you use a high speed machine to remove old interior paint in a building built before 1978, what percentage of the time do you remove more than 6 square feet of paint per job of a painted surface?

_____ % of the time.

11. When you use a high speed machine to remove old interior paint in a building built before 1978, what percentage of the time do you remove more than 60 square feet of paint per job of a painted surface?

_____ % of the time.

12. If you could not use high speed machines to remove old interior paint in a building built before 1978, what alternative paint removal technique would you use instead?

_____.

13. On average, how much would using this alternative to high speed machine paint removal increase the cost of the job?

$_____.

14. What percentage of your interior painting jobs involve removing or replacing more than 6 square feet of trim or moldings?

_____ %

15. What percentage of your interior painting jobs involve removing or replacing more than 40 square feet of trim or moldings?

_____ %

16. What percentage of your interior painting jobs involve removing or replacing more than 80 square feet of trim or moldings?

_____ %

Interior Painting Survey Responses and Summary of Results

Table 4-4 presents the individual responses from firms contacted from each state for the entire interior painting questionnaire. For practices for which both an overall frequency question and relative size-specific frequency questions were asked of firms, the percentage with which each respondent used a surface preparation practice for a certain size threshold was imputed, and then the average was taken across respondents. In other cases, the simple averages of the frequencies are used for estimating the number of events affected by the proposed rule. Summary statistics are calculated in Table 4-5 to show the central tendency and range of work practice frequencies reported by respondents.

Table 4-4: Individual Responses to Interior Painting Firm Questionnaire by State									
Question	**LA**	**WV**	**AL**	**ME**	**ID**	**HI**	**KS**	**UT**	**IN**
2. Use scraper (%)	50.0%	5.0%	0.0%	0.0%	0.0%	0.0%	1.0%	1.0%	0.0%
3. Scrape > 6 ft^2 (%)	10.0%	100.0%	NA	NA	NA	NA	0.0%	1.0%	NA
4. Scrape > 60 ft^2 (%)	Rarely[3]	Don't Know	NA	NA	NA	NA	0.0%	0.0%	NA
5. Scrape > 120 ft^2 (%)	0.0%	Don't Know	NA	NA	NA	NA	0.0%	0.0%	NA
6. Use heat gun (%)	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
7. Heat gun > 6 ft^2 (%)	100.0%	NA	NA	NA	NA	NA	NA	NA	NA
8. Heat gun > 60 ft^2 (%)	0.0%	NA	NA	NA	NA	NA	NA	NA	NA
9. Hi-speed machine (%)	100.0%	0.0%	0.0%	0.0%	0.0%	1.0%	1.0%	0.0%	0.0%
10. Machine > 6 ft^2 (%)	0.0%	NA	NA	NA	NA	100.0%	0.0%	NA	NA
11. Machine > 60 ft^2 (%)	0.0%	NA	NA	NA	NA	50.0%	0.0%	NA	NA
12. Alternative to hi-speed machine	Chemical Stripper	NA	NA	NA	NA	Chemical Stripper	Take off chips and prime over	NA	NA
13. Cost of alternative	At least 15% more per day	NA	NA	NA	NA	$1500 or $2000 a day	Don't Know	NA	NA
14. Trim/ moldings > 6 ft^2 (%)	10.0%	0.0%	5.0%	0.0%	0.0%	30.0%	0.0%	0.0%	1.0%
15. Trim/ moldings > 40 ft^2 (%)	2.0%	0.0%	0.0%	0.0%	0.0%	30-50%	0.0%	0.0%	0.5%
16. Trim/ moldings > 80 ft^2 (%)	1.0%	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%	0.0%	0.3%
Imputed Practice Frequencies, by Size Threshold									
Total scrape > 6 ft^2 (%)[a]	5.0%	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total scrape > 60 ft^2 (%)[b]	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total machine > 6 ft^2 (%)[c]	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%
Total machine > 6 ft^2 (%)[d]	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%

a. Calculated as the product of responses to Question 2 and Question 3.
b. Calculated as the product of responses to Question 2 and Question 4.
c. Calculated as the product of responses to Question 9 and Question 10.
d. Calculated as the product of responses to Question 9 and Question 11.

[3] This firm's answer of "rarely" was inputted as 1% for calculations of summary statistics. This approach was used because two other firms, when prompted to assign a percentage value to their response of "rarely" to questions both estimated 1% frequency.

Table 4-5: Summary Statistics for Interior Painting Questionnaire					
Question	**Average**	**Median**	**Mode**	**Minimum**	**Maximum**
2. Use scraper (%)	**6.3%**	0.0%	0.0%	0.0%	50.0%
3. Scrape > 6 ft^2 (%)	**27.8%**	5.5%	None	0.0%	100.0%
4. Scrape > 60 ft^2 (%)	**0.3%**	0.0%	0.0%	0.0%	1.0%
5. Scrape > 120 ft^2 (%)	**0.0%**	0.0%	0.0%	0.0%	0.0%
6. Use heat gun (%)	**0.1%**	0.0%	0.0%	0.0%	1.0%
7. Heat gun > 6 ft^2 (%)	**100.0%**	100.0%	None	100.0%	100.0%
8. Heat gun > 60 ft^2 (%)	**0.0%**	0.0%	None	0.0%	0.0%
9. Hi-speed machine (%)	**11.3%**	0.0%	0.0%	0.0%	100.0%
10. Machine > 6 ft^2 (%)	**33.3%**	0.0%	0.0%	0.0%	100.0%
11. Machine > 60 ft^2 (%)	**16.7%**	0.0%	0.0%	0.0%	50.0%
12. Alternative to hi-speed machine	**None**	None	None	None	None
13. Cost of alternative	**None**	None	None	None	None
14. Trim/ moldings > 6 ft^2 (%)	**5.1%**	0.0%	0.0%	0.0%	30.0%
15. Trim/ moldings > 40 ft^2 (%)	**4.7%**	0.0%	0.0%	0.0%	40.0%
16. Trim/ moldings > 80 ft^2 (%)	**1.3%**	0.0%	0.0%	0.0%	10.0%
Imputed Practice Frequencies, by Size Threshold					
Total Scrape > 6 ft^2 (%)[a]	**1.1%**	0.0%	0.0%	0.0%	5.0%
Total Scrape > 60 ft^2 (%)[b]	**0.1%**	0.0%	0.0%	0.0%	0.5%
Total Machine > 6 ft^2 (%)[c]	**0.1%**	0.0%	0.0%	0.0%	1.0%
Total Machine > 6 ft^2 (%)[d]	**0.1%**	0.0%	0.0%	0.0%	0.5%

a. Calculated as the product of individual state responses to Question 2 and Question 3.
b. Calculated as the product of individual state responses to Question 2 and Question 4.
c. Calculated as the product of individual state responses to Question 9 and Question 10.
d. Calculated as the product of individual state responses to Question 9 and Question 11.

The event frequency estimates are based on the average of the responses for each question, as calculated from Table 4-4. The median, mode, minimum, and maximum are only presented for descriptive purposes.

Frequency of Interior Painting Events Requiring Dust Wipe Testing or Clearance

The results from the Interior Painting Firm Questionnaire can be used to estimate the frequency of events affected by the LRRP Clearance Rule. The frequency of interior painting with scraping are approximated from the responses to questions (2) through (5). Results from questions (6) through (8) are used to determine the frequency of interior painting events using a heat gun. Responses from questions (9) through (11) are used for estimation of the frequency of interior painting events involving use of a high-speed machine for paint removal. Responses from question (14) through (16) regarding removal or replacement of trim or moldings are used in combination with the two other questionnaires in order to establish overall trim/molding event frequency, but these questions represent the frequency of painting-specific trim or molding removal. Table 4-2 summarizes the survey-based estimation methodologies for interior painting event frequencies affected by the Clearance Rule. The results of two different methods are displayed: (1) estimating the job-size frequency as a percentage of the assumed practice frequency in the 2008 analysis, and (2) estimating the job-size frequency as a percentage of the average practice frequency reported in responses to the Interior Painting Questionnaire (See Table 4-6).

Table 4-6: Estimation of Dust Wipe Testing and Clearance Event Frequencies for Interior Painting

Practice Definition	Calculation Description	Total Number of Events[a]
Dust Wipe Testing Events		
Interior Painting with Scraping	Average of responses to question 2.	6.3% of Interior Painting
Interior Painting with Scraping > 6 Square Feet	Average of responses imputed from questions 2 and 3.	1.1% of Interior Painting
Interior Painting with Scraping > 60 Square Feet	Average of responses imputed from questions 2 and 4.	0.1% of Interior Painting
Interior Painting with Scraping > 120 Square Feet	Average of responses imputed from questions 2 and 5.	None
Interior Painting with Heat Gun	Average of responses to question 6.	0.1% of Interior Painting
Interior Painting with Heat Gun > 6 Square Feet	Average of responses imputed from questions 6 and 7.	0.1% of Interior Painting
Interior Painting with Heat Gun > 60 Square Feet	Average of responses imputed from questions 6 and 8.	None
Removal of Trim or Molding > 6 Square Feet	Average of responses to question 14.	5.1% of Interior Painting
Removal of Trim or Molding > 40 Square Feet	Average of responses to question 15.	4.7% of Interior Painting
Removal of Trim or Molding > 80 Square Feet	Average of responses to question 16.	1.3% of Interior Painting
Clearance Events		
Interior Painting with Use of High-Speed Machine for Paint Removal	Average of responses to question 9.	11.3% of Interior Painting
Interior Painting with Use of High-Speed Machine > 6 Square Feet	Average of responses imputed from questions 9 and 10.	0.1% of Interior Painting
Interior Painting with Use of High-Speed Machine > 60 Square Feet	Average of responses imputed from questions 9 and 11.	0.1% of Interior Painting

[a] The estimated number of events is based on the average of the responses to the survey questions, as shown in Table 4-5.

4.2.1.3 Carpentry Primary Data Collection (<10 Firms)

Carpentry Survey Instrument

The following script was used for administering phone interviews of six carpentry and three general contractor firms. The introduction served to familiarize contractors with the objectives of the survey and the nature of EPA's analysis. Information collected from questions (1) through (4) was used to estimate the frequency of window replacement jobs that also involved window frame replacement. Responses to questions (5) through (12) provide data on the fraction of trim or molding removal activities that exceed various size thresholds in bathroom or kitchen remodeling jobs. The results of questions (13) and (14) provide insight into what other renovation events might result in removal of trim or molding.

Figure 4-3: Carpentry Survey Instrument

Introduction: Hello, I'm _____, calling from Abt Associates. We're an independent research firm that is doing contract work for the Environmental Protection Agency (EPA). We'd like to ask you a few questions in order to better understand how often different practices that sometimes disturb lead-based paint are used. Your responses will be treated as confidential and your name will not be provided to the EPA. There are 14 questions in our survey and we expect it to take about 5 minutes.

If asked why: EPA will be proposing to require dust sampling and/or clearance testing after certain renovation practices are used that may disturb lead-based paint. We will use the responses to our survey to estimate how costly these requirements would be.

1. Do you ever perform window replacement work in buildings built before 1978 for pay?

□ Yes □ No (if no skip to Q3)

2. What percentage of your Pre-1978 window replacement jobs involve replacing the window frame?

_____ %.

3. Do you ever perform door replacement work in buildings built before 1978 for pay?

□ Yes □ No (if no skip to Q5)

4. What percentage of your Pre-1978 door replacement jobs involve replacing the door frame?

_____ %.

5. Do you perform kitchen remodeling work in buildings built before 1978 for pay?

□ Yes □ No (if no skip to Q7)

6. What percentage of your Pre-1978 kitchen remodeling jobs also involve removing or replacing more than 6 square feet of trim or moldings?

_____ %.

7. What percentage of your Pre-1978 kitchen remodeling jobs also involve removing or replacing more than 40 square feet of trim or moldings?

_____ %.

8. What percentage of your Pre-1978 kitchen remodeling jobs also involve removing or replacing more than 80 square feet of trim or moldings?

_____ %.

9. Do you perform bathroom remodeling work in buildings built before 1978 for pay?

□ Yes □ No (if no skip to Q11)

Figure 4-3: Carpentry Survey Instrument

10. What percentage of your Pre-1978 bathroom remodeling jobs also involve removing or replacing more than 6 square feet of trim or moldings?

_____ %.

11. What percentage of your Pre-1978 bathroom remodeling jobs also involve removing or replacing more than 40 square feet of trim or moldings?

_____ %.

12. What percentage of your Pre-1978 bathroom remodeling jobs also involve removing or replacing more than 80 square feet of trim or moldings?

_____ %.

13. Do you ever replace interior trim or moldings for Pre-1978 jobs that do not also include interior painting, kitchen remodeling, bathroom remodeling, or wall removal, replacement, or repair?

□ Yes □ No (end survey if no)

14.

a. Please describe these jobs that require interior trim or molding replacement without interior painting, kitchen remodeling, bathroom remodeling, or wall/repair replacement.

1. _____

2. _____

3. _____

4. _____

b. When performing a Pre-1978{1st type described in 15a} job, what percentage of the time do you remove trim or moldings?

_____ %.

c. When performing a Pre-1978{2nd type described in 15a} job, what percentage of the time do you remove trim or moldings?

_____ %.

d. When performing a Pre-1978{3rd type described in 15a} job, what percentage of the time do you remove trim or moldings?

_____ %.

e. When performing a Pre-1978{4th type described in 15a} job, what percentage of the time do you remove trim or moldings?

_____ %.

Carpentry Survey Responses and Summary of Results

Below, individual responses from firms contacted from each state are presented for the entire questionnaire in Table 4-7. Also, summary statistics are calculated in Table 4-7 that show the central tendency and range of work practice frequencies reported by respondents. The averages of the frequencies will be used for estimating the number of events affected by the proposed rule.

Table 4-7: Individual Responses to Carpentry Questionnaire by State

Question	TX	IA	MI	ME	CA	ID	AL	CO	NY
2. Window frame (%)	100%	15%	NA	100%	90%	NA	20%	80%	1%
4. Door frame (%)	100%	60%	100%	80%	60%	10-20%	20%	98%	100%
6. Kitchen trim/molding > 6 ft^2	NA	15%	NA	50%	60%	>75%	100%	90%	100%
7. Kitchen trim/molding > 40 ft^2	NA	0%	NA	10%	20%	>75%	100%	50%	100%
8. Kitchen trim/molding > 80 ft^2	NA	0%	NA	5%	10%	>75%	100%	25%	10%
10. Bath trim/molding > 6 ft^2	0%	40%	NA	50%	60%	100%	100%	80%	100%
11. Bath trim/molding > 40 ft^2	0%	0%	NA	10%	20%	>50%	50%	60%	5%
12. Bath trim/molding > 80 ft^2	0%	0%	NA	5%	10%	40%	30%	40%	0%
14a. Alternative trim/molding jobs	NA	NA	NA	NA	NA	Replace baseboards or interior casings	NA	Restoration of past remodeling	Paneling or sheet rock in living rooms
14b. Trim/ molding removal (%)	NA	NA	NA	NA	NA	10% each	NA	2%	100%

In the following states, firms with SIC codes of 175102 (Carpenters), 175105 (Window Replacement), and 175110 (Doors – Hanging & Cutting) were randomly sampled: Texas, Iowa, Michigan, Maine, Idaho, and New York. In Colorado and California, firms with SIC codes of 152103 (General Contractors), 152105 (Home Improvements), 152115 (Handyman Services), and 152139 (Remodeling & Repairing Building Contractors), were randomly sampled.

Table 4-8: Summary Statistics for Carpentry Questionnaire

Question	Average	Median	Mode	Minimum	Maximum	Number Responses
2. Window frame (%)	**58.0%**	80.0%	100.0%	1.0%	100.0%	7
4. Door frame (%)	**70.3%**	80.0%	100.0%	15.0%	100.0%	9
6. Kitchen trim/molding > 6 ft^2	**70.0%**	75.0%	100.0%	15.0%	100.0%	7
7. Kitchen trim/molding > 40 ft^2	**50.7%**	50.0%	100.0%	0.0%	100.0%	7
8. Kitchen trim/molding > 80 ft^2	**32.1%**	10.0%	10.0%	0.0%	100.0%	7
10. Bath trim/molding > 6 ft^2	**66.3%**	70.0%	100.0%	0.0%	100.0%	8
11. Bath trim/molding > 40 ft^2	**24.4%**	15.0%	0.0%	0.0%	60.0%	8
12. Bath trim/molding > 80 ft^2	**15.6%**	7.5%	0.0%	0.0%	40.0%	8
14a. Alternative trim/molding jobs	**None**	None	None	None	None	3
14b. Trim/ molding removal (%)	**37.3%**	10.0%	None	2.0%	100.0%	3

The event frequency estimates are based on the average of the responses for each question, as calculated from Table 4-7. The median, mode, minimum, and maximum are only presented for descriptive purposes.

Frequency of Removal or Replacement of Window or Door Frames and Trim or Molding Replacement

The results from the Carpentry Questionnaire are used to estimate the frequency of events affected by the LRRP Clearance Rule. The results from question (2) in the survey are used to estimate the frequency of removing or replacing the frame during window removal/replacement events. Similarly, responses from question (4) are used to determine the frequency of door removal/replacement events also requiring removal of the door frame. The remainder of responses from the Carpentry Survey are used to estimate the frequency of removal of trim or molding in bathroom and kitchen remodeling jobs (for each size threshold). Table 4-9 summarizes the survey-based estimation methodologies for window and door event frequencies affected by the Clearance Rule, and Table 4-10 describes the methodology for estimating bathroom and kitchen events involving removal of trim or molding.

Table 4-9: Estimation of Frequency of Removal or Replacement of Window or Door Frames

Practice Definition	Frequency of Practice [a]	Ratio of Window or Door Events to Total Events[b]	Total Number of Dust Wipe Testing Events
Removal or Replacement of Window Frame	58.0 % (Question 2)	75.0% Windows	58.0% * 75.0% = 43.5% of Window/Door Events
Removal or Replacement of Door Frame	70.0% (Question 4)	25.0% Doors	70.0% * 25.0% = 17.6% of Window/Door Events

a. The estimated number of events is based on the average of the responses to the survey questions, as shown in Table 4-8.
b. The ratio of window events to door events was derived from data from the 1997 American Housing Survey; for public and commercial building COFs it is assumed that windows and doors are replaced at the same time, and therefore it is assumed that frame replacement occurs 70 percent of the time, the higher of the two frame replacement rates.

Table 4-10: Estimation of Dust Wipe Testing Event Frequencies for Trim or Molding Removal in Kitchen and Bathroom Events

2008 Event Category	Practice Definition	Frequency of Practice [a]	Total Number of Dust Wipe Testing Events
Kitchen	Removal of Trim or Molding > 6 Square Feet	70.0% (Question 6)	70.0% of Kitchen
	Removal of Trim or Molding > 40 Square Feet	50.7% (Question 7)	50.7% of Kitchen
	Removal of Trim or Molding > 80 Square Feet	32.1% (Question 8)	32.1% of Kitchen
Bathroom	Removal of Trim or Molding > 6 Square Feet	66.3% (Question 10)	66.3% of Bathroom
	Removal of Trim or Molding > 40 Square Feet	24.4% (Question 11)	24.4% of Bathroom
	Removal of Trim or Molding > 80 Square Feet	15.6% (Question 12)	15.6% of Bathroom

[a] The estimated number of events is based on the average of the responses to the survey questions, as shown in Table 4-8.

4.2.1.4 Plaster Primary Data Collection (<10 Firms)

Plaster Survey Instrument

The following script was used for administering a phone survey of nine general contractor firms. The introduction served to familiarize contractors with the objectives of the survey and the nature of EPA's analysis. Information collected from questions (1) through (4) is used to estimate the frequency of window replacement jobs that also involved window frame replacement. Responses to questions (5) through (12) provide data on the fraction of trim or molding removal activities that exceed varying size thresholds in bathroom or kitchen remodeling jobs. The results of questions (13) and (14) provide insight into what other renovation events might result in removal of trim or molding. The purpose of questions (15) through (19) was to determine how frequently trim or moldings are removed in wall-disturbing events. And finally, responses to questions (20) through (23) serve to estimate the frequency of destructive removal of plaster walls in different size increments.

Figure 4-4: Plaster Survey Instrument

Introduction: Hello, I'm _____, calling from Abt Associates. We're an independent research firm that is doing contract work for the Environmental Protection Agency (EPA). We'd like to ask you a few questions in order to better understand how often different practices that sometimes disturb lead-based paint are used. Your responses will be treated as confidential and your name will not be provided to the EPA. There are 23 questions in our survey and we expect it to take about 10 minutes.

If asked why: EPA will be proposing to require dust sampling and/or clearance testing after certain renovation practices are used that may disturb lead-based paint. We will use the responses to our survey to estimate how costly these requirements would be.

1. Do you perform wall removal, wall replacement or wall repair work in buildings built before 1978 for pay?

□ Yes □ No (if no, end)

2. What percentage of your Pre-1978 wall removal, wall replacement or wall repair jobs also involve replacing more than 6 square feet of trim or moldings?

_____ %.

3. What percentage of your Pre-1978 wall removal, wall replacement or wall repair jobs also involve replacing more than 40 square feet of trim or moldings?

_____ %.

4. What percentage of your Pre-1978 wall removal, wall replacement or wall repair jobs also involve replacing more than 80 square feet of trim or moldings?

_____ %.

5. What percentage of your Pre-1978 wall removal, wall replacement or wall repair jobs involve removing all or part of a plaster wall?

_____ %.

6. What percentage of the time do you use destructive means, such as a sledgehammer, when you are removing all or part of a Pre-1978 plaster wall?

_____ %.

7. When removing all or part of a Pre-1978 plaster wall using destructive means, what percentage of the time do you remove more than 6 square feet of plaster wall?

_____ %.

8. When removing all or part of a Pre-1978 plaster wall using destructive means, what percentage of the time do you remove more than 40 square feet of plaster wall?

_____ %.

9. When removing all or part of a Pre-1978 plaster wall using destructive means, what percentage of the time do you remove more than 60 square feet of plaster wall?

_____ %.

Plaster Questionnaire Responses and Summary of Results

Below, individual responses from firms contacted from each state are presented for the entire questionnaire in Table 4-11. For practices for which both an overall frequency question and relative size-specific frequency questions were asked of firms, the percentage with which each respondent used a work

practice for a certain size threshold was imputed, and then the average was taken across respondents. In other cases, the simple averages of the frequencies are used for estimating the number of events affected by the proposed rule. Summary statistics are also calculated in Table 4-12 to show the central tendency and range of work practice frequencies reported by respondents. For practices which do not require combining overall and relative size-specific frequencies as described above, the simple averages of the frequencies will be used for estimating the number of events affected by the proposed rule.

Table 4-11: Individual Responses to Plaster Questionnaire by State

Question	TX	IA	MI	ME	CA	ID	AL	CO	NY
2. Wall trim/ molding > 6 ft^2 (%)	30%	40%	<5%	50%	40%	100%	100%	100%	10-15%
3. Wall trim/ molding > 40 ft^2 (%)	10%	40%	0.5%	20%	30%	50%	0%	80%	8-12%
4. Wall trim/ molding > 80 ft^2 (%)	10%	10%	0%	5%	10%	10%	0%	50-60%	2-3%
5. Plaster wall (%)	30%	2%	1%	5%	0%	0%	0%	100%	70%
6. Destructive means (%)	10%	100%	1%	5%	NA	NA	NA	30%	100%
7. Destructive plaster > 6 ft^2 (%)	100%	Don't Know	100%	30%	NA	NA	NA	100%	90%
8. Destructive plaster > 40 ft^2 (%)	100%	Don't Know	10%	15%	NA	NA	NA	80%	90%
9. Destructive plaster > 60 ft^2 (%)	0%	Don't Know	1%	10%	NA	NA	NA	70%	90%
Imputed Practice Frequencies, by Size Threshold									
Total destructive plaster > 6 ft^2 (%)[a]	3.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	30.0%	63.0%
Total destructive plaster > 40 ft^2 (%)[b]	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	24.0%	63.0%
Total destructive plaster > 60 ft^2 (%)[c]	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	21.0%	63.0%

a. Calculated as the product of individual state responses to Question 5, Question 6, and Question 7.
b. Calculated as the product of individual state responses to Question 5, Question 6, and Question 8.
c. Calculated as the product of individual state responses to Question 5, Question 6, and Question 9.

For all states, firms with SIC codes of 152103 (General Contractors), 152105 (Home Improvements), 152115 (Handyman Services), and 152139 (Remodeling & Repairing Building Contractors), were randomly sampled.

Table 4-12: Summary Statistics for Plaster Questionnaire					
Question	**Average**	**Median**	**Mode**	**Minimum**	**Maximum**
2. Wall trim/ molding > 6 ft^2 (%)	**53.1%**	40.0%	100.0%	5.0%	100.0%
3. Wall trim/ molding > 40 ft^2 (%)	**26.7%**	20.0%	10.0%	0.0%	80.0%
4. Wall trim/ molding > 80 ft^2 (%)	**11.4%**	10.0%	10.0%	0.0%	55.0%
5. Plaster wall (%)	**23.1%**[4]	2.0%	0.0%	0.0%	100.0%
6. Destructive means (%)	**41.0%**	20.0%	100.0%	1.0%	100.0%
7. Destructive plaster > 6 ft^2 (%)	**84.0%**	100.0%	100.0%	30.0%	100.0%
8. Destructive plaster > 40 ft^2 (%)	**59.0%**	80.0%	None	10.0%	100.0%
9. Destructive plaster > 60 ft^2 (%)	**34.2%**	10.0%	None	0.0%	90.0%
Imputed Practice Frequencies, by Size Threshold					
Total destructive plaster > 6 ft^2 (%)[a]	**10.7%**	0.0%	0.0%	0.0%	63.0%
Total destructive plaster > 40 ft^2 (%)[b]	**10.0%**	0.0%	0.0%	0.0%	63.0%
Total destructive plaster > 60 ft^2 (%)[c]	**9.3%**	0.0%	0.0%	0.0%	63.0%

a. Calculated as the product of individual state responses to Question 5, Question 6, and Question 7.
b. Calculated as the product of individual state responses to Question 5, Question 6, and Question 8.
c. Calculated as the product of individual state responses to Question 5, Question 6, and Question 9.

The event frequency estimates are based on the average of the responses for each question, as calculated from Table 4-11. The median, mode, minimum, and maximum are only presented for descriptive purposes.

Frequency of Plaster Wall Removal Using Destructive Means

Responses from the Plaster Survey are used to estimate the frequency of events affected by the LRRP Clearance Rule. Table 4-13 displays the plaster questionnaire results from above being used to calculate event frequencies for the removal or replacement of plaster wall using destructive means. Frequencies are estimated for various job sizes: greater than 6 square feet, greater than 40 square feet, and greater than 60 square feet.

Table 4-13: Estimation of Frequency of Plaster Removal Using Destructive Means		
Practice Definition	**Calculation Description**	**Total Number of Clearance Events** [a]
Removal or Replacement of Plaster Wall > 6 Square Feet Using Destructive Means	Average of responses imputed from questions 5, 6, and 7.	10.7% of Wall Removal/Replacement
Removal or Replacement of Plaster Wall > 40 Square Feet Using Destructive Means	Average of responses imputed from questions 5, 6, and 8.	10.0% of Wall Removal/Replacement
Removal or Replacement of Plaster Wall > 60 Square Feet Using Destructive Means	Average of responses imputed from questions 5, 6, and 9.	9.3% of Wall Removal/Replacement

[a] The estimated number of events is based on the average of the responses to the survey questions, as shown in Table 4-12.

Since wall removals and replacements are only a subset of all wall-disturbing (and other renovation) events, it is necessary to convert the frequencies above into overall proportions of 2008 LRRP Events. See Table 4-14 for this conversion.

[4] This value is consistent with data from HUD's 2001 National Survey of Lead and Allergens in Housing, which reports that 31% of painted walls in pre-1978 housing are plaster. Since not all wall repair jobs require removing all or part of the wall, the fraction of such jobs removing plaster walls will be less than the percentage of houses with plaster walls.

Table 4-14: Estimation of Event Frequencies for Removal or Replacement of Plaster Walls Using Destructive Means

2008 Event Category	Frequency of Wall Removal or Replacement[a]	Practice Definition	Frequency of Practice [b]	Total Number of Clearance Events
Kitchen	20% (AHS, 1997)	Removal/ Replacement of Plaster Wall > 6 Square Feet Using Destructive Means	10.7% * 20.0% = 2.1%	2.1% of Kitchen
		Removal or Replacement of Plaster Wall > 40 Square Feet Using Destructive Means	10.0% * 20.0% = 2.0%	2.0% of Kitchen
		Removal or Replacement of Plaster Wall > 60 Square Feet Using Destructive Means	9.3% * 20.0% = 1.9%	1.9% of Kitchen
Bathroom	21% (AHS, 1997)	Removal or Replacement of Plaster Wall > 6 Square Feet Using Destructive Means	10.7% * 21.0% = 2.2%	2.2% of Bathroom
		Removal or Replacement of Plaster Wall > 40 Square Feet Using Destructive Means	10.0% * 21.0% = 2.1%	2.1% of Bathroom
		Removal or Replacement of Plaster Wall > 60 Square Feet Using Destructive Means	9.3% * 21.0% = 2.0%	2.0% of Bathroom
Additions	25% (AHS, 1997)	Removal or Replacement of Plaster Wall > 6 Square Feet Using Destructive Means	10.7% * 25.0% = 2.7%	2.7% of Additions
		Removal or Replacement of Plaster Wall > 40 Square Feet Using Destructive Means	10.0% * 25.0% = 2.5%	2.5% of Additions
		Removal or Replacement of Plaster Wall > 60 Square Feet Using Destructive Means	9.3% * 25.0% = 2.3%	2.3% of Additions
Wall-Disturbing	10% (AHS, 1997)	Removal or Replacement of Plaster Wall > 6 Square Feet Using Destructive Means	10.7% * 10.0% = 1.1%	1.1%of Wall-Disturbing
		Removal or Replacement of Plaster Wall > 40 Square Feet Using Destructive Means	10.0% * 10.0% = 1.0%	1.0% of Wall-Disturbing
		Removal or Replacement of Plaster Wall > 60 Square Feet Using Destructive Means	9.3% * 10.0% = 0.9%	0.9%of Wall-Disturbing

[a] The frequency represents the share of instances for an event category where a wall is removed or replaced according to American Housing Survey data. For example, a wall is removed or replaced in 20% of kitchen renovations and 21% of bathroom renovations. In the case of wall-disturbing events, 10% involve removing or replacing a wall, and the remaining 90% involve less extensive work, such as cutting a hole in the wall.

[b] Based on the Frequency of Wall Removal or Replacement in this row, and the Total Number of Clearance Events from Table 4-13

Frequency of Removal of Trim or Molding Replacement During Wall Repair/Replacement

The results from the Plaster Questionnaire can be utilized to estimate the frequency of wall removal or repair events affected by the trim and molding specifications of the LRRP Clearance Rule.[5] The frequency of removal of greater than 6 square feet of trim or molding in proportion to 2008 total events can be approximated from question (2) of the plaster survey; the frequency of removal of greater than 40 square feet of trim or molding can be estimated from question (3); and the frequency of removal of

[5] These are separate from the trim and molding replacements during kitchen and bathroom renovation events that were estimated using the Carpentry Questionnaire.

greater than 80 square feet of trim or molding can be estimated from question (4). Table 4-15 summarizes the survey-based estimation methodologies for the event frequencies of wall removal or repair requiring removal of trim or molding.

Table 4-15: Estimation of Frequency of Removal of Trim or Molding for Wall Replacement/Repair Events

Practice Definition	Frequency of Practice [a]	Total Number of Dust Wipe Testing Events
Removal of Trim or Molding > 6 Square Feet	53.1% (Plaster Survey, Question 2)	53.1% of Wall Replacement/Repair
Removal of Trim or Molding > 40 Square Feet	26.7% (Plaster Survey, Question 3)	26.7% of Wall Replacement/Repair
Removal of Trim or Molding > 80 Square Feet	11.4% (Plaster Survey, Question 4)	11.4% of Wall Replacement/Repair

[a] The estimated number of events is based on the average of the responses to the survey questions, as shown in Table 4-12.

As in the estimation of the frequency of removal or demolition of a plaster wall using destructive means, wall removals and replacements represent only a subset of all wall-disturbing (and other renovation) events. Therefore, it is necessary to convert the frequencies above into overall proportions of wall-disturbing events and additions. This calculation is demonstrated in Table 4-16 below.

Table 4-16: Estimation of Final Event Frequencies for Removal of Trim or Molding

2008 Event Category	Frequency of Wall Removal or Replacement [a]	Practice Definition	Frequency of Practice [b]	Total Number of Dust Wipe Testing Events
Additions	25% (AHS, 1997)	Removal of Trim or Molding > 6 Square Feet	53.1% * 25.0% = 13.3%	13.3% of Additions
		Removal of Trim or Molding > 40 Square Feet	26.7% * 25.0% = 6.7%	6.7% of Additions
		Removal of Trim or Molding > 80 Square Feet	11.4% * 25.0% = 2.8%	2.8% of Additions
Wall-Disturbing	10% (AHS, 1997)	Removal of Trim or Molding > 6 Square Feet	53.1% * 10.0% = 5.3%	5.3% of Wall-Disturbing
		Removal of Trim or Molding > 40 Square Feet	26.7% * 10.0% = 2.7%	2.7% of Wall-Disturbing
		Removal of Trim or Molding > 80 Square Feet	11.4% * 10.0% = 1.1%	1.1% of Wall-Disturbing

[a] The frequency represents the share of instances for an event category where a wall is removed or replaced according to American Housing Survey data. A wall is removed or replaced in 25% of additions In the case of wall-disturbing events, 10% involve removing or replacing a wall, and the remaining 90% involve less extensive work, such as cutting a hole in the wall.
[b] Based on the Frequency of Wall Removal or Replacement in this row, and the Total Number of Dust Wipe Testing Events from Table 4-15.

4.2.2 Event Frequencies Based on Secondary Data Sources

4.2.2.1 Cabinet Removal

For cabinet replacement events – which under the proposed Clearance Rule result in additional dust wipe testing requirements – no primary data collection was used to estimate event frequencies. According to the 1997 American Housing Survey, 58% of kitchen renovations and 42% of bathroom renovations involve cabinet replacement. According to HUD (2001) data, 10.5% of kitchen's have cabinets with an aggregate area larger than 6 square feet and less than 40 square feet, 27.5% have between 40 and 80

square feet, and 62 percent have more than 80 square feet. It is assumed that all bathroom cabinet removal is between 6 and 40 square feet. In order to calculate the exact frequency for each cabinet job size, the following frequencies are multiplied: the percentage of renovations involving cabinet replacement, and the percentage of these jobs of a given square footage size threshold. These computations are presented in Table 4-17 below.

Table 4-17: Estimation of Frequency of Removal of Cabinets

2008 Event Category	Practice Definition	Frequency of Practice	Total Number of Dust Wipe Testing/ Clearance Events
Kitchen	Removal of Cabinets > 6 Square Feet	58.0% * 100.0% = 58.0%	58.0% of Kitchen
	Removal of Cabinets > 40 Square Feet	58.0% * 89.5% = 51.9%	51.9% of Kitchen
	Removal of Cabinets > 80 Square Feet	58.0% * 62.0% = 36.0%	36.0% of Kitchen
Bathroom	Removal of Cabinets > 6 Square Feet	42.0% * 100.0% = 42.0%	42.0% of Bathroom
	Removal of Cabinets > 40 Square Feet	42.0% * 0.0% = 0.0%	None
	Removal of Cabinets > 80 Square Feet	42.0% * 0.0% = 0.0%	None

Sources: American Housing Survey (Census 1997) and National Survey of Lead and Allergens in Housing (HUD 2001)

4.2.3 Summary of Event Frequencies

Table 4-18 and Table 4-19 summarize the frequency estimation methodology for all dust wipe testing and clearance events affected by this revision to the 2008 LRRP Rule, including options for different job size thresholds.

Table 4-18: Dust Wipe Testing Renovation Events		
Clearance Rule Events	**Event Frequency**	**Event Estimation Method**
Interior Painting With Scraping [a]	6.3% of Interior Painting	Based on Primary Data Collection from <10 Firms
(>6 sq. ft. per job)	1.1% of Interior Painting	Based on Primary Data Collection from <10 Firms
(>60 sq. ft. per job)	0.06% of Interior Painting	Based on Primary Data Collection from <10 Firms
(>120 sq. ft. per job)	None	Based on Primary Data Collection from <10 Firms
Interior Painting With Heat Gun [a]	0.1% of Interior Painting	Based on Primary Data Collection from <10 Firms
(>6 sq. ft. per job)	0.1% of Interior Painting	Based on Primary Data Collection from <10 Firms
(>60 sq. ft. per job)	None	Based on Primary Data Collection from <10 Firms
Removal of Trim or Molding [b]		
(> 6 sq. ft. per job)	5.1% of Interior Painting; 70.0% of Kitchen Renovations; 66.3% of Bathroom Renovations; 13.3% of Additions; 5.3% of Wall-Disturbing Events.	Based on Primary Data Collection from <10 Firms
(> 40 sq. ft. per job)	4.7% of Interior Painting; 50.7% of Kitchen Renovations; 24.4% of Bathroom Renovations; 6.7% of Additions; 2.7% of Wall-Disturbing Events.	Based on Primary Data Collection from <10 Firms
(> 80 sq. ft. per job)	1.3% of Interior Painting; 32.1% of Kitchen Renovations; 15.6% of Bathroom Renovations; 2.8% of Additions; 1.1% of Wall-disturbing Events.	Based on Primary Data Collection from <10 Firms
Removal of Cabinets [c]		
(> 6 sq. ft. per job)	58.0% of Kitchen Renovations 42.0% of Bathroom Renovations	Based on data from the 1997 American Housing Survey and HUD's 2001 National Survey of Lead and Allergens in Housing.
(> 40 sq. ft. per job)	51.9% of Kitchen Renovations	Based on data from the 1997 American Housing Survey and HUD's 2001 National Survey of Lead and Allergens in Housing.
(> 80 sq. ft. per job)	36.0% of Kitchen Renovations	Based on data from the 1997 American Housing Survey and HUD's 2001 National Survey of Lead and Allergens in Housing.
Removal or Replacement of Windows Frames [d]	43.5% of Window/Door Events	Based on Primary Data Collection from <10 Firms
Removal or Replacement of Door Frames [d]	17.6% of Window/Door Events	Based on Primary Data Collection from <10 Firms

[a] *Source:* Table 4-6.
[b] Source: Table 4-6, Table 4-10, and Table 4-16.
[c] Source: Table 4-17.
[d] Source: Table 4-9.

Table 4-19: Clearance Renovation Events

Clearance Rule Events	Event Frequency	Event Estimation Method
Plaster – Demolish, or Remove through Destructive Means [a]		
(> 6 sq. ft. per job)	2.1% of Kitchen Renovations; 2.2% of Bathroom Renovations; 2.7% of Additions; 1.1% of Wall-Disturbing Events.	Based on Primary Data Collection from <10 Firms
(> 40 sq. ft. per job)	2.0% of Kitchen Renovations; 2.1% of Bathrooms Renovations; 2.5% of Additions; 1.0% of Wall-Disturbing Events.	Based on Primary Data Collection from <10 Firms
(> 60 sq. ft. per job)	1.9% of Kitchen Renovations; 2.0% of Bathroom Renovations; 2.3% of Additions; 0.9% of Wall-Disturbing Events.	Based on Primary Data Collection from <10 Firms
Interior Painting with High-Speed Machine Paint Removal [b]	11.3% of Interior Painting	Based on Primary Data Collection from <10 Firms
(> 6 sq. ft. per job)	0.1% of Interior Painting	Based on Primary Data Collection from <10 Firms
(>60 sq. ft. per job)	0.1% of Interior Painting	Based on Primary Data Collection from <10 Firms

[a] Source: Table 4-14
[b] Source: Table 4-6

4.2.4 Total Number of Dust Wipe Testing and Clearance Events

This section describes the methodology for applying the event frequencies described above to the numbers of events estimated for the economic analysis of the 2008 LRRP rule in order to estimate the number of dust wipe testing and clearance events.

4.2.4.1 Threshold Options for Amount of Painted Surfaces Disturbed

Under the proposed rule, dust wipe testing or clearance would be required after performing certain types of RRP events where the total amount of painted surfaces disturbed is larger than a specified threshold (measured in square feet). This analysis includes an analysis of three threshold options:

1. Low Threshold Option
   - All event types requiring dust wipe testing where the total job size is larger than 6 square feet.
   - Clearance is required for:
     - high-speed machine removal of paint larger than 6 square feet, and
     - plaster removal using destructive means, larger than 6 square feet.
2. Proposed Threshold Option
   - Dust wipe testing is required for:
     - cabinet and trim events larger than 40 square feet,
     - scraping of paint larger than 60 square feet,
     - heat gun removal of more than 6 square feet
     - Window frame or door frame removal events
   - Clearance is required for:
     - high-speed machine removal of paint larger than 6 square feet, and
     - plaster removal using destructive means, larger than 6 square feet.
3. High Threshold Option

- Dust wipe testing is required for:
  - cabinet and trim events larger than 80 square feet,
  - scraping or heat gun removal of paint larger than 120 square feet, and
  - window frame or door frame removal events.
- Clearance is required for:
  - high-speed machine removal of paint larger than 60 square feet, and
  - plaster removal using destructive means, larger than 60 square feet.

For units undergoing regulated RRP activities, the number of events requiring either dust wipe testing or clearance was estimated. Table 4-20 presents these event types, the areas in which they occur, the type of cleaning verification required, and the size thresholds relevant to each.

Table 4-20: Event Types Requiring Dust Wipe Testing and Clearance by Size Threshold

Event Type	Event Area						Activity	Threshold		
	Bath	Kit	Add	Wall	WD	Paint		Low	Proposed	High
Cabinet Removal	X	X					DWT	6	40	80
Trim/Molding Removal	X	X	X	X		X	DWT	6	40	80
Window / Door Frame Removal					X		DWT	n/a	n/a	n/a
Painting w/ Scraping						X	DWT	6	60	120
Painting w/ Heat Gun						X	DWT	6	6	60
Paint Removal w/ High-Speed Machine						X	DWT & C	6	6	60
Plaster Removal w/ Destructive Means	X	X	X	X			DWT & C	6	6	60

Bath = Bathroom renovation; Kit = Kitchen renovation; Add = Addition; Wall = Wall disturbing event; WD = window frame or door frame event; Paint = Interior Painting
DWT = Dust Wipe Testing
C = Clearance

As shown in the table, window and door frame removal events do not have size thresholds associated with them. It is assumed that any window or door frame removal event will require dust wipe testing, though the necessary amount of dust wipe testing will be dependent on the number of rooms in the work area. For bathroom cabinet removal events, all such events were assumed to disturb between 6 and 40 square feet of cabinetry.

4.2.4.2 Estimating the Number of Dust Wipe Testing and Clearance Events

Three pieces of information were necessary to estimate the number of dust wipe testing and clearance events for each option: (1) the probability that an event occurs above the specified size threshold, (2) the mutually exclusive probability that an event *only occurs in a single room* within a unit and where *no other event occurs* within that unit, and (3) the joint probability that either an event occurs in multiple rooms within a unit or with *any combination of other events* within the unit. The determination of mutually exclusive and joint events has two components: (1) the event type (e.g., cabinet removal), and

(2) the room in which the event takes place (e.g., bathroom). A mutually exclusive event is defined as a single event type occurring only in a single room within a unit, given that no other event types occur. Conversely, a joint event could be any combination of event types occurring within the same unit, or any combination of a single event type occurring in multiple rooms within the unit. The probabilities that events occur above different size thresholds are described in sections 4.2.1, 4.2.2, and 4.2.3

Avoiding Double Counting

Calculating the mutually exclusive and joint probabilities for all event types was necessary to avoid double counting. For example, it was estimated that cabinets and trim are replaced during 32.8% and 66.3% of bathroom remodeling events, respectively. Simply multiplying the number of bathroom remodeling events by the sum of these probabilities (99.1%) to estimate the number of dust wipe testing events due to cabinet or trim replacement will double count instances where cabinets and trim were replaced at the same time. In cases such as this, two event types occur in the same room of a single unit. The unit should therefore only be counted once. Other joint events consist of one or more event types occurring in multiple rooms of a single unit. For example, a bathroom cabinet removal event and a kitchen trim removal event may occur during a single job. As in the previous example, simply multiplying the probabilities of a bathroom cabinet removal and of a kitchen trim removal by the number of units where bathrooms and kitchens are remodeled would count such multiple-event jobs twice.

To avoid double counting multiple-event units, the probability of a unit having a mutually exclusive event is added to the probability of a unit having joint events. In the simplified case of two events types, E_1 and E_2, with probabilities that each occur, p_1 and p_2, respectively, the total number of affected units can be calculated as follows:

(1) Probability of each event occurring by itself:

Probability of E_1 *only*: $p_1(\text{only}) = p_1 * (1 - p_2)$

Probability of E_2 *only*: $p_2(\text{only}) = p_2 * (1 - p_1)$

(2) Probability of both events occurring together:

Probability of E_1 *and* E_2: $p_{1,2}(\text{joint}) = p_1 * p_2$

(3) Total number of units where E_1 and/or E_2 occur:

$\text{Affected units} = u * (p_1(\text{only}) + p_2(\text{only}) + p_{1,2}(\text{joint}))$

Where:

u = the number of units where E_1 or E_2 could occur

Although this example has two event types, the methodology can be extended to determine the number of affected units for any number of event types and rooms in which events occur. Note that for these calculations the analysis relies on the simplifying assumption that these joint probabilities are independently distributed. In reality, these activities are more likely to occur together. Therefore, this simplifying assumption introduces an upward bias to estimates of the number of dust wipe and clearance events, but the magnitude of this bias is unknown.

Grouping Events into Options by Size

This analysis evaluates three threshold options for triggering the dust wipe testing and clearance requirements of the rule. The proposed clearance rule sets thresholds that are specific to the entire job (as opposed to being a component-specific threshold). Thus, it is possible that two smaller renovation tasks occurring in the same unit could trigger the rule's requirements, even if the tasks would not exceed the

threshold when being performed in isolation. The tasks defined in this analysis that may contribute toward the same threshold requirements are as follows:

- Removing more than 40 square feet of trim, molding, cabinets, or other fixtures
    - Replace kitchen cabinets
    - Replace bathroom cabinets
    - Replace kitchen trim
    - Replace bathroom trim
    - Replace trim during painting
    - Replace trim during addition
    - Replace trim during other wall disturbing event
- Demolition, or removal through destructive means, of more than 6 square feet of plaster and lath building component
    - Destructive removal of plaster and lath building component during kitchen remodel
    - Destructive removal of plaster and lath building component during bathroom remodel
    - Destructive removal of plaster and lath building component during an addition
    - Destructive removal of plaster and lath building component during another wall-disturbing event

Thus, in order to calculate whether an entire job exceeded the applicable threshold it was assumed that the average size for a particular task is the midpoint between consecutive size thresholds. For example, an average size of 23 square feet was assumed for a bathroom cabinet removal event, the midpoint between 6 and 40 square feet.

Based on this assumption, the amount of painted surfaces disturbed was combined for multiple-event jobs to determine whether the events exceed the thresholds. For example, suppose a unit undergoes both bathroom cabinet and kitchen cabinet removal events that are between 6 and 40 square feet. Because the estimated total job size is greater than 40 square feet (23 plus 23 equals 46), this job is assumed to exceed the proposed threshold option.

Determining Maximum Room Area Size

As in the estimation of work area sizes for the 2008 LRRP rule, the size of the work area requiring dust wipe testing after a multiple-event job is assumed to be equal to the maximum work area size of the individual events. This assumption accounts for the overlap of different renovation activities occurring within the same unit (for example, replacing cabinets and re-painting a kitchen). Bathroom and kitchen events are exceptions because they are separate rooms within a unit and thus cannot overlap; the sum of their work areas is compared to other event sizes. For example, if the sum of a bathroom and kitchen event is 208 square feet and a 112 square foot painting event is also occurring in the same unit, it is assumed that the painting was performed in the bathroom and kitchen; therefore, the event size would be 208 square feet.

4.2.4.3 Total Number of Dust Wipe Testing and Clearance Events

The analysis calculated the probabilities for all possible combinations of event types and sizes. These probabilities were then applied to the estimates of units performing events compliant with the 2008 LRRP

rule and 2009 proposed opt-out rule requirements. The resulting data included the number of units requiring dust wipe testing or clearance for each size threshold option.

These data were then grouped by the maximum work area sizes to determine the appropriate allocation of dust wipe testing or clearance costs.[6] Testing costs are dependent on work area size, as larger work areas require more dust wipe tests and more re-cleaning when necessary.

Testing costs also depend on the probability that a floor is carpeted because the proposed rule only requires dust wipe tests for uncarpeted floors. As the probability that a floor is carpeted differs for bathrooms and kitchens compared to events performed in other rooms, it was necessary to distinguish between bathroom, kitchen, and other events. In addition, firms performing RRP work in renter-occupied property will incur different paperwork costs than firms performing work in owner-occupied buildings under the proposed LRRP clearance rule, because the dust wipe testing report must be provided to both the owner and the occupant.

Table 4-21 through Table 4-24 present the resulting number of events for dust wipe testing and clearance. Events are presented by building tenure, building type, work area size, and occurrence of a bathroom or kitchen event. Note that events in public and commercial building COFs are always assumed to exceed the highest size threshold option. Table 4-25 presents the total number of dust wipe testing and clearance events for by the type of activity triggering the dust wipe testing or clearance requirements.

[6] The work area sized utilized in this analysis were estimated for EPA's analysis of the 2008 LRRP rule, and are shown below in Table 4-40 through Table 4-49.

Table 4-21: Target Housing Events (thousands): First Year, Low Threshold Option

Size	Dust Wipe Testing				Clearance				Total				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Events Excluding Kitchen or Bathroom													
Bath	34	2	21	21	7.8	0.4	4.8	4.7	41	2	26	25	**94**
Kit	102	6	33	31	1.5	0.1	0.2	0.2	104	6	33	31	**173**
Bath+Kit	1	0	0	0	0.3	0.0	0.0	0.0	1	0	0	0	**2**
S-Paint	53	3	25	38	1.3	0.1	0.5	0.8	55	3	25	39	**122**
M-Paint	28	2	14	24	0.5	0.0	0.2	0.4	28	2	14	25	**69**
L-Paint	26	1	13	23	0.4	0.0	0.2	0.4	26	2	14	24	**65**
S-WD	96	5	32	30	0.3	0.0	0.1	0.0	96	5	32	30	**163**
L-WD	101	6	32	31	0.6	0.0	0.1	0.1	101	6	32	31	**171**
Subtotal	*441*	*25*	*170*	*199*	*12.6*	*0.6*	*6.2*	*6.6*	*453*	*25*	*176*	*205*	***860***
Events Including Kitchens or Bathrooms													
Bath	97	4	149	89	3.7	0.2	5.8	3.3	101	4	155	93	**353**
Kit	116	7	141	149	4.5	0.2	4.5	4.7	121	7	145	154	**427**
Bath+Kit	35	4	87	31	2.7	0.3	6.3	2.1	37	5	93	33	**168**
S-Paint	4	0	6	3	0.2	0.0	0.3	0.2	5	0	6	4	**15**
M-Paint	5	0	4	5	0.3	0.0	0.2	0.3	5	0	4	6	**15**
L-Paint	2	0	5	2	0.2	0.0	0.4	0.1	2	0	5	2	**9**
S-WD	6	0	5	0	0.2	0.0	0.2	0.0	6	0	5	0	**11**
L-WD	16	1	10	5	0.8	0.0	0.4	0.2	17	1	10	5	**33**
Subtotal	*281*	*17*	*405*	*285*	*12.7*	*0.8*	*18.1*	*10.8*	*294*	*18*	*423*	*296*	*1,030*
All Events													
Total	**722**	**42**	**574**	**483**	**25.3**	**1.4**	**24.3**	**17.4**	**747**	**43**	**599**	**501**	**1,890**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a medium painting sized event; L-Paint indicates a large painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event.

A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:

Bathroom size: wall-disturbing events, addition events

Kitchen size: wall-disturbing events, addition events, window/door replacements

Bathroom + kitchen size: wall-disturbing events, addition events

"0" and "0.0" indicate more than zero but fewer than 500 and 50 events respectively.

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-22: Target Housing Events (thousands): First Year, Proposed Option

Type	Dust Wipe Testing				Clearance				Total				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Events Excluding Kitchen or Bathroom													
Bath	17	1	11	10	8.1	0.4	5.3	4.9	25	1	16	15	**58**
Kit	104	6	35	32	1.7	0.1	0.3	0.3	106	6	35	32	**179**
Bath+Kit	1	0	0	0	0.3	0.0	0.1	0.0	1	0	0	0	**1**
S-Paint	42	2	19	30	1.2	0.1	0.5	0.8	43	2	20	31	**96**
M-Paint	22	1	11	19	0.5	0.0	0.2	0.4	22	1	11	19	**54**
L-Paint	20	1	10	18	0.4	0.0	0.2	0.4	21	1	11	19	**51**
S-WD	101	6	34	31	0.3	0.0	0.1	0.0	101	6	34	31	**172**
L-WD	104	6	35	32	0.6	0.0	0.1	0.1	105	6	35	32	**178**
Subtotal	*410*	*23*	*155*	*173*	*13.2*	*0.6*	*6.9*	*6.9*	*424*	*24*	*162*	*180*	***789***
Events Including Kitchens or Bathrooms													
Bath	52	2	80	48	3.5	0.2	5.5	3.1	56	2	86	51	**195**
Kit	102	6	124	133	4.4	0.2	4.6	4.8	106	6	128	137	**379**
Bath+Kit	35	5	87	31	2.6	0.3	6.1	2.0	38	5	93	33	**169**
S-Paint	4	0	5	3	0.2	0.0	0.2	0.1	4	0	5	3	**12**
M-Paint	4	0	3	4	0.2	0.0	0.1	0.2	4	0	3	5	**12**
L-Paint	2	0	4	1	0.1	0.0	0.3	0.1	2	0	4	1	**8**
S-WD	3	0	3	0	0.2	0.0	0.2	0.0	3	0	3	0	**6**
L-WD	13	1	7	4	0.8	0.0	0.4	0.2	13	1	8	4	**26**
Subtotal	*215*	*14*	*313*	*224*	*12.1*	*0.8*	*17.4*	*10.5*	*227*	*15*	*331*	*234*	*807*
All Events													
Total	**625**	**37**	**468**	**397**	**25.3**	**1.4**	**24.3**	**17.4**	**650**	**39**	**493**	**414**	**1,596**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a medium painting sized event; L-Paint indicates a large painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event.

A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:

Bathroom size: wall-disturbing events, addition events
Kitchen size: wall-disturbing events, addition events, window/door replacements
Bathroom + kitchen size: wall-disturbing events, addition events

"0" and "0.0" indicate more than zero but fewer than 500 and 50 events respectively.

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-23: Target Housing Events (thousands): First Year, High Threshold Option

Type	Dust Wipe Testing				Clearance				Total				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Events Excluding Kitchen or Bathroom													
Bath	7	0	5	4	7.5	0.4	5.0	4.5	15	1	9	9	**34**
Kit	108	6	37	33	1.7	0.1	0.3	0.3	109	6	37	33	**186**
Bath+Kit	0	0	0	0	0.3	0.0	0.2	0.0	1	0	0	0	**1**
S-Paint	12	1	5	8	0.5	0.0	0.3	0.4	12	1	6	9	**27**
M-Paint	6	0	3	5	0.2	0.0	0.1	0.2	6	0	3	5	**14**
L-Paint	5	0	3	5	0.2	0.0	0.1	0.2	5	0	3	5	**13**
S-WD	106	6	37	33	0.3	0.0	0.1	0.0	107	6	37	33	**182**
L-WD	107	6	37	33	0.5	0.0	0.1	0.1	108	6	37	33	**184**
Subtotal	*351*	*20*	*126*	*121*	*11.3*	*0.5*	*6.1*	*5.7*	*363*	*20*	*132*	*127*	***642***
Events Including Kitchens or Bathrooms													
Bath	25	1	38	22	3.0	0.1	4.8	2.7	28	1	43	25	**97**
Kit	84	5	102	110	3.7	0.2	4.2	4.2	87	5	106	114	**312**
Bath+Kit	32	4	80	29	2.1	0.3	4.8	1.6	34	4	85	30	**154**
S-Paint	3	0	4	3	0.1	0.0	0.2	0.1	4	0	5	3	**11**
M-Paint	4	0	3	4	0.2	0.0	0.1	0.1	4	0	3	4	**12**
L-Paint	2	0	4	1	0.1	0.0	0.2	0.1	2	0	4	1	**8**
S-WD	2	0	1	0	0.2	0.0	0.1	0.0	2	0	1	0	**3**
L-WD	10	1	6	3	0.7	0.0	0.4	0.2	10	1	6	3	**20**
Subtotal	*161*	*11*	*238*	*172*	*10.0*	*0.7*	*14.7*	*9.0*	*171*	*12*	*253*	*181*	*617*
All Events													
Total	**512**	**31**	**364**	**293**	**21.4**	**1.2**	**20.9**	**14.6**	**534**	**32**	**385**	**307**	**1,258**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a medium painting sized event; L-Paint indicates a large painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event.

A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:

Bathroom size: wall-disturbing events, addition events
Kitchen size: wall-disturbing events, addition events, window/door replacements
Bathroom + kitchen size: wall-disturbing events, addition events

"0" and "0.0" indicate more than zero but fewer than 500 and 50 events respectively.

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-24: Public and Commercial Building COF Events: First Year, All Options			
Building Type	**Dust Wipe Testing**	**Clearance**	**Total**
Kindergarten (Public)	158	35	192
Kindergarten (Large Private)	23	5	27
Kindergarten (Small Private)	27	6	32
Pre-K + Kindergarten (Public)	123	27	150
Pre-K + Kindergarten (Large Private)	67	15	82
Pre-K + Kindergarten (Small Private)	34	7	41
Daycare Center (Renter-Occupied)	171	37	208
Daycare Center (Owner-Occupied)	117	26	142
Daycare Center (Non-Profit who performs some of own RRP)	149	32	181
Daycare Center (Non-Profit who uses contractors)	55	12	67
Daycare Center (In Public School)	8	2	10
Daycare Center (In Large Private School)	0	0	0
Daycare Center (In Small Private School)	0	0	0
All Events	**930**	**203**	**1,134**
Note: A zero indicates that fewer than one event is performed annually.			

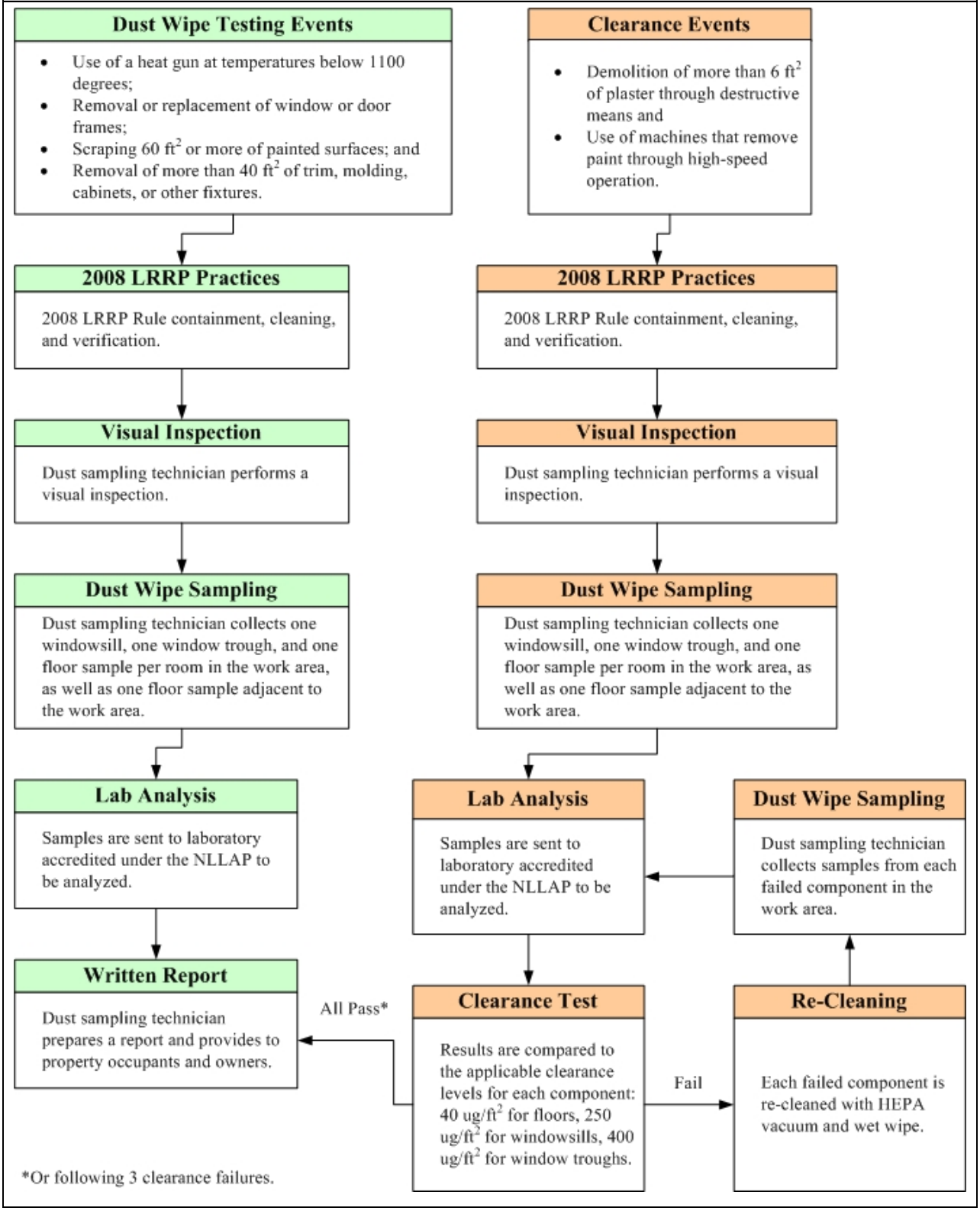
Table 4-25: Total First Year Events by Event Type									
	Low Threshold			**Proposed Threshold**			**High Threshold**		
Event Type	**Target Housing**	**Public and Com. Bldg. COF**	**Total**	**Target Housing**	**Public and Com. Bldg. COF**	**Total**	**Target Housing**	**Public and Com. Bldg. COF**	**Total**
Dust Wipe Testing Events									
Heat gun, < 1000 degrees	3,633	1	3,635	3,799	1	3,800	-	1	1
Window/door frame removal	483,244	663	483,907	512,852	663	513,515	543,863	663	544,526
Scraping	39,964	89	40,053	2,089	89	2,179	-	89	89
Trim, molding, cabinet removal	687,319	176	687,495	436,450	176	436,626	206,915	176	207,092
Multiple activity events[a]	607,308	-	607,308	572,232	-	572,232	449,293	-	449,293
Subtotal, dust wipe testing	1,821,468	930	1,822,398	1,527,422	930	1,528,353	1,200,071	930	1,201,002
Clearance Events									
High speed paint removal	3,633	160	3,793	3,799	160	3,959	2,027	160	2,187
Plaster demolition through destructive means	21,097	43	21,140	28,703	43	28,746	31,094	43	31,137
Multiple activity events[a]	43,704	-	43,704	35,932	-	35,932	24,959	-	24,959
Subtotal, clearance events	68,434	203	68,637	68,434	203	68,637	58,079	203	58,283
Total, All Event Types	**1,889,902**	**1,134**	**1,891,036**	**1,595,856**	**1,134**	**1,596,990**	**1,258,151**	**1,134**	**1,259,284**
[a] Multiple event types occurring during the course of a single job (e.g., a renovation with both window frame removal and trim removal). Because the probability of multiple-activity events varies with the size threshold, the number of events for single-event activities is not consistent across size thresholds.									

4.3 Costs of Dust Sampling and Clearance

Two requirements of the proposed LRRP Clearance Rule that have cost implications are: (1) a requirement to perform dust wipe testing for a subset of RRP activities, and (2) a requirement to perform dust wipe testing and achieve clearance for a second subset of RRP activities where the quantity of lead dust and the characteristics of the dust make it hard to clean up. Figure 4-5 presents a summary of the dust wipe testing and clearance requirements.

This section outlines a methodology for estimating the costs of these requirements under the proposed LRRP Clearance Rule and presents the resulting total costs. First, the cost of using a third party to perform dust wipe testing services following certain RRP events is estimated. Next, firm costs associated with dust wipe testing when the firm's own dust sampling technician is used are described. Re-cleaning cost estimates and clearance failure rates for different surfaces are also presented. Finally, these costs are combined to determine the total cost of dust wipe testing and clearance requirements for all applicable events.

Figure 4-5: Summary of Required Activities for Performing Dust Wipe Testing and Clearance



4.3.1 Costs of Renovation Firm and Third Party Dust Wipe Testing

In order to estimate the costs of conducting dust wipe testing following RRP activities, EPA administered a questionnaire to nine lead evaluation firms that included questions about what the firms would charge to perform dust wipe testing and what the labor requirements and laboratory costs would be for performing the testing. The sampling procedure for lead evaluation firm selection is discussed below. The questionnaire and a description of the purpose of each question are also provided. The final section outlines the results of the survey.

4.3.1.1 Lead Evaluation Firm Sample Universe

To draw the sample of lead evaluation firms, nine states were randomly selected while limiting the sample selection to no more than one state per EPA region. In addition, states were selected such that at least one and no more than two states would have lead abatement and evaluation programs administered by EPA.[7] The nine states selected according to these criteria were: Minnesota, Idaho, Georgia, Maine, Colorado, Oklahoma, Virginia, Kansas, and New Jersey. Idaho was the state selected with a lead-based paint program administered by EPA.[8]

Once the nine states were selected, lists of lead evaluation firms from state program websites were obtained and contractors were randomly called until a firm from each selected state agreed to complete the questionnaire. One outlier response was removed from the analysis. This was the first firm that completed the questionnaire, and the survey instrument completed by this firm asked about the cost for taking dust wipe samples, analyzing them, and providing a short report. This firm reported extremely high costs and a substantial amount of the costs were related to providing the report. Because the firm appears to have erroneously concluded that an exhaustive report would be required, the wording of the questionnaire for subsequent respondents was changed from "short report" to "one-page report." The cost estimates provided by the subsequent respondents were an order of magnitude lower than those from the first respondent. Since the first firm's estimates appear to be uncharacteristically high due in part to this difference in wording, their responses were dropped from the analysis. Simple averages were calculated for each question across the eight remaining responses in order to estimate the necessary parameters.

4.3.1.2 Script for Lead Evaluation Firm Questionnaire

Figure 4-1 presents the script used in the survey of lead evaluation firms. The introduction served to familiarize firms with the objectives of the survey and the nature of EPA's proposed rule revision. Information collected in question (1) provides a basis for estimating the costs of third party testing. Third party testing may be used in some cases – even if it is not required – because it will be less expensive for renovation firms that perform RRP events infrequently enough that the cost of certifying a dust sampling technician is not justified. Information collected in questions (2) and (3) allow estimation of the costs of dust wipe testing by the renovation firm. The cost is the labor time multiplied by the renovator wage rate, plus lab fees, plus the cost of materials, plus the cost of shipping samples to the lab. Information collected in questions (4) and (5) provide information about the amount of lead time currently needed before conducting a third party inspection and the amount of time it takes to get test results back after dust sampling, but these questions were not used in this cost analysis.

[7, 8] 24% of all states have a lead-based paint certification program administered by the EPA.

Figure 4-6: Lead Evaluation Firm Survey Instrument

Introduction: Hello, I'm _____, calling from Abt Associates. We're an independent research firm that is doing contract work for the Environmental Protection Agency (EPA). We'd like to ask you a few questions in order to better understand how much it might cost to perform dust clearance testing after renovation activities. EPA will be proposing to require dust sampling and/or clearance testing after certain renovation practices are used that may disturb lead-based paint. We will use the responses to our survey to estimate how costly these requirements would be. Your responses will be treated as confidential and your name will not be provided to the EPA. There are 5 questions in our survey and we expect it to take less than 5 minutes.

Screen Q1: Does your firm perform lead evaluation such as dust sampling?
□ Yes □ No (end survey if no)

Screen Q2: Are you knowledgeable about the costs of performing some of these services?
□ Yes {Skip to (1) if Yes.}□ No

Screen Q3: Is there someone there I could speak with who is knowledgeable about the costs of performing some of these services?
□ Yes {re-read intro and skip to (1)}□ No

Screen Q4: Is there another time I could call back to speak with someone who is knowledgeable about the costs of performing some of these services?
□ Yes: _____ □ No (end survey)

(1) What would you charge to take four dust wipe samples (one window trough, one window sill, and two floor samples), have them sent in and analyzed by the lab, and provide a 1-page report to the contractor?
$_____.

a. How much extra would it cost per additional dust wipe sample?
$_____.

b. How much would it cost for only two dust wipe samples (window sill and trough)?
$_____.

(2) What would the lab portion of the above costs be?
$_____.

(3) Excluding travel time, how much labor time would be required to take four samples, send them to the lab, and provide a report to the contractor?
____ hours.

(4) How much time would it take between sampling and receiving the lab results?
____ days.

(5) How much lead time would your firm need to get an inspector to the site?
____ days.

4.3.1.3 Lead Evaluation Firm Responses and Summary of Results

Individual survey responses are presented by state in Table 4-1. The table also presents summary statistics showing the average and range of dust wipe testing cost responses.

Table 4-26: Summary of Responses to Lead Evaluation Firm Questionnaire by State

	(1)	(1a)	(1b)	(2)	(3)	(4)	(5)
Individual Responses							
Colorado	$250-$350	$20	$180-$200	$20/sample	2 hours	24 hours	2 hours - 1 day
Georgia	$500	$25	$425-$450	$25/sample	5 hours	3-5 business days	1-2 business days
Idaho	$1800-$2000	$150	$1500-$1800	$50/sample	8-15 hours	10 working days	1 day-1 week
Kansas	$450	$20	$400	$135 total ($20/sample)	3 hours	3 days	2 days
Maine	$225	$20	$190	$20/sample	20 minutes	48 hours	24 hours
Minnesota	$175-$200	$45	$85-$100	$15 plus $5/sample	2 hours	1 day	1-2 business days
New Jersey	$175	$20	$135	$20/sample	10 minutes	4-5 business days	1-2 days
Oklahoma	$110	$8.50	$92	$8.50/sample	1 hour	3 days	1 hour
Virginia	$150	$50	"Just different lab costs"	Don't Know	30/40 minutes - 1 hour	1 week	"several days"
Summary Statistics							
Median	$225	$20	$190	$20/sample	2 hours	3 days	1.5 days
Mean[1]	**$262**	**$26**	**$220**	**$19/sample**	**1 hour, 45 minutes**	**3 days**	**1.5 days**
Mode	N.A.	$20	$190	$20/sample	2 hours	1 day	1.5 days
Minimum	$110	$9	$92	$9/sample	10 minutes	1 day	1 hour
Maximum[1]	$1900	$150	$1650	$50/sample	12 hours	7 days	4 days
Maximum[2]	$500	$50	$438	$25/sample	5 hours	5 hours	4 days

1. Excludes the response from the firm in Idaho that was provided before the questionnaire was reworded.

4.3.2 Costs of Third Party Dust Wipe Testing and Clearance

Responses to question 1 are used to estimate how much it would cost renovation firms to hire third-party lead evaluation firms to perform dust wipe testing in order to comply with the LRRP Clearance Rule. The total cost of collecting, analyzing, and reporting four dust wipe samples as well as the marginal cost per additional sample were estimated. As shown in Table 4-27 below, third-party dust wipe testing costs are split into fixed and variable costs.

Table 4-27: Fixed and Variable Costs of Dust Wipe Sampling

Total Cost for Four Dust Wipes	Additional Cost per Wipe	Fixed Costs of Dust Wipe Testing
$262 (Question 1)	$26 (Question 1a.)	$262 minus four times $26 = $158

Using the information on fixed and variable costs of dust wipe sampling, the costs of third-party lead dust wipe testing is estimated, as illustrated in Table 4-28.

Table 4-28: Summary of Per-Event Costs for Events with Third Party Dust Wipe Testing

Event Type	(A) Fixed Cost Per Event	(B) Number of Samples[a]	(C) Marginal Cost Per Sample	(D) Re-cleaning Costs	Total
Dust Wipe Testing Events	Estimated as the sum of: • third party dust wipe testing costs ($158 from Question 1 and Question 1a) • photocopy costs • shipping costs ($4.95 per occupant or owner for priority mail) • shipping labor (5 minutes)	Estimated as the sum of: (1) the number of windows multiplied by two samples, (2) the number of rooms multiplied by the likelihood of non-carpeted floors, and (3) one sample outside the work area.	$26 third party dust wipe testing costs (Question 1a)	None	The sum of: the fixed event cost (A), and the estimated number of samples (B) times the marginal cost (C).
Clearance Events	Estimated as the sum of: • third party dust wipe testing costs ($158 from Question 1 and Question 1a) multiplied by the expected number of clearance tests • photocopy costs multiplied by the expected number of clearance tests • shipping costs ($4.95 per occupant or owner for priority mail) • shipping labor (5 minutes)	Estimated as the sum of: (1) the product of the number of windows, two samples per window, and one plus the combined first and second failure rate, (2) the product of the number of rooms, the likelihood of non-carpeted floors, and one plus the combined first and second failure rates, and (3) one sample outside the work area.	$26 third party dust wipe testing costs (Question 1a)	The sum of the following costs: floor labor and material re-cleaning costs times the floor clearance failure rate; sill labor and material re-cleaning costs times the sill clearance failure rate; trough labor and material re-cleaning costs times the trough clearance failure rate; travel costs times the combined clearance failure rate.	The sum of: the fixed event cost (A), the estimated number of samples (B) times the marginal cost (C), and re-cleaning costs (D).

[a]For events in schools where there are more than four rooms affected, dust wipe samples are assumed to be taken from only four rooms.

For clearance events where there are more than four rooms affected (10.3 classrooms for schools with kindergartens and 13.2 classrooms for schools with kindergartens and pre-kindergartens), the initial dust wipe samples are assumed to be taken from only four rooms. If all dust wipe samples show results below clearance levels, there is no re-cleaning. If any sample of a given type (i.e., sill, trough, or floor) fails the clearance test, the failed surface must be re-cleaned, and all other surfaces of the same type in the untested rooms are assumed to be re-cleaned. In the event of a first-round failure, exactly four dust wipe samples of the type(s) that failed are assumed to be taken. They will include the failed surfaces plus additional samples as necessary to get to a total of four samples of the same type. If any sample of a given type fails the second-round clearance test, the failed surface will be re-cleaned, and all other surfaces of the same type (i.e., sill, trough, floor) in the remaining untested rooms will be re-cleaned.

4.3.3 Cost Estimation for Renovation Firms Performing Dust Wipe Testing and Clearance

The costs of dust wipe sampling for a renovation firm can be split into: (1) dust sampling material costs, (2) renovation firm labor costs, (3) shipping of samples, (4) lab costs, (5) report paperwork costs, and (6) shipping of results.[9] The methodology used to estimate the direct costs of dust wipe testing is presented in Table 4-29. The costs associated with dust sampling technician training are presented in sections 4.4 and 4.5.

Dust wipe testing costs are expected to vary according to the number of samples that are required, which will vary depending upon the number of rooms where samples must be taken and whether or not carpet is

[9] Most renovation firms are assumed to have a renovator become trained and certified as a Dust Sampling Technician, instead of hiring a third party firm to take the sample (see Section 4.4). These firms can take the samples and send them to the lab themselves. Because the staff are already at the renovation site, there are not travel costs associated with dust wipe testing for these events.

present. For a typical one-room renovation event, four samples would be required (window sill, window trough, workroom floor, adjacent room floor). For a renovation event where both the renovated room and the adjacent room are carpeted, only two samples would be required (window sill and window trough). Each additional room inside the work area will add 2-3 dust wipes depending on whether or not the room is carpeted (and whether or not there are windows in the work area), however samples are not required for more than 4 rooms in a unit's work area.

Labor time in the lead evaluation firm questionnaire was defined as "the amount of labor time, excluding travel time, required to take four dust wipe samples, send them to the lab, and provide a one page report to the contractor." Although use of this question for estimating the labor cost for events that require more or less than four samples may be limited, responses to question 1a regarding the cost of taking additional samples can be used to estimate the additional labor necessary per sample (See column C of Table 4-29).

Table 4-29: Summary of Dust Wipe Testing Costs (2008$)

(A) Number of Samples	(B) Lab and Material Cost Per Sample	(C) Marginal Labor Cost Per Sample	(D) Shipping Costs	(E) Report Paperwork Costs Per Event	(F) Fixed Labor Costs	(G) Total
Dust-Sampling-Only Events: Estimated as the sum of: (1) the number of windows multiplied by two samples, (2) the number of rooms multiplied by the likelihood of non-carpeted floors, and (3) one sample outside the work area.	Estimated as $19 per sample for lab fees (Question 2) plus $0.25 [a] for the dust wipe.	The cost of an additional sample was estimated to be $26 for third party testing (Question 1a). This includes $19 for lab fees (Question 2) plus $0.25[a] for the dust wipe, implying that the cost of the marginal labor per dust wipe is $6.75. Assuming a loaded wage of $34.92/hour, this implies that the marginal labor per sample is about 0.19 hours.	Estimated as the sum of: • $4.95 for shipping samples to the lab • Costs of shipping results to owners and occupants ($4.95 for each recipient) • $0.56 for ten minutes of labor time (at the renovator hourly wage rate of $34.92).	Estimated as $0.36 to make one copy of the four-page report for the property owner.[c] For rental properties, estimated as $0.72 to make two copies (for both the owner and occupant). It is assumed that public or commercial building COFs will also make 2 copies of the report.	Estimated to be 0.83 hours: calculated as 1.75 hours (the total from Question 3) less the variable labor (0.76 hours or 0.19 per sample shown in column C) less shipping labor (0.16 hours shown in column D).	Estimated as the sum of (D), (E) and (F) plus the number of units from (A) multiplied by the sum of the costs of (B) and (C).
Clearance Events: Estimated as the sum of: (1) the product of the number of windows, two window samples, and one plus the combined first and second failure rate, (2) the product of the number of rooms, the likelihood of non-carpeted floors, and one plus the combined first and second failure rates, and (3) one sample outside the work area.			Estimated as the sum of: • The expected number of clearance tests multiplied by (1) $4.95 for shipping samples to the lab and (2) $0.28 for 5 minutes of labor time (at a renovator wage rate) • Costs of shipping results to owners and occupants ($4.95 for each recipient or $15.68[b] for each recipient for events affecting access to the kitchen and bathroom) • $0.28 for five minutes of labor time (at the renovator wage rate).	Estimated as the specific per-report costs described for dust wipe testing events above multiplied by the expected number of clearance tests per event.	Estimated to be 0.83 hours calculated as above multiplied by the expected number of clearance tests.	

[a] The cost of a 200 pack of Ghost Wipes (ASTM approved wipes for lead dust testing) divided by 200.
[b] $15.68 is the average of USPS, FedEx, and UPS overnight rates for a package of ½ lb in distance zone 1 or 2
[c] The report is assumed to be four pages on average, this accounts for a one page job description, one page of lab results, one page for a diagram of sample locations, and one additional page is assumed to account for the instances where more than three pages might be necessary.

4.3.4 Likelihood of Clearance Failure

In order to approximate the frequency that dust wipe testing will result in floor or window re-cleaning activities, a clearance failure rate must be estimated separately for each component. Post-cleaning verification lead dust levels from EPA's Dust Study can be used to estimate what proportion of renovation events will fail the first (or both the first and second) round of clearance. Table 4-30 describes the methodology for estimating the failure rate using two different rates of floor sample failure for work areas with floors in "poor" condition and work areas with floors in "fair" or "good" condition. The Dust Study demonstrated that poor floor condition is positively correlated with post-cleaning-verification dust lead levels and it is likely that more floors in the dust study were in poor condition compared to those in the regulated housing stock. Therefore, this analysis estimates different clearance failure rates depending on floor condition in order to reduce the upward bias on failure rates that would result if the analysis did not account for floor condition in the failure rate estimates.

The Dust Study included window sill dust wipe tests, but did not include window trough dust wipe tests. However, in many instances in the Dust Study the window sills were in such poor condition that sampling trays were placed on the sills and the dust wipe samples were taken from the sampling trays. Since these sampling trays are likely to be easier to clean than the average window sill that may be in fair or poor condition, this analysis uses the floor failure rate as a proxy for the sill and trough failure rate. The estimated average floor failure rate is 13.8 percent, which is higher than the 13.3 percent failure rate for window sill tests observed in the Dust Study.

Table 4-30: Window Sill, Window Trough, and Floor Sample Clearance Failure Rates

Formula	Failure Rate	Description/Comments
Floors		
Overall: (Poor-condition floor failure rate)*(percentage of floors not smooth/cleanable) + (fair/good-condition floor failure rate)*(percentage of floors smooth/cleanable)	13.8%	The average clearance failure rate of floors, weighted by the proportion of uncarpeted floor surfaces in pre-1978 housing that are described as smooth/cleanable (98.08%) versus not smooth/cleanable (1.92%) from NSLAH data. Sample weights were used.
Poor-Condition Floors: (Number of post-verification floor samples in Phase I experiments > 40 µg/ft2)/(total number of floor samples in Phase I experiments)	78.6%	Clearance failure rate of floors for experiments in Dust Study that used plastic containment and rule cleaning practices, with pre-work floors in poor condition. There were 22 samples in this group that failed out of a total of 28 samples from 7 experiments.
Fair/Good-Condition Floors: (Number of post-verification floor samples in Phase I experiments > 40 µg/ft2)/(total number of floor samples in Phase I experiments)	12.5%	Clearance failure rate of floors for experiments in Dust Study that used plastic containment and rule cleaning practices, with pre-work floors in either fair or good condition. There were 4 samples in this group that failed out of a total of 32 samples from 8 experiments.
Window Sills and Troughs		
n.a.	13.8%	Assumed to be the same as the floor failure rate.

The overall floor failure rate was estimated as a weighted average of the poor-condition floor and fair/good-condition floor failure rates. HUD's (2001) National Survey of Lead and Allergens in Housing (NSLAH) data was used to calculate the percentage of pre-1978 housing with floors that are non smooth/cleanable – a proxy for poor condition floors. The overall floor clearance failure rate was estimated as the frequency of not smooth/cleanable floors (1.92%) multiplied by the poor-condition floor

failure rate (78.6%), and the frequency of smooth/cleanable floors (98.08%) multiplied by the fair/good-condition floor failure rate (12.5%). Thus, the weighted average clearance failure rate for floor surface samples is 13.8%.

This analysis makes the simplifying assumption that following a single clearance failure and the necessary re-cleaning activities, the sample will have an equal probability of failing clearance the second time around. This assumption is made because no current studies provide information about the likelihood of a second clearance failure for lead dust wipe tests. Therefore, the second failure rate can be estimated as the first failure rate squared – that is, the likelihood of one failure multiplied by the likelihood of another failure given the first failure. The combined failure rate is the sum of this value and the original failure rate calculated in Table 4-30. These combined component failure rates are presented below in Table 4-31.

Table 4-31: Combined First and Second Clearance Failure Rates

Sample Component	Formula	Combined 1st and 2nd Failure Rate
Window Sill	$(0.138) + (0.138)^2$	15.70%
Window Trough	$(0.138) + (0.138)^2$	15.70%
Floor	$(0.138) + (0.138)^2$	15.70%

4.3.5 Costs of Re-Cleaning After a Clearance Test Failure

This section presents the methodology used for estimating re-cleaning costs when a clearance failure has occurred. The re-cleaning methods prescribed by the LRRP Clearance Rule are the same as the initial cleaning methods from the 2008 LRRP Rule: thus, these costs are estimated following the 2008 analysis methodology.

4.3.5.1 Costs of Re-Cleaning

Table 4-32 lists the potential re-cleaning activities associated with clearance and describes how to determine costs per square foot for these activities. It is important to note that for events that only require dust-wipe testing (use of a heat gun, removal or replacement of windows or door frames, scraping an area of 60 sq. ft. or greater, or removal of over 40 sq. ft. of trim or molding), no re-cleaning or re-testing is required by the rule. For clearance events (use of a high-speed paint removal machine or demolition or destructive removal of over 6 sq. ft. of plaster), re-cleaning and re-sampling are necessary only for a subset of events in which any surface fails the first or second round of clearance. In the event of a failed clearance test, only the components that failed the tests must be re-cleaned. For example, if the window sill sample failed clearance but the window troughs and the floors passed, the window sill must be re-cleaned but the window troughs and the floors do not need to be re-cleaned.

Table 4-32: Material Cost and Labor Hours per Square Foot Required for Re-Cleaning Activities (2008$)

Cost Type	Material Cost/ Sq.Ft.	Labor Hours/ Sq.Ft.	Rule Text & Estimation Method
(1) HEPA Vacuum and Wet Wipe/Mopping (Floors)	$0.022	0.005	**HEPA vacuum:** Thoroughly vacuum all remaining surfaces and objects in the work area, including furniture and fixtures, with a HEPA vacuum. **Wet Wipe/Mopping:** Mop uncarpeted floors thoroughly, using a mopping method that keeps the wash water separate from the rinse water, such as the 2-bucket mopping method, or using a wet mopping system. Likelihood of uncarpeted floors times 110% of the square footage of the work area.
(2) HEPA Vacuum and Wet Wipe/Mopping (Window Sills)	$0.022	0.005	**HEPA vacuum:** Thoroughly vacuum all remaining surfaces and objects in the work area, including furniture and fixtures, with a HEPA vacuum. **Wet Wipe/Mopping:** Wipe all remaining surfaces and objects in the work area, except for carpeted or upholstered surfaces, with a damp cloth. The number of windows times size of windowsill
(3 HEPA Vacuum and Wet Wipe/Mopping (Window Troughs)	$0.022	0.1	**HEPA vacuum:** Thoroughly vacuum all remaining surfaces and objects in the work area, including furniture and fixtures, with a HEPA vacuum. **Wet Wipe/Mopping:** Wipe all remaining surfaces and objects in the work area, except for carpeted or upholstered surfaces, with a damp cloth. The number of windows
Assumptions: Labor and material costs were derived from RS Means data for the activity: "Asbestos Abatement Work Area, pre-cleaning, HEPA vacuum and wet wipe, flat surfaces"; cleaning of 110% of the total square footage accounts for additional horizontal surfaces that may require cleaning, such as floor space outside the perimeter of the work area; cleaning a window trough is more labor-intensive than other surfaces and thus it is assumed that this requires 6 minutes per square foot of vacuuming and cleaning.			

Labor Hours Per Square Foot

The labor hours per square foot required for HEPA vacuuming and wet wiping that was estimated for the 2008 analysis was derived from RS Means data for the activity: "Asbestos Abatement Work Area, pre-cleaning, HEPA vacuum and wet wipe, flat surfaces," which specified 0.005 labor hours per square foot. Since following clearance failure the firm must return to the renovation work location to perform re-cleaning and re-testing, travel costs must be included in the total cost of re-cleaning. According to the 2008 LRRP Rule, either a certified renovator or a worker supervised by an on-site certified renovator must carry out cleaning activities.[10] Because estimated labor time for re-cleaning is under an hour for the majority of events, the analysis assumes that only the renovator will travel to re-clean the work area following clearance failure. Travel cost details are provided in Table 4-33 below.

[10] Re-cleaning must be performed following the cleaning procedures prescribed by the 2008 rule.

Table 4-33: Travel Costs for Re-Cleaning (2008$)					
Required Persons	Round Trip Mileage	Travel Cost/Mile	Traveling Time	Value of Time/Hr.	Total Travel Costs for Re-Cleaning
1 renovator	30 mi.	$0.545[a]	0.75	$34.92	(30 mi * $0.545) + (0.75 hr * $34.92) = $42.54
Assumptions: The worker or renovator responsible for re-cleaning the work area will travel approximately 15 miles (roughly 20 minutes) each direction to the job; a loaded hourly wage of $34.92 is used (from construction supervisor wage rates, BLS 2008); since re-cleaning jobs usually require only an hour or less of labor time, only one person travels to perform re-cleaning. a. This mileage cost reflects the average standard mileage rate from 2008 which is used for computing deductible costs of operating an automobile for business purposes (IRS 2008). This average value is computed as a simple average of the rate applicable from January 1 - June 30, 2008 and the rate applicable from July 1 – December 31, 2008.					

The example presented in Table 4-34 – estimating costs for a small interior painting job with a high-speed paint removal machine in single-family owned housing– shows the cost of re-cleaning after failing a clearance test. The proposed rule requirements indicate that if the residual lead level in a particular dust sample equals or exceeds the applicable clearance level, the components represented by the failed sample shall be re-cleaned or re-tested. Since the three dust wipe samples obtained from the work area are one each from the floor, interior window sill, and window trough, whichever sample fails will result in the re-cleaning of *only* that surface area. Therefore, for both window failed clearance and floor failed clearance, three estimation steps are required: summary of required units, cost per unit, and total activity cost.

Table 4-34: An Example of Re-Cleaning Cost Estimation – Interior Painting with High-Speed Machine Paint Removal (2008$)				
Event	**Cost Component**	**(A) Summary of Required Units**	**(B) Cost Per Unit**	**(C) Total Cost Per Activity**
Small Owner-Occupied Single Family Interior Painting with High-Speed Machine Paint Removal:	Floor	HEPA Vacuum and Wet Wipe/Mopping: 48% * 110% * 112 sq ft.] = 59.136 sq. ft.	$0.022 + (0.005) * $34.92) = $0.197	59.136 sq. ft. HEPA vacuum * $0.197 = $11.63
	Window Sill	HEPA Vacuum and Wet Wipe/Mopping: 1 window * 0.667 sq. ft. = 0.667 sq. ft.	$0.022 + (0.005 * $34.92) = $0.197	0.667 sq. ft. HEPA vacuum * $0.197 = $0.13
	Window Trough	HEPA Vacuum and Wet Wipe/Mopping: 1 window * 0.667 sq. ft. = 0.667 sq. ft.	$0.022 + (0.10 * $34.92) = $3.514	0.667 sq. ft. HEPA vacuum * $3.514 = $2.34
Assumptions: A small interior painting event in a single family owned property has a work area of one room and 112 square feet; the likelihood of carpet is 52%; the labor cost uses a mean loaded wage rate of $34.92 based on average construction supervisor hourly wages (BLS 2008).				

Because prescribed re-cleaning activities are determined by which dust wipe in a given work area fails, the method for estimating costs is presented in three different tables (Table 4-35, Table 4-36, and Table 4-37) for three different possible situations: a floor sample failing clearance, a window sill sample failing clearance, and a window trough sample failing clearance. If more than one component were to fail clearance, all material and labor costs from the tables could simply be combined, except for travel (since the firm would not need to travel twice to re-clean two separate components).

Table 4-38 shows several examples of the estimated cost breakdown among materials, labor, and travel, for each possible combination of failed work area components for a small interior painting event in single-family owner-occupied housing. Overall, for a single event type such as small interior painting, the variance of total re-cleaning costs is small – this is because the bulk of re-cleaning costs comes from the travel expense portion.

Table 4-35: Costs Per Re-Cleaning – Floor Sample Clearance Failure

Material Units			Labor Hours			Total Costs
HEPA Vacuum	Wet Wipe / Mopping	Travel Mileage	HEPA Vacuum	Wet Wipe	Travel Time	
(1-carpet likelihood) * 110% square footage	(1-carpet likelihood) * 110% square footage	30 miles	0.0025 hrs. * (1-carpet likelihood) * 110% square footage	0.0025 hrs. * (1-carpet likelihood) * 110% square footage	0.75 hrs.	$0.011*vacuum and wet wipe units + $0.545 * mileage + $34.92* total labor hours
Note: For kitchen events, 125% square footage will be used in place of 110% square footage.						

Table 4-36: Costs Per Re-Cleaning – Window Sill Sample Clearance Failure

Material Units			Labor Hours			Total Costs
HEPA Vacuum	Wet Wipe / Mopping	Travel Mileage	HEPA Vacuum	Wet Wipe	Travel Time	
0.667 square feet * number of windows	0.667 square feet * number of windows	30 miles	0.0025 hours * 0.667 square feet * number of windows	0.0025 hours * 0.667 square feet * number of windows	0.75 hrs.	$0.011*vacuum and wet wipe units + $0.545 * mileage + $34.92* total labor hours
Note: For kitchen events, 125% square footage will be used in place of 110% square footage.						

Table 4-37: Costs Per Re-Cleaning – Window Trough Sample Clearance Failure

Material Units			Labor Hours			Total Costs
HEPA Vacuum	Wet Wipe / Mopping	Travel Mileage	HEPA Vacuum	Wet Wipe	Travel Time	
0.667 square feet * number of windows	0.667 square feet * number of windows	30 miles	0.05 hours * 0.667 square feet * number of windows	0.05 hours * 0.667 square feet * number of windows	0.75 hrs.	$0.011*vacuum and wet wipe units + $0.545 * mileage + $34.92* total labor hours
Note: For kitchen events, 125% square footage will be used in place of 110% square footage.						

Table 4-38: Costs Per Re-Cleaning Example – Owner-Occupied Single-Family Small Interior Painting Event				
Failed Component	**Materials Cost**	**Labor Cost**	**Travel Cost**	**Total**
Floor	$1.30	$10.33	$42.54	$54.17
Sill	$0.01	$0.12	$42.54	$42.67
Trough	$0.01	$2.33	$42.54	$44.88
Floor, Sill	$1.32	$10.44	$42.54	$54.30
Floor, Trough	$1.32	$12.65	$42.54	$56.51
Sill, Trough	$0.03	$2.45	$42.54	$45.02
Floor, Sill, Trough	$1.33	$12.77	$42.54	$56.64

In order to estimate average per-event re-cleaning costs, the likelihood of clearance failure for each sample type must be accounted for (see Section 4.3.4). The analysis makes the simplifying assumption that sample failures are not correlated (e.g., a floor sample failure would not make a window trough sample failure any more likely). In order to calculate the average re-cleaning costs for a clearance failure event, the likelihoods of each component failure are multiplied by their respective component cleaning costs, and these values are summed. Travel, which is not a component-specific re-cleaning cost, is estimated as the flat travel cost above multiplied by the likelihood of any clearance failures. The cost example of a small interior painting event presented in Table 4-38 above is extended below in Table 4-39 to show the average expected re-cleaning costs. While Table 4-38 shows the costs per re-cleaning for the different scenarios where it would be required, Table 4-39 presents the average expected re-cleaning costs, over all jobs, accounting for the instances where no re-cleaning is required because clearance is achieved after the initial cleaning. Averaging the re-cleaning costs across all jobs (i.e., those that require re-cleaning and those that do not) simplifies the calculations by allowing the calculation of a total cost per event that applies to all jobs.

Table 4-39: Example of Average Expected Re-Cleaning Costs: Owner-Occupied Single-Family Small Interior Painting Event								
Floor Re-Cleaning		**Sill Re-Cleaning**		**Trough Re-Cleaning**		**Travel**		**Total**
Material	**Labor**	**Material**	**Labor**	**Material**	**Labor**	**Mileage**	**Value of Time**	
Average Costs for all Clearance Events								
$0.20	$1.62	$0.002	$0.02	$0.002	$0.37	$5.77	$9.24	$17.22
Methodology								
Floor failure rate * 110% uncarpeted square footage * $0.022	Floor failure rate * 110% uncarpeted square footage * 0.005 * renovator wage rate	Sill failure rate * total window surface area * $0.022	Sill failure rate * total window surface area * 0.005 * renovator wage rate	Trough failure rate * total window surface area * $0.022	Trough failure rate * total window surface area * 0.1 * renovator wage rate	Expected number of re-cleanings* 20 miles * $0.545	Expected number of re-cleanings* 0.5 hours* renovator wage rate	Re-cleaning material costs + re-cleaning labor costs + travel costs
In order to calculate a total cost per event that applies to all jobs, the average re-cleaning costs are calculated across all jobs (i.e., those that require re-cleaning and those that do not).								

4.3.6 Summary of Dust Wipe Testing and Clearance Costs Per-Event

Each type of event will incur a different set of costs based on the number of dust wipe samples required, whether clearance is required, whether it is in target housing or a public or commercial building COF, and

other event characteristics. Table 4-40 through Table 4-49 below summarize the cost components for all event possibilities considered in this analysis.

Table 4-40: Dust Wipe Testing Per-Event Costs Summary: Single-Family Owner-Occupied Target Housing

Size of Work Area for the Event[1]	Number of Dust Wipe Samples[2, 3]	Lab Costs[3]	Dust Wipe Testing Labor Costs[3]	Dust Wipe Testing Material Costs[3]	Total Shipping[3]	Report Paperwork[3]	Total Per-Event Cost[3]
Events Excluding Kitchens or Bathrooms							
Bathroom Size (48 ft^2)	2.96	$56.24	$48.39	$0.74	$15.72	$0.36	$121.45
Kitchen Size (160 ft^2)	2.96	$56.24	$48.39	$0.74	$15.72	$0.36	$121.45
Bath + Kitchen Size (208 ft^2)	5.44	$103.36	$64.84	$1.36	$15.72	$0.36	$185.64
Small Painting Size (112 ft^2)	2.96	$56.24	$48.39	$0.74	$15.72	$0.36	$121.45
Medium Painting Size (308 ft^2)	3.63	$68.96	$52.83	$0.91	$15.72	$0.36	$138.78
Large Painting Size (504 ft^2)	5.64	$107.13	$66.16	$1.41	$15.72	$0.36	$190.78
Small Window Door Size (63 ft^2)	2.96	$56.24	$48.39	$0.74	$15.72	$0.36	$121.45
Large Window Door Size (640 ft^2)	7.03	$133.52	$75.37	$1.76	$15.72	$0.36	$226.73
Events Including Kitchens or Bathrooms							
Bathroom Size (48 ft^2)	3.78	$71.82	$53.83	$0.95	$15.72	$0.36	$142.68
Kitchen Size (160 ft^2)	3.78	$71.82	$53.83	$0.95	$15.72	$0.36	$142.68
Bath + Kitchen Size (208 ft^2)	6.67	$126.73	$73.00	$1.67	$15.72	$0.36	$217.48
Small Painting Size (112 ft^2)	3.78	$71.82	$53.83	$0.95	$15.72	$0.36	$142.68
Medium Painting Size (308 ft^2)	4.27	$81.04	$57.05	$1.07	$15.72	$0.36	$155.23
Large Painting Size (504 ft^2)	6.16	$117.08	$69.63	$1.54	$15.72	$0.36	$204.33
Small Window Door Size (63 ft^2)	3.78	$71.82	$53.83	$0.95	$15.72	$0.36	$142.68
Large Window Door Size (640 ft^2)	7.50	$142.51	$78.51	$1.88	$15.72	$0.36	$238.98

[1] Event sizes were estimated for EPA's 2008 LRRP Rule Analysis and represent the work area size and not necessarily the amount of lead-based paint disturbed. A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:

bathroom size: wall-disturbing events, addition events

kitchen size: wall-disturbing events, addition events, window/door replacements

bathroom + kitchen size: wall-disturbing events, addition events

[2] The average number of required samples is presented. One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected and the probability that floors are carpeted were estimated following the methodology developed for the 2008 LRRP rule analysis.

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-41: Dust Wipe Testing Per-Event Costs Summary: Single-Family Renter-Occupied Target Housing

Size of Work Area for the Event[1]	Number of Dust Wipe Samples[2, 3]	Lab Costs[3]	Dust Wipe Testing Labor Costs[3]	Dust Wipe Testing Material Costs[3]	Total Shipping[3]	Report Paperwork[3]	Total Per-Event Cost[3]
Events Excluding Kitchens or Bathrooms							
Bathroom Size (48 ft^2)	2.96	$56.24	$48.39	$0.74	$20.67	$0.72	$126.76
Kitchen Size (120 ft^2)	2.96	$56.24	$48.39	$0.74	$20.67	$0.72	$126.76
Bath + Kitchen Size (168 ft^2)	5.44	$103.36	$64.84	$1.36	$20.67	$0.72	$190.95
Small Painting Size (96 ft^2)	2.96	$56.24	$48.39	$0.74	$20.67	$0.72	$126.76
Medium Painting Size (232 ft^2)	3.11	$59.07	$49.38	$0.78	$20.67	$0.72	$130.61
Large Painting Size (368 ft^2)	4.65	$88.28	$59.58	$1.16	$20.67	$0.72	$170.41
Small Window Door Size (55 ft^2)	2.96	$56.24	$48.39	$0.74	$20.67	$0.72	$126.76
Large Window Door Size (480 ft^2)	5.94	$112.78	$68.13	$1.48	$20.67	$0.72	$203.79
Events Including Kitchens or Bathrooms							
Bathroom Size (48 ft^2)	3.78	$71.82	$53.83	$0.95	$20.67	$0.72	$147.99
Kitchen Size (120 ft^2)	3.78	$71.82	$53.83	$0.95	$20.67	$0.72	$147.99
Bath + Kitchen Size (168 ft^2)	6.67	$126.73	$73.00	$1.67	$20.67	$0.72	$222.79
Small Painting Size (96 ft^2)	3.78	$71.82	$53.83	$0.95	$20.67	$0.72	$147.99
Medium Painting Size (232 ft^2)	3.73	$70.81	$53.48	$0.93	$20.67	$0.72	$146.61
Large Painting Size (368 ft^2)	5.16	$97.96	$62.96	$1.29	$20.67	$0.72	$183.59
Small Window Door Size (55 ft^2)	3.78	$71.82	$53.83	$0.95	$20.67	$0.72	$147.99
Large Window Door Size (480 ft^2)	6.38	$121.30	$71.11	$1.60	$20.67	$0.72	$215.39

[1] Event sizes were estimated for EPA's 2008 LRRP Rule Analysis and represent the work area size and not necessarily the amount of lead-based paint disturbed. A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:

bathroom size: wall-disturbing events, addition events

kitchen size: wall-disturbing events, addition events, window/door replacements

bathroom + kitchen size: wall-disturbing events, addition events

[2] The average number of required samples is presented. One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected and the probability that floors are carpeted were estimated following the methodology developed for the 2008 LRRP rule analysis.

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-42: Dust Wipe Testing Per-Event Costs Summary: Multi-Family Owner-Occupied Target Housing

Size of Work Area for the Event[1]	Number of Dust Wipe Samples[2, 3]	Lab Costs[3]	Dust Wipe Testing Labor Costs[3]	Dust Wipe Testing Material Costs[3]	Total Shipping[3]	Report Paperwork[3]	Total Per-Event Cost[3]
Events Excluding Kitchens or Bathrooms							
Bathroom Size (48 ft^2)	2.96	$56.24	$48.39	$0.74	$15.72	$0.36	$121.45
Kitchen Size (80 ft^2)	2.96	$56.24	$48.39	$0.74	$15.72	$0.36	$121.45
Bath + Kitchen Size (128 ft^2)	5.44	$103.36	$64.84	$1.36	$15.72	$0.36	$185.64
Small Painting Size (84 ft^2)	2.96	$56.24	$48.39	$0.74	$15.72	$0.36	$121.45
Medium Painting Size (184 ft^2)	2.96	$56.24	$48.39	$0.74	$15.72	$0.36	$121.45
Large Painting Size (284 ft^2)	3.95	$75.09	$54.97	$0.99	$15.72	$0.36	$147.13
Small Window Door Size (45 ft^2)	2.96	$56.24	$48.39	$0.74	$15.72	$0.36	$121.45
Large Window Door Size (320 ft^2)	4.40	$83.57	$57.93	$1.10	$15.72	$0.36	$158.68
Events Including Kitchens or Bathrooms							
Bathroom Size (48 ft^2)	3.78	$71.82	$53.83	$0.95	$15.72	$0.36	$142.68
Kitchen Size (80 ft^2)	3.78	$71.82	$53.83	$0.95	$15.72	$0.36	$142.68
Bath + Kitchen Size (128 ft^2)	6.67	$126.73	$73.00	$1.67	$15.72	$0.36	$217.48
Small Painting Size (84 ft^2)	3.78	$71.82	$53.83	$0.95	$15.72	$0.36	$142.68
Medium Painting Size (184 ft^2)	3.54	$67.26	$52.24	$0.89	$15.72	$0.36	$136.46
Large Painting Size (284 ft^2)	4.38	$83.30	$57.84	$1.10	$15.72	$0.36	$158.31
Small Window Door Size (45 ft^2)	4.81	$91.41	$60.67	$1.20	$15.72	$0.36	$169.37

[1] Event sizes were estimated for EPA's 2008 LRRP Rule Analysis and represent the work area size and not necessarily the amount of lead-based paint disturbed. A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:

bathroom size: wall-disturbing events, addition events

kitchen size: wall-disturbing events, addition events, window/door replacements

bathroom + kitchen size: wall-disturbing events, addition events

[2] The average number of required samples is presented. One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected and the probability that floors are carpeted were estimated following the methodology developed for the 2008 LRRP rule analysis.

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-43: Dust Wipe Testing Per-Event Costs Summary: Multi-Family Renter-Occupied Target Housing

Size of Work Area for the Event[1]	Number of Dust Wipe Samples[2, 3]	Lab Costs[3]	Dust Wipe Testing Labor Costs[3]	Dust Wipe Testing Material Costs[3]	Total Shipping[3]	Report Paperwork[3]	Total Per-Event Cost[3]
Events Excluding Kitchens or Bathrooms							
Bathroom Size (48 ft^2)	2.96	$56.24	$48.39	$0.74	$20.67	$0.72	$126.76
Kitchen Size (80 ft^2)	2.96	$56.24	$48.39	$0.74	$20.67	$0.72	$126.76
Bath + Kitchen Size (128 ft^2)	5.44	$103.36	$64.84	$1.36	$20.67	$0.72	$190.95
Small Painting Size (84 ft^2)	2.96	$56.24	$48.39	$0.74	$20.67	$0.72	$126.76
Medium Painting Size (184 ft^2)	2.96	$56.24	$48.39	$0.74	$20.67	$0.72	$126.76
Large Painting Size (284 ft^2)	3.95	$75.09	$54.97	$0.99	$20.67	$0.72	$152.44
Small Window Door Size (45 ft^2)	2.96	$56.24	$48.39	$0.74	$20.67	$0.72	$126.76
Large Window Door Size (320 ft^2)	4.40	$83.57	$57.93	$1.10	$20.67	$0.72	$163.99
Events Including Kitchens or Bathrooms							
Bathroom Size (48 ft^2)	3.78	$71.82	$53.83	$0.95	$20.67	$0.72	$147.99
Kitchen Size (80 ft^2)	3.78	$71.82	$53.83	$0.95	$20.67	$0.72	$147.99
Bath + Kitchen Size (128 ft^2)	6.67	$126.73	$73.00	$1.67	$20.67	$0.72	$222.79
Small Painting Size (84 ft^2)	3.78	$71.82	$53.83	$0.95	$20.67	$0.72	$147.99
Medium Painting Size (184 ft^2)	3.54	$67.26	$52.24	$0.89	$20.67	$0.72	$141.77
Large Painting Size (284 ft^2)	4.38	$83.30	$57.84	$1.10	$20.67	$0.72	$163.62
Small Window Door Size (45 ft^2)	4.81	$91.41	$60.67	$1.20	$20.67	$0.72	$174.68

[1] Event sizes were estimated for EPA's 2008 LRRP Rule Analysis and represent the work area size and not necessarily the amount of lead-based paint disturbed. A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:

bathroom size: wall-disturbing events, addition events

kitchen size: wall-disturbing events, addition events, window/door replacements

bathroom + kitchen size: wall-disturbing events, addition events

[2] The average number of required samples is presented. One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected and the probability that floors are carpeted were estimated following the methodology developed for the 2008 LRRP rule analysis.

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-44: Dust Wipe Testing Per-Event Costs Summary: Public and Commercial Building COFs

Size of Work Area for the Event[1]	Number of Dust Wipe Samples[2, 3]	Lab Costs[3]	Dust Wipe Testing Labor Costs[3]	Dust Wipe Testing Material Costs[3]	Total Shipping[3]	Report Paperwork[3]	Total Per-Event Cost[3]
Kindergarten (Public; 13,560 ft^2)	11.30	$214.70	$103.72	$2.83	$20.67	$0.72	$342.64
Kindergarten (Large Private; 13,560 ft^2)	11.30	$214.70	$103.72	$2.83	$20.67	$0.72	$342.64
Kindergarten (Small Private; 13,560 ft^2)	11.30	$214.70	$103.72	$2.83	$20.67	$0.72	$342.64
Pre-K + Kindergarten (Public; 15,674 ft^2)	11.30	$214.70	$103.72	$2.83	$20.67	$0.72	$342.64
Pre-K + Kindergarten (Large Private; 15,674 ft^2)	11.30	$214.70	$103.72	$2.83	$20.67	$0.72	$342.64
Pre-K + Kindergarten (Small Private; 15,674 ft^2)	11.30	$214.70	$103.72	$2.83	$20.67	$0.72	$342.64
Daycare Center (Renter-Occupied; 2,400 ft^2)	9.41	$178.82	$91.19	$2.35	$20.67	$0.72	$293.75
Daycare Center (Owner-Occupied; 2400 ft^2)	9.41	$178.82	$91.19	$2.35	$20.67	$0.72	$293.75
Daycare Center (Non-Profit who performs some of own RRP; 2,400 ft^2)	9.41	$178.82	$91.19	$2.35	$20.67	$0.72	$293.75
Daycare Center (Non-Profit who uses contractors; 2,400 ft^2)	9.41	$178.82	$91.19	$2.35	$20.67	$0.72	$293.75
Daycare Center (In Public School; 2,400 ft^2)	9.41	$178.82	$91.19	$2.35	$20.67	$0.72	$293.75
Daycare Center (In Large Private School; 2,400 ft^2)	9.41	$178.82	$91.19	$2.35	$20.67	$0.72	$293.75
Daycare Center (In Small Private School; 2,400 ft^2)	9.41	$178.82	$91.19	$2.35	$20.67	$0.72	$293.75

[1] Event sizes were estimated for EPA's 2008 LRRP Rule Analysis and represent the work area size and not necessarily the amount of lead-based paint disturbed.

[2] One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected were estimated following the methodology developed for the 2008 LRRP rule analysis

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

Table 4-45: Average Clearance Costs Per-Event (Averaged Across Events that Pass and Fail Clearance): Single-Family Owner-Occupied Target Housing

Size of Work Area for the Event[1]	Average Number of Dust Wipe Samples[2]	Average Lab Costs[3,5]	Average Dust Wipe Testing Labor Costs[3,5]	Average Dust Wipe Testing Material Costs[3,5]	Average Total Shipping[3,5]	Average Report Paperwork[3,5]	Average Re-Cleaning Material[4,5]	Average Re-Cleaning Labor[4,5]	Average Re-Cleaning Travel[4,5]	Average Total Costs Per-Event[5]
Events Excluding Kitchens or Bathrooms										
Bathroom Size (48 ft^2)	3.35	$63.64	$61.11	$0.84	$18.49	$0.49	$0.09	$1.08	$15.00	$160.75
Kitchen Size (160 ft^2)	3.35	$63.64	$61.11	$0.84	$18.49	$0.49	$0.30	$3.08	$15.00	$162.96
Bath + Kitchen Size (208 ft^2)	6.22	$118.16	$87.46	$1.55	$20.49	$0.58	$0.39	$4.16	$25.81	$258.61
Small Painting Size (112 ft^2)	3.35	$63.64	$61.11	$0.84	$18.49	$0.49	$0.21	$2.01	$15.00	$161.79
Medium Painting Size (308 ft^2)	4.12	$78.36	$68.29	$1.03	$19.05	$0.51	$0.57	$5.22	$18.02	$191.05
Large Painting Size (504 ft^2)	6.45	$122.52	$89.43	$1.61	$20.61	$0.58	$0.94	$8.81	$26.47	$270.97
Events Including Kitchens or Bathrooms										
Bathroom Size (48 ft^2)	4.23	$80.44	$68.41	$1.06	$29.61	$0.50	$0.17	$1.67	$17.11	$198.98
Kitchen Size (160 ft^2)	4.23	$80.44	$68.41	$1.06	$29.61	$0.50	$0.55	$5.06	$17.11	$202.75
Bath + Kitchen Size (208 ft^2)	7.58	$143.98	$98.56	$1.89	$31.79	$0.60	$0.72	$6.74	$28.90	$313.17
Small Painting Size (112 ft^2)	4.23	$80.44	$68.41	$1.06	$29.61	$0.50	$0.38	$3.39	$17.11	$200.91
Medium Painting Size (308 ft^2)	4.82	$91.50	$74.01	$1.20	$30.09	$0.53	$0.90	$7.82	$19.69	$225.73
Large Painting Size (504 ft^2)	7.03	$133.52	$94.15	$1.76	$31.58	$0.59	$1.26	$11.39	$27.77	$302.03

[1] A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:
bathroom size: wall-disturbing events, addition events
kitchen size: wall-disturbing events, addition events, window/door replacements
bathroom + kitchen size: wall-disturbing events, addition events

[2] One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected and the probability that floors are carpeted were estimated following the methodology developed for the 2008 LRRP rule analysis

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

[4] See section 4.3.5 for a description of how these costs are calculated.

[5] These costs vary by the size and type of the event because of varying clearance failure rates; estimated clearance failure rates are more likely for events where more samples are required. In addition, shipping costs are higher for clearance events where a kitchen or bathroom is inside the work area because renovators are assumed to use overnight shipping in order to allow occupants to access the work area sooner.

Note: In order to calculate a total cost per event that applies to all jobs, the average re-cleaning costs are calculated across all jobs (i.e., those that require re-cleaning and those that do not).

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-46: Average Clearance Costs Per Event (Averaged Across Events that Pass and Fail Clearance): Single-Family Renter-Occupied Target Housing

Size of Work Area for the Event[1]	Average Number of Dust Wipe Samples[2]	Average Lab Costs[3,5]	Average Dust Wipe Testing Labor Costs[3,5]	Average Dust Wipe Testing Material Costs[3,5]	Average Total Shipping[3,5]	Average Report Paperwork[3,5]	Average Re-Cleaning Material[4,5]	Average Re-Cleaning Labor[4,5]	Average Re-Cleaning Travel[4,5]	Average Total Costs Per-Event[5]
Events Excluding Kitchens or Bathrooms										
Bathroom Size (48 ft^2)	3.35	$63.64	$61.11	$0.84	$23.44	$0.97	$0.09	$1.08	$15.00	$166.18
Kitchen Size (80 ft^2)	3.35	$63.64	$61.11	$0.84	$23.44	$0.97	$0.23	$2.51	$15.00	$167.74
Bath + Kitchen Size (128 ft^2)	6.22	$118.16	$87.46	$1.55	$25.44	$1.16	$0.32	$3.58	$25.81	$263.49
Small Painting Size (84 ft^2)	3.35	$63.64	$61.11	$0.84	$23.44	$0.97	$0.18	$1.77	$15.00	$166.96
Medium Painting Size (184 ft^2)	3.52	$66.91	$62.71	$0.88	$23.57	$0.99	$0.43	$3.96	$15.68	$175.12
Large Painting Size (284 ft^2)	5.30	$100.71	$79.10	$1.33	$24.82	$1.10	$0.69	$6.52	$22.46	$236.72
Events Including Kitchens or Bathrooms										
Bathroom Size (48 ft^2)	4.23	$80.44	$68.41	$1.06	$45.29	$1.01	$0.17	$1.67	$17.11	$215.16
Kitchen Size (80 ft^2)	4.23	$80.44	$68.41	$1.06	$45.29	$1.01	$0.42	$3.99	$17.11	$217.73
Bath + Kitchen Size (128 ft^2)	7.58	$143.98	$98.56	$1.89	$47.47	$1.21	$0.58	$5.66	$28.90	$328.25
Small Painting Size (84 ft^2)	4.23	$80.44	$68.41	$1.06	$45.29	$1.01	$0.33	$2.96	$17.11	$216.61
Medium Painting Size (184 ft^2)	4.19	$79.60	$68.23	$1.05	$45.32	$1.01	$0.69	$6.06	$17.28	$219.25
Large Painting Size (284 ft^2)	5.86	$111.34	$83.70	$1.47	$46.52	$1.12	$0.95	$8.63	$23.78	$277.52

[1] A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:
bathroom size: wall-disturbing events, addition events
kitchen size: wall-disturbing events, addition events, window/door replacements
bathroom + kitchen size: wall-disturbing events, addition events

[2] One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected and the probability that floors are carpeted were estimated following the methodology developed for the 2008 LRRP rule analysis.

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

[4] See section 4.3.5 for a description of how these costs are calculated.

[5] These costs vary by the size and type of the event because of varying clearance failure rates; estimated clearance failure rates are more likely for events where more samples are required. In addition, shipping costs are higher for clearance events where a kitchen or bathroom is inside the work area because renovators are assumed to use overnight shipping in order to allow occupants to access the work area sooner.

Note: In order to calculate a total cost per event that applies to all jobs, the average re-cleaning costs are calculated across all jobs (i.e., those that require re-cleaning and those that do not).

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-47: Average Clearance Costs Per Event (Averaged Across Events that Pass and Fail Clearance): Multi-Family Owner-Occupied Target Housing

Size of Work Area for the Event[1]	Average Number of Dust Wipe Samples[2]	Average Lab Costs[3,5]	Average Dust Wipe Testing Labor Costs[3,5]	Average Dust Wipe Testing Material Costs[3,5]	Average Total Shipping[3,5]	Average Report Paperwork[3,5]	Average Re-Cleaning Material[4,5]	Average Re-Cleaning Labor[4,5]	Average Re-Cleaning Travel[4,5]	Average Total Costs Per-Event[5]
Events Excluding Kitchens or Bathrooms										
Bathroom Size (48 ft^2)	3.35	$63.64	$61.11	$0.84	$18.49	$0.49	$0.09	$1.08	$15.00	$160.75
Kitchen Size (80 ft^2)	3.35	$63.64	$61.11	$0.84	$18.49	$0.49	$0.15	$1.54	$15.00	$161.27
Bath + Kitchen Size (128 ft^2)	6.22	$118.16	$87.46	$1.55	$20.49	$0.58	$0.24	$2.62	$25.81	$256.92
Small Painting Size (84 ft^2)	3.35	$63.64	$61.11	$0.84	$18.49	$0.49	$0.16	$1.60	$15.00	$161.33
Medium Painting Size (184 ft^2)	3.35	$63.64	$61.11	$0.84	$18.49	$0.49	$0.34	$3.05	$15.00	$162.96
Large Painting Size (284 ft^2)	4.50	$85.45	$71.73	$1.12	$19.31	$0.52	$0.53	$4.80	$19.44	$202.90
Events Including Kitchens or Bathrooms										
Bathroom Size (48 ft^2)	4.23	$80.44	$68.41	$1.06	$29.61	$0.50	$0.17	$1.67	$17.11	$198.98
Kitchen Size (80 ft^2)	4.23	$80.44	$68.41	$1.06	$29.61	$0.50	$0.28	$2.53	$17.11	$199.94
Bath + Kitchen Size (128 ft^2)	7.58	$143.98	$98.56	$1.89	$31.79	$0.60	$0.44	$4.20	$28.90	$310.36
Small Painting Size (84 ft^2)	4.23	$80.44	$68.41	$1.06	$29.61	$0.50	$0.29	$2.64	$17.11	$200.06
Medium Painting Size (184 ft^2)	3.98	$75.53	$66.27	$0.99	$29.50	$0.50	$0.54	$4.66	$16.49	$194.48
Large Painting Size (284 ft^2)	4.97	$94.41	$75.63	$1.24	$30.25	$0.53	$0.72	$6.34	$20.58	$229.70

[1] A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:
bathroom size: wall-disturbing events, addition events
kitchen size: wall-disturbing events, addition events, window/door replacements
bathroom + kitchen size: wall-disturbing events, addition events

[2] One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected and the probability that floors are carpeted were estimated following the methodology developed for the 2008 LRRP rule analysis

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

[4] See section 4.3.5 for a description of how these costs are calculated.

[5] These costs vary by the size and type of the event because of varying clearance failure rates; estimated clearance failure rates are more likely for events where more samples are required. In addition, shipping costs are higher for clearance events where a kitchen or bathroom is inside the work area because renovators are assumed to use overnight shipping in order to allow occupants to access the work area sooner.

Note: In order to calculate a total cost per event that applies to all jobs, the average re-cleaning costs are calculated across all jobs (i.e., those that require re-cleaning and those that do not).

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-48: Average Clearance Costs Per Event (Averaged Across Events that Pass and Fail Clearance): Multi-Family Renter-Occupied Target Housing

Size of Work Area for the Event[1]	Average Number of Dust Wipe Samples[2]	Average Lab Costs[3,5]	Average Dust Wipe Testing Labor Costs[3,5]	Average Dust Wipe Testing Material Costs[3,5]	Average Total Shipping[3,5]	Average Report Paperwork[3,5]	Average Re-Cleaning Material[4,5]	Average Re-Cleaning Labor[4,5]	Average Re-Cleaning Travel[4,5]	Average Total Costs Per-Event[5]
Events Excluding Kitchens or Bathrooms										
Bathroom Size (48 ft^2)	3.35	$63.64	$61.11	$0.84	$23.44	$0.97	$0.09	$1.08	$15.00	$166.18
Kitchen Size (80 ft^2)	3.35	$63.64	$61.11	$0.84	$23.44	$0.97	$0.15	$1.54	$15.00	$166.70
Bath + Kitchen Size (128 ft^2)	6.22	$118.16	$87.46	$1.55	$25.44	$1.16	$0.24	$2.62	$25.81	$262.44
Small Painting Size (84 ft^2)	3.35	$63.64	$61.11	$0.84	$23.44	$0.97	$0.16	$1.60	$15.00	$166.77
Medium Painting Size (184 ft^2)	3.35	$63.64	$61.11	$0.84	$23.44	$0.97	$0.34	$3.05	$15.00	$168.40
Large Painting Size (284 ft^2)	4.50	$85.45	$71.73	$1.12	$24.26	$1.05	$0.53	$4.80	$19.44	$208.38
Events Including Kitchens or Bathrooms										
Bathroom Size (48 ft^2)	4.23	$80.44	$68.41	$1.06	$45.29	$1.01	$0.17	$1.67	$17.11	$215.16
Kitchen Size (80 ft^2)	4.23	$80.44	$68.41	$1.06	$45.29	$1.01	$0.28	$2.53	$17.11	$216.13
Bath + Kitchen Size (128 ft^2)	7.58	$143.98	$98.56	$1.89	$47.47	$1.21	$0.44	$4.20	$28.90	$326.65
Small Painting Size (84 ft^2)	4.23	$80.44	$68.41	$1.06	$45.29	$1.01	$0.29	$2.64	$17.11	$216.25
Medium Painting Size (184 ft^2)	3.98	$75.53	$66.27	$0.99	$45.18	$1.00	$0.54	$4.66	$16.49	$210.66
Large Painting Size (284 ft^2)	4.97	$94.41	$75.63	$1.24	$45.93	$1.07	$0.72	$6.34	$20.58	$245.92

[1] A "bathroom size" or "kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are:
bathroom size: wall-disturbing events, addition events
kitchen size: wall-disturbing events, addition events, window/door replacements
bathroom + kitchen size: wall-disturbing events, addition events

[2] One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected and the probability that floors are carpeted were estimated following the methodology developed for the 2008 LRRP rule analysis

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

[4] See section 4.3.5 for a description of how these costs are calculated.

[5] These costs vary by the size and type of the event because of varying clearance failure rates; estimated clearance failure rates are more likely for events where more samples are required. In addition, shipping costs are higher for clearance events where a kitchen or bathroom is inside the work area because renovators are assumed to use overnight shipping in order to allow occupants to access the work area sooner.

Note: In order to calculate a total cost per event that applies to all jobs, the average re-cleaning costs are calculated across all jobs (i.e., those that require re-cleaning and those that do not).

Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors.

Table 4-49: Clearance Per-Event Costs Summary: Public and Commercial Building COFs

Size of Work Area for the Event[1]	Average Number of Dust Wipe Samples[2]	Average Lab Costs[3,5]	Average Dust Wipe Testing Labor Costs[3,5]	Average Dust Wipe Testing Material Costs[3,5]	Average Total Shipping[3,5]	Average Report Paperwork[3,5]	Average Re-Cleaning Material[4,5]	Average Re-Cleaning Labor[4,5]	Average Re-Cleaning Travel[4,5]	Average Total Costs Per-Event[5]
Kindergarten (Public; 13,560 ft^2)	19.08	$362.56	$195.78	$4.77	$31.72	$1.73	$92.36	$832.67	$59.82	$1,581.41
Kindergarten (Large Private; 13,560 ft^2)	19.08	$362.56	$195.78	$4.77	$31.72	$1.73	$92.36	$832.67	$59.82	$1,581.41
Kindergarten (Small Private; 13,560 ft^2)	19.08	$362.56	$195.78	$4.77	$31.72	$1.73	$92.36	$832.67	$59.82	$1,581.41
Pre-K + Kindergarten (Public; 15,674 ft^2)	19.08	$362.56	$195.78	$4.77	$31.72	$1.73	$119.49	$1,077.25	$59.82	$1,853.11
Pre-K + Kindergarten (Large Private; 15,674 ft^2)	19.08	$362.56	$195.78	$4.77	$31.72	$1.73	$119.49	$1,077.25	$59.82	$1,853.11
Pre-K + Kindergarten (Small Private; 15,674 ft^2)	19.08	$362.56	$195.78	$4.77	$31.72	$1.73	$119.49	$1,077.25	$59.82	$1,853.11
Daycare Center (Renter-Occupied; 2,400 ft^2)	10.79	$204.93	$125.36	$2.70	$27.52	$1.35	$6.11	$55.06	$37.06	$460.08
Daycare Center (Owner-Occupied; 2400 ft^2)	10.79	$204.93	$125.36	$2.70	$27.52	$1.35	$6.11	$55.06	$37.06	$460.08
Daycare Center (Non-Profit who performs some of own RRP; 2,400 ft^2)	10.79	$204.93	$125.36	$2.70	$27.52	$1.35	$6.11	$55.06	$37.06	$460.08
Daycare Center (Non-Profit who uses contractors; 2,400 ft^2)	10.79	$204.93	$125.36	$2.70	$27.52	$1.35	$6.11	$55.06	$37.06	$460.08
Daycare Center (In Public School; 2,400 ft^2)	10.79	$204.93	$125.36	$2.70	$27.52	$1.35	$6.11	$55.06	$37.06	$460.08
Daycare Center (In Large Private School; 2,400 ft^2)	10.79	$204.93	$125.36	$2.70	$27.52	$1.35	$6.11	$55.06	$37.06	$460.08
Daycare Center (In Small Private School; 2,400 ft^2)	10.79	$204.93	$125.36	$2.70	$27.52	$1.35	$6.11	$55.06	$37.06	$460.08

[1] One sample is required outside the work area and three samples are required per room in the work area: (1) floor sample, (2) window sill sample, and (3) window trough sample. However, floor samples are not required on carpeted floors (so the minimum number of required samples may be as low as two if the work area is one room and all floors are carpeted). The estimated numbers of rooms affected were estimated following the methodology developed for the 2008 LRRP rule analysis

[2] In order to calculate a total cost per event that applies to all jobs, the average re-cleaning costs are calculated across all jobs (i.e., those that require re-cleaning and those that do not).

[3] See section 4.3.3 and Table 4-29 for a description of how these costs are calculated.

[4] See section 4.3.5 for a description of how these costs are calculated.

[5] The photocopy material and shipping costs vary by the size of the event because estimated clearance failure rates are more likely for events where more samples are required.

4.3.7 Total Dust Wipe Testing and Clearance Event Costs

Total costs are estimated by combining the total number of events affected by the proposed Clearance Rule from Section 4.2 and the per-event dust wipe testing and clearance costs from the tables above. Table 4-50 through Table 4-52 present the final number of events, per-event costs, and total costs for dust wipe testing and clearance. Costs are presented by building tenure, building type, work area size, and occurrence of a bathroom or kitchen event. The different size threshold options are displayed in three separate tables: (1) the low threshold option, (2) the proposed option, and (3) the high threshold option.

Table 4-50: Total Target Housing First Year Costs: Low Threshold Option

Type	Events (thousands)				Unit Costs				Total Costs (millions)				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Dust Wipe Testing Events Excluding Kitchen or Bathroom													
Bath	34	2	21	21	$121	$121	$127	$127	$4.1	$0.2	$2.6	$2.6	**$9.5**
Kit	102	6	33	31	$121	$121	$127	$127	$12.4	$0.7	$4.1	$3.9	**$21.2**
Bath+Kit	1	0	0	0	$186	$186	$191	$191	$0.2	$0.0	$0.0	$0.0	**$0.3**
S-Paint	53	3	25	38	$121	$121	$127	$127	$6.5	$0.4	$3.1	$4.9	**$14.8**
M-Paint	28	2	14	24	$139	$121	$131	$127	$3.8	$0.2	$1.8	$3.1	**$9.0**
L-Paint	26	1	13	23	$191	$147	$170	$152	$4.9	$0.2	$2.3	$3.6	**$11.0**
S-WD	96	5	32	30	$121	$121	$127	$127	$11.6	$0.7	$4.0	$3.8	**$20.1**
L-WD	101	6	32	31	$227	$159	$204	$164	$22.8	$0.9	$6.6	$5.1	**$35.4**
Subtotal	*441*	*25*	*170*	*199*	-	-	-	-	*$66.5*	*$3.3*	*$24.6*	*$26.9*	***$121.3***
Dust Wipe Testing Events Including Kitchens or Bathrooms													
Bath	97	4	149	89	$143	$143	$148	$148	$13.8	$0.6	$22.0	$13.2	**$49.7**
Kit	116	7	141	149	$143	$143	$148	$148	$16.6	$1.0	$20.8	$22.1	**$60.5**
Bath+Kit	35	4	87	31	$217	$217	$223	$223	$7.5	$1.0	$19.3	$6.9	**$34.7**
S-Paint	4	0	6	3	$143	$143	$148	$148	$0.6	$0.0	$0.9	$0.5	**$2.0**
M-Paint	5	0	4	5	$155	$136	$147	$142	$0.8	$0.0	$0.5	$0.7	**$2.1**
L-Paint	2	0	5	2	$204	$158	$184	$164	$0.4	$0.0	$0.9	$0.3	**$1.6**
S-WD	6	0	5	0	$143		$148		$0.9	$0.0	$0.7	$0.0	**$1.6**
L-WD	16	1	10	5	$239	$169	$215	$175	$3.8	$0.1	$2.1	$0.8	**$6.9**
Subtotal	*281*	*17*	*405*	*285*	-	-	-	-	*$44.5*	*$2.8*	*$67.2*	*$44.6*	***$159.0***
Clearance Events Excluding Kitchen or Bathroom													
Bath	8	0	5	5	$161	$161	$166	$166	$1.2	$0.1	$0.8	$0.8	**$2.9**
Kit	1	0	0	0	$163	$161	$168	$167	$0.2	$0.0	$0.0	$0.0	**$0.3**
Bath+Kit	0	0	0	0	$259	$257	$263	$262	$0.1	$0.0	$0.0	$0.0	**$0.1**
S-Paint	1	0	1	1	$162	$161	$167	$167	$0.2	$0.0	$0.1	$0.1	**$0.4**
M-Paint	0	0	0	0	$191	$163	$175	$168	$0.1	$0.0	$0.0	$0.1	**$0.2**
L-Paint	0	0	0	0	$271	$203	$237	$208	$0.1	$0.0	$0.1	$0.1	**$0.2**
S-WD	0	0	0	0	$161		$166		$0.1	$0.0	$0.0	$0.0	**$0.1**
L-WD	1	0	0	0	$325	$221	$288	$227	$0.2	$0.0	$0.0	$0.0	**$0.2**
Subtotal	*13*	*1*	*6*	*7*	-	-	-	-	*$2.2*	*$0.1*	*$1.1*	*$1.1*	***$4.5***
Clearance Events Including Kitchens or Bathrooms													
Bath	4	0	6	3	$199	$199	$215	$215	$0.7	$0.0	$1.3	$0.7	**$2.7**
Kit	5	0	4	5	$203	$200	$218	$216	$0.9	$0.0	$1.0	$1.0	**$3.0**
Bath+Kit	3	0	6	2	$313	$310	$328	$327	$0.9	$0.1	$2.1	$0.7	**$3.7**
S-Paint	0	0	0	0	$201	$200	$217	$216	$0.0	$0.0	$0.1	$0.0	**$0.2**
M-Paint	0	0	0	0	$226	$194	$219	$211	$0.1	$0.0	$0.0	$0.1	**$0.2**
L-Paint	0	0	0	0	$302	$230	$278	$246	$0.0	$0.0	$0.1	$0.0	**$0.2**
S-WD	0	0	0	0	$199		$215		$0.0	$0.0	$0.0	$0.0	**$0.1**
L-WD	1	0	0	0	$354	$248	$327	$264	$0.3	$0.0	$0.1	$0.0	**$0.5**
Subtotal	*13*	*1*	*18*	*11*	-	-	-	-	*$3.0*	*$0.2*	*$4.7*	*$2.6*	***$10.5***
All Events													
Total	**747**	**43**	**599**	**501**	**-**	**-**	**-**	**-**	**$116.2**	**$6.4**	**$97.6**	**$75.2**	**$295.3**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a small painting sized event; L-Paint indicates a small painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event. A "bathroom size" or kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are: (1) Bathroom size: wall-disturbing events, addition events, (2) Kitchen size: wall-disturbing events, addition events, window/door replacements, (3) Bathroom + kitchen size: wall-disturbing events, addition events. "0" and "0.0" indicate more than zero but fewer than 500 and 50 events respectively. Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors. Clearance costs include the cost of associated dust wipe testing.

Table 4-51: Total Target Housing First Year Costs: Proposed Option

Type	Events (thousands)				Unit Costs				Total Costs (millions)				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Dust Wipe Testing Events Excluding Kitchen or Bathroom													
Bath	17	1	11	10	$121	$121	$127	$127	$2.1	$0.1	$1.3	$1.3	**$4.8**
Kit	104	6	35	32	$121	$121	$127	$127	$12.7	$0.7	$4.4	$4.0	**$21.8**
Bath+Kit	1	0	0	0	$186	$186	$191	$191	$0.1	$0.0	$0.0	$0.0	**$0.1**
S-Paint	42	2	19	30	$121	$121	$127	$127	$5.1	$0.3	$2.5	$3.8	**$11.6**
M-Paint	22	1	11	19	$139	$121	$131	$127	$3.0	$0.2	$1.4	$2.4	**$7.0**
L-Paint	20	1	10	18	$191	$147	$170	$152	$3.8	$0.2	$1.8	$2.8	**$8.6**
S-WD	101	6	34	31	$121	$121	$127	$127	$12.2	$0.7	$4.3	$4.0	**$21.2**
L-WD	104	6	35	32	$227	$159	$204	$164	$23.6	$0.9	$7.1	$5.3	**$36.9**
Subtotal	*410*	*23*	*155*	*173*	-	-	-	-	*$62.6*	*$3.1*	*$22.9*	*$23.6*	***$112.1***
Dust Wipe Testing Events Including Kitchens or Bathrooms													
Bath	52	2	80	48	$143	$143	$148	$148	$7.5	$0.3	$11.9	$7.1	**$26.8**
Kit	102	6	124	133	$143	$143	$148	$148	$14.6	$0.9	$18.3	$19.6	**$53.4**
Bath+Kit	35	5	87	31	$217	$217	$223	$223	$7.6	$1.0	$19.4	$6.9	**$34.9**
S-Paint	4	0	5	3	$143	$143	$148	$148	$0.5	$0.0	$0.7	$0.4	**$1.7**
M-Paint	4	0	3	4	$155	$136	$147	$142	$0.6	$0.0	$0.4	$0.6	**$1.7**
L-Paint	2	0	4	1	$204	$158	$184	$164	$0.4	$0.0	$0.7	$0.2	**$1.3**
S-WD	3	0	3	0	$143		$148		$0.5	$0.0	$0.4	$0.0	**$0.8**
L-WD	13	1	7	4	$239	$169	$215	$175	$3.0	$0.1	$1.6	$0.6	**$5.4**
Subtotal	*215*	*14*	*313*	*224*	-	-	-	-	*$34.6*	*$2.4*	*$53.5*	*$35.5*	***$126.0***
Clearance Events Excluding Kitchen or Bathroom													
Bath	8	0	5	5	$161	$161	$166	$166	$1.3	$0.1	$0.9	$0.8	**$3.1**
Kit	2	0	0	0	$163	$161	$168	$167	$0.3	$0.0	$0.0	$0.0	**$0.4**
Bath+Kit	0	0	0	0	$259	$257	$263	$262	$0.1	$0.0	$0.0	$0.0	**$0.1**
S-Paint	1	0	1	1	$162	$161	$167	$167	$0.2	$0.0	$0.1	$0.1	**$0.4**
M-Paint	0	0	0	0	$191	$163	$175	$168	$0.1	$0.0	$0.0	$0.1	**$0.2**
L-Paint	0	0	0	0	$271	$203	$237	$208	$0.1	$0.0	$0.1	$0.1	**$0.3**
S-WD	0	0	0	0	$161		$166		$0.1	$0.0	$0.0	$0.0	**$0.1**
L-WD	1	0	0	0	$325	$221	$288	$227	$0.2	$0.0	$0.0	$0.0	**$0.3**
Subtotal	*13*	*1*	*7*	*7*	-	-	-	-	*$2.3*	*$0.1*	*$1.2*	*$1.2*	***$4.8***
Clearance Events Including Kitchens or Bathrooms													
Bath	4	0	5	3	$199	$199	$215	$215	$0.7	$0.0	$1.2	$0.7	**$2.6**
Kit	4	0	5	5	$203	$200	$218	$216	$0.9	$0.0	$1.0	$1.0	**$3.0**
Bath+Kit	3	0	6	2	$313	$310	$328	$327	$0.8	$0.1	$2.0	$0.7	**$3.6**
S-Paint	0	0	0	0	$201	$200	$217	$216	$0.0	$0.0	$0.1	$0.0	**$0.1**
M-Paint	0	0	0	0	$226	$194	$219	$211	$0.1	$0.0	$0.0	$0.0	**$0.1**
L-Paint	0	0	0	0	$302	$230	$278	$246	$0.0	$0.0	$0.1	$0.0	**$0.2**
S-WD	0	0	0	0	$199		$215		$0.0	$0.0	$0.0	$0.0	**$0.1**
L-WD	1	0	0	0	$354	$248	$327	$264	$0.3	$0.0	$0.1	$0.0	**$0.5**
Subtotal	*12*	*1*	*17*	*11*	-	-	-	-	*$2.9*	*$0.2*	*$4.5*	*$2.5*	***$10.1***
All Events													
Total	**650**	**39**	**493**	**414**	**-**	**-**	**-**	**-**	**$102.4**	**$5.7**	**$82.0**	**$62.8**	**$253.0**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a small painting sized event; L-Paint indicates a small painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event. A "bathroom size" or kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are: (1) Bathroom size: wall-disturbing events, addition events, (2) Kitchen size: wall-disturbing events, addition events, window/door replacements, (3) Bathroom + kitchen size: wall-disturbing events, addition events. "0" and "0.0" indicate more than zero but fewer than 500 and 50 events respectively. Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors. Clearance costs include the cost of associated dust wipe testing.

Table 4-52: Total Target Housing First Year Costs: High Threshold Option

Type	Events (thousands)				Unit Costs				Total Costs (millions)				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Dust Wipe Testing Events Excluding Kitchen or Bathroom													
Bath	7	0	5	4	$121	$121	$127	$127	$0.9	$0.0	$0.6	$0.6	**$2.1**
Kit	108	6	37	33	$121	$121	$127	$127	$13.1	$0.7	$4.7	$4.2	**$22.7**
Bath+Kit	0	0	0	0	$186	$186	$191	$191	$0.0	$0.0	$0.0	$0.0	**$0.1**
S-Paint	12	1	5	8	$121	$121	$127	$127	$1.4	$0.1	$0.7	$1.0	**$3.2**
M-Paint	6	0	3	5	$139	$121	$131	$127	$0.8	$0.0	$0.4	$0.6	**$1.8**
L-Paint	5	0	3	5	$191	$147	$170	$152	$1.0	$0.0	$0.5	$0.7	**$2.2**
S-WD	106	6	37	33	$121	$121	$127	$127	$12.9	$0.7	$4.6	$4.2	**$22.4**
L-WD	107	6	37	33	$227	$159	$204	$164	$24.3	$1.0	$7.5	$5.4	**$38.2**
Subtotal	*351*	*20*	*126*	*121*	-	-	-	-	*$54.5*	*$2.6*	*$18.9*	*$16.7*	***$92.7***
Dust Wipe Testing Events Including Kitchens or Bathrooms													
Bath	25	1	38	22	$143	$143	$148	$148	$3.5	$0.2	$5.6	$3.3	**$12.7**
Kit	84	5	102	110	$143	$143	$148	$148	$11.9	$0.7	$15.1	$16.2	**$43.9**
Bath+Kit	32	4	80	29	$217	$217	$223	$223	$7.0	$0.9	$17.9	$6.4	**$32.2**
S-Paint	3	0	4	3	$143	$143	$148	$148	$0.5	$0.0	$0.7	$0.4	**$1.6**
M-Paint	4	0	3	4	$155	$136	$147	$142	$0.6	$0.0	$0.4	$0.6	**$1.7**
L-Paint	2	0	4	1	$204	$158	$184	$164	$0.3	$0.0	$0.7	$0.2	**$1.3**
S-WD	2	0	1	0	$143		$148		$0.2	$0.0	$0.2	$0.0	**$0.4**
L-WD	10	1	6	3	$239	$169	$215	$175	$2.3	$0.1	$1.2	$0.5	**$4.1**
Subtotal	*161*	*11*	*238*	*172*	-	-	-	-	*$26.5*	*$1.9*	*$41.8*	*$27.6*	***$97.8***
Clearance Events Excluding Kitchen or Bathroom													
Bath	7	0	5	5	$161	$161	$166	$166	$1.2	$0.1	$0.8	$0.7	**$2.8**
Kit	2	0	0	0	$163	$161	$168	$167	$0.3	$0.0	$0.1	$0.0	**$0.4**
Bath+Kit	0	0	0	0	$259	$257	$263	$262	$0.1	$0.0	$0.0	$0.0	**$0.1**
S-Paint	1	0	0	0	$162	$161	$167	$167	$0.1	$0.0	$0.0	$0.1	**$0.2**
M-Paint	0	0	0	0	$191	$163	$175	$168	$0.0	$0.0	$0.0	$0.0	**$0.1**
L-Paint	0	0	0	0	$271	$203	$237	$208	$0.1	$0.0	$0.0	$0.0	**$0.1**
S-WD	0	0	0	0	$161		$166		$0.1	$0.0	$0.0	$0.0	**$0.1**
L-WD	1	0	0	0	$325	$221	$288	$227	$0.2	$0.0	$0.0	$0.0	**$0.2**
Subtotal	*11*	*1*	*6*	*6*	-	-	-	-	*$2.0*	*$0.1*	*$1.1*	*$1.0*	***$4.1***
Clearance Events Including Kitchens or Bathrooms													
Bath	3	0	5	3	$199	$199	$215	$215	$0.6	$0.0	$1.0	$0.6	**$2.2**
Kit	4	0	4	4	$203	$200	$218	$216	$0.8	$0.0	$0.9	$0.9	**$2.6**
Bath+Kit	2	0	5	2	$313	$310	$328	$327	$0.6	$0.1	$1.6	$0.5	**$2.8**
S-Paint	0	0	0	0	$201	$200	$217	$216	$0.0	$0.0	$0.0	$0.0	**$0.1**
M-Paint	0	0	0	0	$226	$194	$219	$211	$0.0	$0.0	$0.0	$0.0	**$0.1**
L-Paint	0	0	0	0	$302	$230	$278	$246	$0.0	$0.0	$0.1	$0.0	**$0.1**
S-WD	0	0	0	0	$199		$215		$0.0	$0.0	$0.0	$0.0	**$0.1**
L-WD	1	0	0	0	$354	$248	$327	$264	$0.2	$0.0	$0.1	$0.0	**$0.4**
Subtotal	*10*	*1*	*15*	*9*	-	-	-	-	*$2.4*	*$0.2*	*$3.8*	*$2.1*	***$8.4***
All Events													
Total	**534**	**32**	**385**	**307**	**-**	**-**	**-**	**-**	**$85.3**	**$4.8**	**$65.5**	**$47.4**	**$203.0**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a small painting sized event; L-Paint indicates a small painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event. A "bathroom size" or kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are: (1) Bathroom size: wall-disturbing events, addition events, (2) Kitchen size: wall-disturbing events, addition events, window/door replacements, (3) Bathroom + kitchen size: wall-disturbing events, addition events. "0" and "0.0" indicate more than zero but fewer than 500 and 50 events respectively. Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors. Clearance costs include the cost of associated dust wipe testing.

Table 4-53: Total Public and Commercial Building COF First Year Costs

Building Type	Events		Unit Costs[a]		Total Costs		
	DWT	Clearance	DWT	Clearance	DWT	Clearance	Total
Kindergarten (Public)	158	35	$465	$1,876	$73,449	$64,824	$138,273
Kindergarten (Large Private)	23	5	$465	$1,876	$10,481	$9,250	$19,730
Kindergarten (Small Private)	27	6	$465	$1,876	$12,412	$10,818	$23,230
Pre-K + Kindergarten (Public)	123	27	$465	$2,147	$57,383	$57,800	$115,183
Pre-K + Kindergarten (Large Private)	67	15	$465	$2,147	$31,351	$31,579	$62,931
Pre-K + Kindergarten (Small Private)	34	7	$465	$2,147	$15,780	$16,056	$31,836
Daycare Center (Renter-Occupied)	171	37	$416	$688	$71,004	$25,674	$96,678
Daycare Center (Owner-Occupied)	117	26	$416	$688	$48,670	$17,598	$66,269
Daycare Center (Non-Profit who performs some of own RRP)	149	32	$416	$688	$61,873	$22,372	$84,245
Daycare Center (Non-Profit who uses contractors)	55	12	$416	$688	$22,771	$8,234	$31,005
Daycare Center (In Public School)	8	2	$416	$688	$3,256	$1,177	$4,434
Daycare Center (In Large Private School)	0	0	$416	$688	$16	$6	$22
Daycare Center (In Small Private School)	0	0	$416	$688	$32	$12	$44
All Building Types	**930**	**203**	**--**	**--**	**$408,479**	**$265,399**	**$673,878**

a. These unit costs for events in public and commercial building COFs are third party costs since the analysis assumes that non-residential contractors and operators of public and commercial building COFs will not perform enough dust wipe testing or clearance events annually to make training an in-house dust sampling technician worthwhile. A zero indicates that fewer than 0.5 events are performed on average each year.

4.4 Number of Sampling Technicians Seeking Training and Certification

The proposed LRRP clearance rule would require all entities that conduct certain RRP activities known to generate high levels of lead dust to either hire a third party or use an employee trained as a dust sampling technician to perform post-renovation dust sampling. A trained dust sampling technician is an individual who has successfully completed a dust sampling technician course accredited by EPA or an EPA-authorized State or Tribal program. 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. Depending on the average number of events triggering dust wipe testing or clearance requirements performed by an entity each year, it will be cost-effective for some entities to use third-party dust sampling technicians and others to train their own dust sampling technician. The sections below present an analysis of which firms and entities would choose to train their own dust sampling technician as well as an estimate of the number of personnel requiring additional training under the proposed LRRP Clearance Rule.

4.4.1 Residential Activities: Estimating the Number of Personnel Obtaining Training to Meet the Demand for Dust Wipe Testing and Clearance Services

4.4.1.1 Firms Certified Under the 2008 LRRP rule and the 2009 Proposed Opt-Out Rule

This analysis utilizes the total estimated numbers of firms seeking certification from the economic analysis of the 2008 LRRP rule (EPA 2008) and the economic analysis of the 2009 proposed Opt-Out rule (EPA 2009). The general approach used by EPA (2008, 2009) was to obtain Census estimates of the total number of establishments 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. These data are used as the basis for estimating the number of firms that will pursue training for a dust sampling technician.

The total numbers of establishments are adjusted in three ways: (1) according to the share of their revenues that come from residential work, (2) to reflect the share of the housing stock that is affected by the 2009 proposed Opt-Out Rule, and (3) to reflect a 75 percent compliance rate following previous analyses (EPA 2008, 2009). These adjustments imply that there will be some degree of specialization in regulated work. They do not, however, imply full specialization in regulated work. For example, 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 imply more specialization and result in a lower estimate of the number of affected firms and personnel.

The numbers of certified firms performing RRP in target housing under the 2008 LRRP Rule and the subsequent 2009 proposed Opt-Out Rule are estimated in three segments: (1) residential construction establishments with employees and (2) non-employer residential construction establishments (i.e., self-employed contractors). Note that this analysis excludes the following construction and real estate sectors expected to be affected by the 2008 LRRP rule but not the proposed LRRP Clearance Rule: (1) siding contractors, (2) other building equipment contractors, (3) other building finishing contractors, (4) glass and glazing contractors. [11] In addition, this analysis assumes that residential property managers and lessors do not perform the RRP activities that would require dust wipe testing or clearance under the

[11] Renovators in these sectors are not expected to typically perform the types of renovation events that require dust wipe testing or clearance under the proposed rule.

proposed rule. These activities are primarily major renovations such as kitchen remodeling, bathroom remodeling and window and door replacement. The more minor and routine RRP activities that would be expected to be performed by property manager and lessor staff, such as re-painting a rental unit, would generally not require using the paint removal practices that trigger the proposed clearance rule requirements. To the extent that property manager and lessors have staff that perform activities that would be covered by the proposed LRRP Clearance Rule, this analysis may be slightly understating the costs of performing these activities (by not including dust sampling technician training costs for these firms). Note that another implication of this assumption is that the estimated small business impacts (presented in Chapter 6) on construction firms are higher, since the costs associated with a larger number of events are attributed to a smaller number of firms. Table 4-54 presents the estimated number of firms in each segment expected to seek LRRP program certification under the 2008 LRRP rule and the 2009 proposed Opt-Out rule.

Table 4-54: Total Number of Residential RRP Firms Certified under LRRP Program in First Year

NAICS	Description	Number of Employer Estab. in Industry	Residential Adjustment Factor: Residential Revenues as a Percent of Total Value of Construction	Number of Estab., Adjusted by Percentage of Housing Stock Affected (65%), Residential Adjustment Factor, and Assumed Compliance Rate (75%)
Employer Construction Establishments				
236118	Residential remodelers	82,747	56%	22,590
238350	Finish carpentry	35,087	50%	8,552
238340	Tile and terrazzo	8,950	28%	1,222
238220	Plumbing and HVAC	87,501	27%	11,517
238320	Painting and wall covering	38,943	25%	4,746
238210	Electrical contractors	62,586	23%	7,018
238310	Drywall and insulation	19,598	21%	2,006
Subtotal		**335,412**	**35%**	**57,651**
Non-Employer Construction Establishments				
236118	Residential remodelers	194,182	56%	53,012
238350	Finish carpentry	185,118	50%	45,122
238340	Tile and terrazzo	47,220	28%	6,446
238220	Plumbing and HVAC	110,183	27%	14,503
238320	Painting and wall covering	205,462	25%	25,041
238210	Electrical contractors	102,219	23%	11,462
238310	Drywall and insulation	103,398	21%	10,586
Subtotal		**947,782**	**36%**	**166,170**
All Residential RRP Firms				**223,821**

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

4.4.1.2 Estimating the Stock of Trained Dust Sampling Technicians Necessary to Meet Demand for Dust Wipe Testing and Clearance Services in Target Housing

The proposed LRRP Clearance rule requires firms to ensure that dust wipe testing and clearance activities covered by the rule are performed by certified dust sampling technicians, inspectors, or risk-assessors. To estimate the number of individuals that will seek dust sampling technician training, the analysis first considered whether it would be more cost effective for firms to: (1) obtain dust sampling technician training for one of their employees, or (2) use a third party to conduct dust wipe testing. Thus, a firm must perform a minimum number of dust wipe testing or clearance events annually for the cost savings from performing this activity with their own employee to outweigh the dust sampling technician training costs.

Following the analysis of the 2008 LRRP rule (EPA 2008), it is assumed that the number of events performed per firm is proportional to the number of employees per firm. The average employment size was calculated by dividing the number of construction employees by the number of establishments in each industry (See Table 4-55). For non-employer firms, it is assumed that one person performs all the RRP work. Table 4-55 presents both the number of dust wipe testing and clearance events for the proposed option.

Table 4-55: Construction Employees and Annual Dust Wipe Testing and Clearance Events Per Establishment (Proposed Option)

NAICS	Description	Number of Certified Estab. in Industry	Number of Construction Workers Employed by Certified Estab.	Employees Per Estab.	Annual Number of Dust Wipe Testing and Clearance Events Per Estab.
Employer Construction Establishments					
236118	Residential remodelers	22,590	56,684	2.5	8.5
238350	Finish carpentry	8,552	31,660	3.7	12.5
238340	Tile and terrazzo	1,222	6,106	5.0	16.9
238220	Plumbing and HVAC	11,517	93,776	8.1	27.6
238320	Painting and wall covering	4,746	22,465	4.7	16.0
238210	Electrical contractors	7,017	67,993	9.7	32.8
238310	Drywall and insulation	2,006	26,744	13.3	45.1
Non-Employer Construction Establishments					
236118	Residential remodelers	53,012	n.a.	n.a.	3.4
238350	Finish carpentry	45,123	n.a.	n.a.	3.4
238340	Tile and terrazzo	6,446	n.a.	n.a.	3.4
238220	Plumbing and HVAC	14,503	n.a.	n.a.	3.4
238320	Painting and wall covering	25,041	n.a.	n.a.	3.4
238210	Electrical contractors	11,461	n.a.	n.a.	3.4
238310	Drywall and insulation	10,585	n.a.	n.a.	3.4
All Residential RRP Firms		**223,821**	**305,428**	**6.4**	**8.2**

Source: U.S. Census Bureau 2005i,j; U.S. Small Business Administration 2005; EPA Calculations
*Non-employer establishments by definition have no employees; it is estimated that these establishments are self-employed contractors which perform 2.8 Clearance Rule events per year, or the average number for one employee in an employer construction firm.

Given the average annual number of dust wipe testing and clearance events performed by each category of firm, estimates of third party and in-house dust wipe testing costs can be compared to determine the most cost-effective approach to dust-wipe sampling. This comparison is presented in Table 4-56. Since

the firm category with the maximum number of annual dust wipe testing and clearance events only has an average of 37.8 of these events annually ("Drywall and insulation contractors"), and each dust wipe testing event requiring four samples only takes on average 1.75 hours, it is reasonable to assume that no firm would need to train more than one dust sampling technician for an annual maximum total of 66 hours of work per year. [12]

Given that the expected amount firms save by using their own dust sampling technicians is much greater than the annualized cost of dust sampling technician training ($146)[13] for certified firms in all of the sectors shown in Table 4-56, this analysis assumes that each establishment will choose to incur training costs for one dust sampling technician. Note that this result also holds true for the alternative options considered in this analysis (not shown in table).

Table 4-56: Cost Comparison for Third Party and In-House Dust Sampling Technicians (Proposed Option)

NAICS	Description	Annual Dust Wipe Testing and Clearance Events	Annual Cost Per Firm for Third Party Services[a]	Annual Cost Per Firm for In-House Dust Sampling Technician[b]	Annual Savings Per Firm from Using an In-House Dust Sampling Technician
Employer Construction Establishments					
236118	Residential remodelers	8.5	$2,529	$1,420	$1,109
238350	Finish carpentry	12.5	$3,731	$2,096	$1,635
238340	Tile and terrazzo	16.9	$5,037	$2,829	$2,208
238220	Plumbing and HVAC	27.6	$8,206	$4,609	$3,597
238320	Painting and wall covering	16.0	$4,771	$2,679	$2,091
238210	Electrical contractors	32.8	$9,766	$5,485	$4,281
238310	Drywall and insulation	45.1	$13,435	$7,546	$5,889
Non-Employer Construction Establishments					
236118	Residential remodelers	3.4	$1,008	$566	$442
238350	Finish carpentry	3.4	$1,008	$566	$442
238340	Tile and terrazzo	3.4	$1,008	$566	$442
238220	Plumbing and HVAC	3.4	$1,008	$566	$442
238320	Painting and wall covering	3.4	$1,008	$566	$442
238210	Electrical contractors	3.4	$1,008	$566	$442
238310	Drywall and insulation	3.4	$1,008	$566	$442
All Residential RRP Firms		**8.2**	**$2,431**	**$1,365**	**$1,065**

[a,b] All costs are calculated using unrounded number of events; a 3 percent discount rate is used.

[12] The average amount of labor time necessary for a dust sampling event with four required samples was estimated using primary data collection of 9 lead evaluation firms. The specific results of this survey are available in Section 4.3.1.

[13] This average cost is calculated by dividing the 50-year average dust sampling technician training costs ($29,563,881) by the 50-year average number of firms expected to seek dust sampling technician training (202,745).

4.4.2 Public and Commercial Building Activities: Estimating the Number of Personnel Obtaining Training to Meet the Demand for Dust Wipe Testing and Clearance Services

This analysis compared the costs of using third party dust sampling technicians with the costs of training a dust sampling technician for those public and commercial building owners that perform RRP using their own staff. However, since this analysis estimates that staff in public and commercial building COFs will perform activities requiring dust wipe testing or clearance relatively infrequently, the per-event cost savings from having a trained dust sampling technician on staff are not large enough to justify the dust sampling technician training costs. The additional costs associated with using third party testing for a dust wipe testing or clearance event in a public or commercial building is estimated to range from $149 to $161, which is well below the estimated costs of obtaining dust sampling technician training, $621. Thus, the analysis assumes that public and commercial building COFs will use third party testing in lieu of training their own dust sampling technician.

The economic analysis for the 2008 LRRP rule estimated that there would be 3,223 nonresidential contractors seeking certification in the first year of the rule's implementation, and that these contractors would perform an average of 280,434 events per year (EPA 2008). However, since this analysis estimates that non-residential contractors will perform only an average of 406 dust wipe testing or clearance events annually, or one regulated event about every eight years on average, the additional costs associated with third party testing, $155, are lower than the dust sampling training cost of $621.[14], Thus, it is assumed that these nonresidential building contractors will use third party testing rather than obtain dust sampling technician training for one of their employees. Note that although the analysis makes the simplifying assumption that third party testing will always be used for dust wipe testing and clearance events in public and commercial buildings, in reality some firms with trained dust sampling technicians may perform some of this work. These firms could be non-residential contractors specializing in dust wipe testing and clearance work, or they could be firms that also perform dust wipe testing and clearance in residential units. To the extent that third party testing is not used, this analysis may be overstating the costs of dust wipe testing and clearance for these structures.

4.4.3 Estimating the Number of Personnel Seeking Training Each Year Under the LRRP Clearance Proposed Rule

The number of individuals seeking training in any given year is estimated from the stock of firms and individuals necessary to meet demand for dust wipe testing services. (Because training is valid for five years, the annual number trained each year after the first year is a fraction of the total stock of trained individuals and certified firms).

Note that many of the additional dust sampling technicians that are expected undergo training because of the proposed LRRP Clearance Rule are likely to seek training before the provision goes into effect. However, this analysis utilizes the simplifying assumption that any additional initial training takes place over a 12 month period starting from the date of the expansion of the regulated universe.

4.4.3.1 Training after the Initial Years

Following the 2008 LRRP rule analysis (EPA 2008), this analysis assumes a steady annual number of individual trainings following the first year of regulation with an annual decline of 0.41 percent. Note

[14] This analysis assumes that private schools, public schools, and non-profit daycare centers which use in-house staff to perform RRP will perform all window/door carpentry work in-house. Non-residential contractor firms will perform all other RRP. Non-residential contractor firms will perform all RRP events in owner-occupied daycare centers, daycare centers that do not perform all of their own RRP (i.e., contract some of it out), and small private schools.

that if all the individuals needed to meet the demand for clearance requirements were trained in the first year, one might expect a drop in the level of training in the second year, followed by a spike in the fifth year. That is, one might expect a cyclical pattern of training to emerge. However, it is difficult to predict how cyclical the training demand might be or how this cyclicality might diminish over time. Therefore, this analysis assumes that a typical amount of training occurs each year after the first year. 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 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 trainings each year are initial trainings. Specifically, after the first year, 86.7% percent of the dust sampling technicians seeking training 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).[15]

4.4.3.2 Summary of Number of Individuals Trained to Perform Dust Wipe Testing and Clearance

Table 4-57 presents a summary of the estimated stock of dust sampling technicians that will perform RRP requiring dust wipe testing or clearance. The number of trained personnel are segmented by establishment type: employer construction, non-employer construction, and residential property manager and lessor. As demonstrated in Section 4.4.2, no employees working in public and commercial buildings are expected to seek dust sampling technician training. In year one, a total of 223,821 trained dust sampling technicians will be necessary to perform dust wipe testing and clearance services for regulated residential RRP. As described above, this number decreases by 0.41% each year to account for the decline in pre-1978 building stock.

Table 4-57: Estimated Stock of Trained Dust Sampling Technicians and Certified Firms to Perform RRP, by Year

Year	Stock of Trained Dust Sampling Technicians	Initial Trainings	Refresher Trainings
Employer Construction Establishments			
Year 1	57,651	57,651	0
Year 2	57,415	9,952	1,531
Non-Employer Construction Establishments			
Year 1	166,170	166,170	0
Year 2	165,489	28,685	4,413
All Establishments			
Year 1	233,821	233,821	0
Year 2	222,904	38,637	5,944

4.5 Sampling Technician 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

[15] It was found in this study of a training certification program that lasted three years that in a given year, 52% of individuals seeking training were seeking initial training, and 48% were seeking refresher training. This percentage was adjusted to apply to a 5-year training cycle (86.7%) by multiplying 52% by five-thirds.

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 dust sampling technicians, several cost components are calculated including tuition rates, wage rates, and travel and expense costs. Each certified dust sampling technician will participate in 8 hours of formal initial training. Refresher dust sampling technician certification training is required every five years; the refresher course is four hours.

Tuition for the initial certified dust sampling technician training class is estimated to be $205 and each corresponding refresher course's tuition is estimated to be $103. 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). This value is then converted to 2008 dollars.[16] Additional travel and meal costs associated with training are assumed to be $134 (EPA 2006).[17] Digital photos of each certified dust sampling technician 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), which results in a total cost of $1.76 (or $2 in 2008 dollars). 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 dust sampling technicians to receive formal initial training is $279 (8 hours at a loaded wage rate of $34.92/hour); for refresher training the value is $140 (EPA 2006). Certified dust sampling technicians might be self-employed or employed by a larger company. Therefore, the value of time is likely to represent a mix of lost wages and additional overhead to firms. As shown in Table 4-58, the aggregated incremental cost of training is $621 for initial certified dust sampling technician training and $378 for refresher certified dust sampling technician training.

Table 4-58: Dust Sampling Technician Training Costs Per Individual (2008$)

	Tuition	Value of Time	Travel and Meals	Digital Photo	Total
Initial Training	$205	$279	$134	$2	$621
Refresher Training	$103	$140	$134	$2	$378

Sources: BLS 2008, IRS 2008, EPA 2006

4.5.2 Total Training Costs

Table 4-59 presents the total training costs of the rule for the first three years. The number of dust sampling technicians seeking training is described in Section 4.4.3; the value of training time for dust sampling technicians 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

[16] 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 dust sampling technician course. For example, the initial courses are the only courses with hands-on training, but they are also longer than the technician course. The refresher courses are more similar in length, but have no hands on requirements.

[17] Travel costs include 2 hours of travel time ($70), meals ($10), and mileage costs (50 miles, $54).

first year, 86.7 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, the number of dust sampling technicians seeking training, and the undiscounted total training costs. As shown in Table 4-59, total training costs for Year 1 will be $138,993,017 and total training costs for Year 2 will be $25,475,936.

Table 4-59: Total Dust Sampling Technician Training Costs (2008$)

Year	Type of Training	Number of Dust Sampling Technicians Seeking Training	Average Cost of Training	Total Training Cost (2008$, before discounting)
Year 1	Initial	223,821	$621	$138,993,017
Year 2	Initial	38,637	$621	$23,993,345
	Refresher	5,944	$378	$2,246,868

4.6 Total Incremental Costs of Proposed LRRP Clearance Rule

This section presents the total costs of the proposed LRRP Clearance Rule. Total costs are presented for the first and second years of regulation, and total 50-year and annualized costs are also calculated. The total costs are calculated over a 50-year period using both 3 and 7 percent discount rates. 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 dust sampling technician training costs account for the training and certification of all dust sampling technicians required to meet the demand for dust wipe testing and clearance services in the first year. In subsequent years, it is assumed that one fifth of the necessary stock of individuals will obtain training each year (since refresher-training and re-certification is required every five years).

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 4-60 presents the first year, second year, total 50-year and 50-year annualized incremental costs of the proposed LRRP Clearance Rule. Total work practice costs are lower for the options with larger size thresholds for triggering the rule's requirements. As shown in the table, training costs are not assumed to vary with the size thresholds. However, it should be noted that it is possible that fewer sampling technicians may seek training if the universe of events changes, in which case the difference in costs between threshold options would be larger than estimated for this analysis.

Table 4-60: Total Incremental Costs of Proposed LRRP Clearance Rule (millions 2008$)										
Option	**Year 1**			**Year 2**			**50-Year Total**		**Annualized Total**	
	Work Practice Costs	**Training Costs**	**Total**	**Work Practice Costs**	**Training Costs**	**Total**	**3%**	**7%**	**3%**	**7%**
Target Housing										
Low Threshold	$295	$139	$434	$294	$26	$320	$8,023	$4,629	$312	$335
Proposed Threshold	$253	$139	$392	$252	$26	$278	$6,983	$4,035	$271	$292
High Threshold	$203	$139	$342	$202	$26	$228	$5,753	$3,332	$224	$241
Public and Commercial Building COFs										
All Thresholds[1]	$1	--	$1	$1	--	$1	$17	$9	$1	$1
All Structure Types										
Low Threshold	$296	$139	$435	$295	$26	$321	$8,040	$4,638	$312	$336
Proposed Threshold	$254	$139	$393	$253	$26	$279	$6,999	$4,044	$272	$293
High Threshold	$204	$139	$343	$203	$26	$229	$5,769	$3,342	$224	$242

[1]It is assumed that the number of events in Public and Commercial COFs are not affected by the size thresholds, since the larger scale of the activities that are expected to occur in these structures are assumed to exceed all size thresholds.

Table 4-61 presents more detail on which types of events drive the total incremental work practice costs of the rule. The table demonstrates that despite the relatively higher costs of clearance, dust wipe testing accounts for the substantial majority of the total work practice costs because of the higher frequency with which it is required.

The largest contributor to total work practice costs under the low and the proposed threshold options is from dust wipe testing multiple activity events, which represent the dust wipe testing events that trigger more than one of the rule's threshold requirements. These event types represent a smaller share of the total costs for the larger size threshold options, since fewer renovation activities trigger the rule's requirements as the size threshold increases. For example, dust wipe testing for an event where a door and 10 square feet of trim was removed would be considered a multiple activity event under the low threshold option (since the trim removal and door removal both trigger the dust wipe testing requirements). However, this would be categorized as a door removal event under the proposed option (since the door removal is the only activity that triggers the rule's requirements under the proposed option). This example also illustrates why total window/door frame removal event costs are higher for the higher threshold options even though the size thresholds for these activities do not vary by option.

Table 4-61: Total Incremental Annualized Work Practice Costs by Event Type (3 percent discount rate, thousands 2008$)

Event Type	Low Threshold			Proposed Threshold			High Threshold		
	Target Housing	Public and Com. COF	Total	Target Housing	Public and Com. COF	Total	Target Housing	Public and Com. COF	Total
Dust Wipe Testing Events									
Heat gun, < 1000 degrees	$481	$1	$481	$501	$1	$502	$0	$1	$1
Window/door frame removal	$70,096	$278	$70,374	$74,407	$278	$74,686	$78,926	$278	$79,204
Scraping	$5,287	$37	$5,324	$276	$37	$313	$0	$37	$37
Trim, molding, cabinet removal	$93,051	$74	$93,125	$58,866	$74	$58,940	$28,238	$74	$28,312
Multiple activity events[a]	$99,036	-	$99,036	$93,575	-	$93,575	$74,898	-	$74,898
Subtotal, dust wipe testing	*$267,949*	*$390*	*$268,340*	*$227,625*	*$390*	*$228,015*	*$182,062*	*$390*	*$182,452*
Clearance Events									
High speed machines	$650	$200	$850	$678	$200	$878	$361	$200	$561
Plaster demolition through destructive means	$3,474	$54	$3,528	$4,924	$54	$4,978	$5,459	$54	$5,512
Multiple activity events[a]	$10,191	-	$10,191	$8,603	-	$8,603	$6,132	-	$6,132
Subtotal, clearance events	*$14,315*	*$254*	*$14,569*	*$14,205*	*$254*	*$14,459*	*$11,952*	*$254*	*$12,205*
Total, All Event Types	***$282,265***	***$644***	***$282,909***	***$241,830***	***$644***	***$242,474***	***$194,013***	***$644***	***$194,658***

[a] Multiple event types occurring during the course of a single job (e.g., a renovation with both window frame removal and trim removal).

4.7 Alternative Baseline and Options

4.7.1 2008 LRRP Rule Universe (Excludes Opt-Out Eligible Housing)

This section presents the costs for the alternative baseline scenario where the opt-out provision is not eliminated as proposed in October 2009 (74 FR 55506). The primary cost estimates for the Proposed LRRP Clearance Rule were estimated under a baseline scenario where the opt-out provision of the 2008 LRRP rule has been eliminated. However, because the proposed LRRP Clearance Rule was developed before the LRRP Opt-Out Rule was finalized, the costs of the Proposed LRRP Clearance Rule are also estimated for the alternative baseline scenario where the opt-out provision has not been eliminated. Under this alternative baseline it is estimated that there would be fewer affected events and fewer sampling technicians seeking training because opt-out eligible housing units would be able to opt-out of the requirements of the LRRP program, including the proposed LRRP Clearance Rule. Opt-out eligible housing includes owner-occupied housing units that are not COFs where no child under the age of six or pregnant woman resides.

Table 4-62 presents the total estimated number of events and target housing work practice costs under this alternative baseline scenario. The estimated number of events is 1,032,606 under this scenario compared to 1,595,856 under the primary baseline scenario and the total target housing work practice costs are $165 million under this scenario compared to $254 million under the primary baseline scenario (See Table 4-62 and Table 4-51). The public and commercial building COF universe and costs are the same under both scenarios.

Table 4-62: Total First Year Target Housing Costs: 2008 Rule Universe (Excludes Opt-Out Housing)

Type	Events (thousands)				Unit Costs				Total Costs (thousands)				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Dust Wipe Testing Events Excluding Kitchen or Bathroom													
Bath	3	0	11	10	$121	$121	$127	$127	$0.4	$0.0	$1.3	$1.3	**$3.1**
Kit	19	1	35	32	$121	$121	$127	$127	$2.3	$0.1	$4.4	$4.0	**$10.8**
Bath+Kit	0	0	0	0	$186	$186	$191	$191	$0.0	$0.0	$0.0	$0.0	**$0.0**
S-Paint	7	0	19	30	$121	$121	$127	$127	$0.9	$0.0	$2.5	$3.8	**$7.2**
M-Paint	4	0	11	19	$139	$121	$131	$127	$0.5	$0.0	$1.4	$2.4	**$4.4**
L-Paint	3	0	10	18	$191	$147	$170	$152	$0.6	$0.0	$1.8	$2.8	**$5.2**
S-WD	18	1	34	31	$121	$121	$127	$127	$2.1	$0.1	$4.3	$4.0	**$10.6**
L-WD	18	1	35	32	$227	$159	$204	$164	$4.2	$0.1	$7.1	$5.3	**$16.7**
Subtotal	*72*	*4*	*155*	*173*	-	-	-	-	*$11.0*	*$0.5*	*$22.9*	*$23.6*	***$57.9***
Dust Wipe Testing Events Including Kitchens or Bathrooms													
Bath	9	0	80	48	$143	$143	$148	$148	$1.3	$0.0	$11.9	$7.1	**$20.3**
Kit	20	0	124	133	$143	$143	$148	$148	$2.8	$0.1	$18.3	$19.6	**$40.9**
Bath+Kit	8	1	87	31	$217	$217	$223	$223	$1.8	$0.2	$19.4	$6.9	**$28.4**
S-Paint	1	0	5	3	$143	$143	$148	$148	$0.1	$0.0	$0.7	$0.4	**$1.2**
M-Paint	1	0	3	4	$155	$136	$147	$142	$0.1	$0.0	$0.4	$0.6	**$1.2**
L-Paint	0	0	4	1	$204	$158	$184	$164	$0.1	$0.0	$0.7	$0.2	**$1.1**
S-WD	1	0	3	0	$143		$148		$0.1	$0.0	$0.4	$0.0	**$0.5**
L-WD	3	0	7	4	$239	$169	$215	$175	$0.7	$0.0	$1.6	$0.6	**$3.0**
Subtotal	*43*	*2*	*313*	*224*	-	-	-	-	*$7.1*	*$0.4*	*$53.5*	*$35.5*	***$96.4***
Clearance Events Excluding Kitchen or Bathroom													
Bath	2	0	5	5	$161	$161	$166	$166	$0.2	$0.0	$0.9	$0.8	**$2.0**
Kit	0	0	0	0	$163	$161	$168	$167	$0.1	$0.0	$0.0	$0.0	**$0.2**
Bath+Kit	0	0	0	0	$259	$257	$263	$262	$0.0	$0.0	$0.0	$0.0	**$0.1**
S-Paint	0	0	1	1	$162	$161	$167	$167	$0.0	$0.0	$0.1	$0.1	**$0.3**
M-Paint	0	0	0	0	$191	$163	$175	$168	$0.0	$0.0	$0.0	$0.1	**$0.1**
L-Paint	0	0	0	0	$271	$203	$237	$208	$0.0	$0.0	$0.1	$0.1	**$0.2**
S-WD	0	0	0	0	$161		$166		$0.0	$0.0	$0.0	$0.0	**$0.0**
L-WD	0	0	0	0	$325	$221	$288	$227	$0.0	$0.0	$0.0	$0.0	**$0.1**
Subtotal	*3*	*0*	*7*	*7*	-	-	-	-	*$0.5*	*$0.0*	*$1.2*	*$1.2*	***$2.8***
Clearance Events Including Kitchens or Bathrooms													
Bath	1	0	5	3	$199	$199	$215	$215	$0.1	$0.0	$1.2	$0.7	**$2.0**
Kit	1	0	5	5	$203	$200	$218	$216	$0.2	$0.0	$1.0	$1.0	**$2.2**
Bath+Kit	1	0	6	2	$313	$310	$328	$327	$0.2	$0.0	$2.0	$0.7	**$2.9**
S-Paint	0	0	0	0	$201	$200	$217	$216	$0.0	$0.0	$0.1	$0.0	**$0.1**
M-Paint	0	0	0	0	$226	$194	$219	$211	$0.0	$0.0	$0.0	$0.0	**$0.1**
L-Paint	0	0	0	0	$302	$230	$278	$246	$0.0	$0.0	$0.1	$0.0	**$0.1**
S-WD	0	0	0	0	$199		$215		$0.0	$0.0	$0.0	$0.0	**$0.0**
L-WD	0	0	0	0	$354	$248	$327	$264	$0.1	$0.0	$0.1	$0.0	**$0.3**
Subtotal	*2*	*0*	*17*	*11*	-	-	-	-	*$0.6*	*$0.0*	*$4.5*	*$2.5*	***$7.7***
All Events													
Total	**120**	**6**	**493**	**414**	**-**	**-**	**-**	**-**	**$19.1**	**$0.9**	**$82.0**	**$62.8**	**$164.8**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a small painting sized event; L-Paint indicates a small painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event. A "bathroom size" or kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are: (1) Bathroom size: wall-disturbing events, addition events, (2) Kitchen size: wall-disturbing events, addition events, window/door replacements, (3) Bathroom + kitchen size: wall-disturbing events, addition events. A zero indicates a small positive number rounded to zero in the table. . Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors. Clearance costs include the cost of associated dust wipe testing.

Table 4-63 presents the estimated number of sampling technicians trained under the alternative baseline scenario where the opt-out provision is not eliminated. The estimated number of sampling technicians trained in the first year is 136,714 under this scenario compared to 233,821 under the primary baseline scenario and the total first year training costs are $85 million under this scenario compared to $139 million under the primary baseline scenario (See Table 4-63 and Table 4-59).

Table 4-63: Total Dust Sampling Technician Training Costs: 2008 Rule Universe (Excludes Opt-Out Housing - 2008$)

Year	Type of Training	Number of Dust Sampling Technicians Seeking Training	Average Cost of Training	Total Training Cost (2008$, before discounting)
Year 1	Initial	136,714	$621	$84,899,362
Year 2	Initial	23,600	$621	$14,655,554
	Refresher	3,631	$378	$1,372,426

Table 4-64 presents a comparison of the costs of the LRRP Clearance Proposed Rule for both the primary baseline scenario and the alternative baseline scenario where the opt-out provision is not eliminated as was proposed in October 2009. Under this alternative baseline it is estimated that there would be fewer affected events and fewer sampling technicians seeking training, and Table 4-64 shows how much lower these costs would be under this alternative baseline scenario.

Table 4-64: Total Incremental Costs of Clearance Rule (millions 2008$)

Option	Year 1			Year 2			50-Year Total		Annualized Total	
	Work Practice Costs	Training Costs	Total	Work Practice Costs	Training Costs	Total	3%	7%	3%	7%
Primary Baseline Scenario: Universe includes Opt-Out	$254	$139	$393	$253	$26	$279	$6,999	$4,044	$272	$293
Alternative Baseline Scenario: 2008 Rule Universe (Excludes Opt-Out)	$166	$85	$250	$165	$16	$181	$4,535	$2,619	$176	$190
Percentage Difference	-35%	-39%	-36%	-35%	-39%	-35%	-35%	-35%	-35%	-35%

4.7.2 Mandatory Third Party Third Party Dust Wipe Sampling Option

This section presents the estimated costs under an alternative option where dust wipe sampling must be performed by a third party. Other requirements are the same as under the proposed option.

Table 4-65 presents the total estimated number of events and target housing work practice costs under this alternative option. The estimated number of events is the same under this scenario compared to the primary option and the total target housing work practice costs are $450 million under this scenario

compared to $254 million under the primary option (See Table 4-65 and Table 4-51). The public and commercial building COF universe and costs are the same under both scenarios.

Table 4-65: Total First Year Target Housing Event Costs: Third Party Dust Sampling Option													
Type	Events (thousands)				Unit Costs				Total Costs (thousands)				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Dust Wipe Testing Events Excluding Kitchen or Bathroom													
Bath	17	1	11	10	$243	$243	$248	$248	$4.2	$0.2	$2.6	$2.6	**$9.6**
Kit	104	6	35	32	$243	$243	$248	$248	$25.4	$1.4	$8.6	$7.9	**$43.4**
Bath+Kit	1	0	0	0	$308	$308	$313	$313	$0.2	$0.0	$0.0	$0.0	**$0.2**
S-Paint	42	2	19	30	$243	$243	$248	$248	$10.1	$0.6	$4.8	$7.5	**$23.0**
M-Paint	22	1	11	19	$261	$243	$252	$248	$5.6	$0.3	$2.8	$4.7	**$13.4**
L-Paint	20	1	10	18	$313	$269	$292	$274	$6.3	$0.3	$3.1	$5.0	**$14.7**
S-WD	101	6	34	31	$243	$243	$248	$248	$24.4	$1.4	$8.5	$7.8	**$42.1**
L-WD	104	6	35	32	$349	$281	$326	$286	$36.4	$1.7	$11.3	$9.2	**$58.5**
Subtotal	*410*	*23*	*155*	*173*	-	-	-	-	*$112.6*	*$5.9*	*$41.8*	*$44.6*	***$204.9***
Dust Wipe Testing Events Including Kitchens or Bathrooms													
Bath	52	2	80	48	$265	$265	$270	$270	$13.8	$0.6	$21.7	$12.9	**$49.1**
Kit	102	6	124	133	$265	$265	$270	$270	$27.0	$1.6	$33.4	$35.8	**$97.8**
Bath+Kit	35	5	87	31	$340	$340	$345	$345	$11.9	$1.5	$30.0	$10.7	**$54.1**
S-Paint	4	0	5	3	$265	$265	$270	$270	$1.0	$0.0	$1.3	$0.8	**$3.1**
M-Paint	4	0	3	4	$277	$258	$268	$264	$1.2	$0.1	$0.8	$1.2	**$3.2**
L-Paint	2	0	4	1	$326	$280	$306	$286	$0.6	$0.1	$1.2	$0.4	**$2.2**
S-WD	3	0	3	0	$265		$270		$0.9	$0.0	$0.7	$0.0	**$1.5**
L-WD	13	1	7	4	$361	$291	$338	$297	$4.6	$0.2	$2.5	$1.1	**$8.3**
Subtotal	*215*	*14*	*313*	*224*	-	-	-	-	*$60.8*	*$4.1*	*$91.7*	*$62.8*	***$219.4***
Clearance Events Excluding Kitchen or Bathroom													
Bath	8	0	5	5	$325	$325	$331	$331	$2.6	$0.1	$1.7	$1.6	**$6.2**
Kit	2	0	0	0	$328	$326	$332	$331	$0.6	$0.0	$0.1	$0.1	**$0.8**
Bath+Kit	0	0	0	0	$454	$453	$459	$458	$0.1	$0.0	$0.0	$0.0	**$0.2**
S-Paint	1	0	1	1	$326	$326	$332	$331	$0.4	$0.0	$0.2	$0.3	**$0.9**
M-Paint	0	0	0	0	$364	$328	$342	$333	$0.2	$0.0	$0.1	$0.1	**$0.4**
L-Paint	0	0	0	0	$469	$380	$423	$386	$0.2	$0.0	$0.1	$0.1	**$0.4**
S-WD	0	0	0	0	$326		$331		$0.1	$0.0	$0.0	$0.0	**$0.1**
L-WD	1	0	0	0	$535	$404	$489	$410	$0.3	$0.0	$0.1	$0.0	**$0.4**
Subtotal	*13*	*1*	*7*	*7*	-	-	-	-	*$4.6*	*$0.2*	*$2.3*	*$2.3*	***$9.4***
Clearance Events Including Kitchens or Bathrooms													
Bath	4	0	5	3	$359	$359	$364	$364	$1.3	$0.1	$2.0	$1.1	**$4.4**
Kit	4	0	5	5	$363	$360	$367	$365	$1.6	$0.1	$1.7	$1.7	**$5.1**
Bath+Kit	3	0	6	2	$507	$504	$512	$510	$1.3	$0.2	$3.1	$1.0	**$5.6**
S-Paint	0	0	0	0	$361	$360	$366	$365	$0.1	$0.0	$0.1	$0.1	**$0.2**
M-Paint	0	0	0	0	$393	$353	$369	$358	$0.1	$0.0	$0.1	$0.1	**$0.2**
L-Paint	0	0	0	0	$493	$400	$446	$405	$0.1	$0.0	$0.1	$0.0	**$0.3**
S-WD	0	0	0	0	$359		$365		$0.1	$0.0	$0.1	$0.0	**$0.1**
L-WD	1	0	0	0	$557	$423	$509	$428	$0.4	$0.0	$0.2	$0.1	**$0.7**
Subtotal	*12*	*1*	*17*	*11*	-	-	-	-	*$4.9*	*$0.3*	*$7.3*	*$4.2*	***$16.8***
All Events													
Total	**650**	**39**	**493**	**414**	**-**	**-**	**-**	**-**	**$182.9**	**$10.5**	**$143.1**	**$113.9**	**$450.4**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a small painting sized event; L-Paint indicates a small painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event. A "bathroom size" or kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are: (1) Bathroom size: wall-disturbing events, addition events, (2) Kitchen size: wall-disturbing events, addition events, window/door replacements, (3) Bathroom + kitchen size: wall-disturbing events, addition events. A zero indicates a small positive number rounded to zero in the table. . Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors. Clearance costs include the cost of associated dust wipe testing.

Because this option assumes that all dust wipe testing and clearance events will be performed by third party firms, the costs associated with dust sampling technicians are implicitly included in the additional costs associated with third party testing.

Table 4-66 presents a comparison of the costs of the LRRP Clearance Proposed Rule for both the primary option and the alternative option where all dust sampling following target housing events is performed by third party establishments instead of residential RRP firms. Under this alternative option it is estimated that there would be the same number of affected events and higher overall costs.

Table 4-66: Total Incremental Costs of Clearance Rule (2008$): Mandatory Third Party Dust Sampling Option

Option	Year 1			Year 2			50-Year Total		Annualized Total	
	Work Practice Costs	Training Costs	Total	Work Practice Costs	Training Costs	Total	3%	7%	3%	7%
Proposed Rule: In-house Dust Wipe Sampling Allowed	$254	$139	$393	$253	$26	$279	$6,999	$4,044	$272	$293
Alternative Option: Mandatory Third Party Dust Wipe Sampling	$451		$451	$449		$449	$11,095	$6,334	$431	$459
Percentage Difference	n.a.		15%	n.a.		61%	59%	57%	59%	57%

4.7.3 Dust Wipe Testing Only Option

This section presents the estimated costs under an alternative option where only dust wipe testing is required in all instances where either dust wipe testing or clearance is required under the proposed rule (i.e., clearance is not required for any RRP events).

Table 4-67 presents the total estimated number of events and target housing work practice costs under this alternative option. The estimated number of events is the same under the dust wipe testing option compared to the primary option, although all events previously requiring clearance will now only require dust wipe testing. The total target housing work practice costs are $249 million under this scenario compared to $254 million under the primary option (See Table 4-67 and Table 4-51). The public and commercial building COF universe and costs under the alternative option are presented in Table 4-68.

Table 4-67: Total First Year Target Housing Costs: Dust Wipe Testing Option

Type	Events (thousands)				Unit Costs				Total Costs (millions)				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Events Excluding Kitchen or Bathroom													
Bath	25	1	16	15	$121	$121	$127	$127	$3.1	$0.2	$2.0	$1.9	**$7.2**
Kit	106	6	35	32	$121	$121	$127	$127	$12.9	$0.7	$4.4	$4.1	**$22.1**
Bath+Kit	1	0	0	0	$186	$186	$191	$191	$0.2	$0.0	$0.0	$0.0	**$0.2**
S-Paint	43	2	20	31	$121	$121	$127	$127	$5.2	$0.3	$2.5	$3.9	**$11.9**
M-Paint	22	1	11	19	$139	$121	$131	$127	$3.1	$0.2	$1.5	$2.5	**$7.2**
L-Paint	21	1	11	19	$191	$147	$170	$152	$3.9	$0.2	$1.8	$2.8	**$8.8**
S-WD	101	6	34	31	$121	$121	$127	$127	$12.2	$0.7	$4.4	$4.0	**$21.3**
L-WD	105	6	35	32	$227	$159	$204	$164	$23.8	$1.0	$7.1	$5.3	**$37.1**
Subtotal	*424*	*24*	*162*	*180*	--	--	--	--	*$64.4*	*$3.1*	*$23.8*	*$24.5*	***$115.7***
Events Including Kitchens or Bathrooms													
Bath	56	2	86	51	$143	$143	$148	$148	$8.0	$0.3	$12.7	$7.5	**$28.6**
Kit	106	6	128	137	$143	$143	$148	$148	$15.2	$0.9	$19.0	$20.3	**$55.4**
Bath+Kit	38	5	93	33	$217	$217	$223	$223	$8.2	$1.1	$20.7	$7.4	**$37.3**
S-Paint	4	0	5	3	$143	$143	$148	$148	$0.5	$0.0	$0.7	$0.4	**$1.8**
M-Paint	4	0	3	5	$155	$136	$147	$142	$0.7	$0.0	$0.5	$0.7	**$1.8**
L-Paint	2	0	4	1	$204	$158	$184	$164	$0.4	$0.0	$0.8	$0.2	**$1.5**
S-WD	3	0	3	0	$143	$0	$148	$0	$0.5	$0.0	$0.4	$0.0	**$0.9**
L-WD	13	1	8	4	$239	$169	$215	$175	$3.2	$0.1	$1.7	$0.7	**$5.7**
Subtotal	*227*	*15*	*331*	*234*	--	--	--	--	*$36.6*	*$2.5*	*$56.6*	*$37.3*	***$132.9***
All Events													
Total	**650**	**39**	**493**	**414**	**--**	**--**	**--**	**--**	**$101.0**	**$5.6**	**$80.3**	**$61.7**	**$248.7**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a small painting sized event; L-Paint indicates a small painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event. A "bathroom size" or kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are: (1) Bathroom size: wall-disturbing events, addition events, (2) Kitchen size: wall-disturbing events, addition events, window/door replacements, (3) Bathroom + kitchen size: wall-disturbing events, addition events. A zero indicates a small positive number rounded to zero in the table. . Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors. Clearance costs include the cost of associated dust wipe testing.

Table 4-68: Total First Year Public and Commercial Building COF Costs: Dust Wipe Testing Option

Building Type	Events	Unit Costs	Total Costs
Kindergarten (Public)	192	$465	$89,531
Kindergarten (Large Private)	27	$465	$12,775
Kindergarten (Small Private)	32	$465	$15,096
Pre-K + Kindergarten (Public)	150	$465	$69,908
Pre-K + Kindergarten (Large Private)	82	$465	$38,195
Pre-K + Kindergarten (Small Private)	41	$465	$19,259
Daycare Center (Renter-Occupied)	208	$416	$86,526
Daycare Center (Owner-Occupied)	142	$416	$59,310
Daycare Center (Non-Profit who performs some of own RRP)	181	$416	$75,398
Daycare Center (Non-Profit who uses contractors)	67	$416	$27,749
Daycare Center (In Public School)	10	$416	$3,968
Daycare Center (In Large Private School)	0	$416	$20
Daycare Center (In Small Private School)	0	$416	$39
All Building Types	1134	--	$497,774

a. These unit costs for events in public and commercial building COFs are third party costs since the analysis assumes that non-residential contractors and operators of public and commercial building COFs will not perform enough dust wipe testing events annually to make training an in-house dust sampling technician worthwhile.

Because under this option all residential construction establishments will still be expected to train an in-house dust sampling technician, total training costs will be the same under both the primary option and alternative option. Therefore – as under the primary option – the estimated number of sampling technicians trained in the first year will be 233,821 and training costs will amount to $139 million.

Table 4-69 presents a comparison of the costs of the LRRP Clearance Proposed Rule for both the primary option and the alternative option under which all events affected by the rule would only require dust wipe testing. Under this alternative option it is estimated that there would be the same total number of affected events, the same total number of sampling technicians and training costs, and lower average per-event costs.

Table 4-69: Total Incremental Costs of Dust Wipe Testing Only Option (million $)

Option	Year 1			Year 2			50-Year Total		Annualized Total	
	Work Practice Costs	Training Costs	Total	Work Practice Costs	Training Costs	Total	3%	7%	3%	7%
Proposed Rule: Dust Wipe Testing and Clearance	$254	$139	$393	$253	$26	$279	$6,999	$4,044	$272	$293
Alternative Option: Dust Wipe Testing Only	$249	$139	$388	$248	$26	$274	$6,888	$3,981	$268	$288
Percentage Difference	-2%	0%	-1%	-2%	0%	-2%	-2%	-2%	-2%	-2%

4.7.4 Clearance for All Events Option

This section presents the estimated costs under an alternative option where clearance is required in all instances where either dust wipe testing or clearance is required under the proposed rule.

Table 4-70 presents the total estimated number of events and target housing work practice costs under this alternative option. The estimated number of events is the same under this scenario compared to the primary option, although all events previously only requiring dust wipe testing will now require achieving clearance. The total target housing event costs are $351 million under this scenario compared to $254 million under the primary option (See Table 4-70 and Table 4-51). Public and commercial building COF universe and costs under the alternative option are presented in Table 4-71.

Table 4-70: Total First Year Target Housing Costs: Clearance Option

Type	Events (thousands)				Unit Costs				Total Costs (thousands)				
	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	SF-O	MF-O	SF-R	MF-R	**Total**
Events Excluding Kitchen or Bathroom													
Bath	25	1	16	15	$161	$161	$166	$166	$4.1	$0.2	$2.6	$2.6	**$9.5**
Kit	106	6	35	32	$163	$161	$168	$167	$17.3	$1.0	$5.9	$5.3	**$29.5**
Bath+Kit	1	0	0	0	$259	$257	$263	$262	$0.2	$0.0	$0.0	$0.0	**$0.3**
S-Paint	43	2	20	31	$162	$161	$167	$167	$6.9	$0.4	$3.3	$5.1	**$15.8**
M-Paint	22	1	11	19	$191	$163	$175	$168	$4.2	$0.2	$2.0	$3.3	**$9.7**
L-Paint	21	1	11	19	$271	$203	$237	$208	$5.6	$0.2	$2.5	$3.9	**$12.2**
S-WD	101	6	34	31	$161	$161	$166	$166	$16.2	$0.9	$5.7	$5.2	**$28.1**
L-WD	105	6	35	32	$325	$221	$288	$227	$34.0	$1.3	$10.1	$7.3	**$52.7**
Subtotal	*424*	*24*	*162*	*180*	--	--	--	--	*$88.6*	*$4.2*	*$32.1*	*$32.7*	***$157.7***
Events Including Kitchens or Bathrooms													
Bath	56	2	86	51	$199	$199	$215	$215	$11.1	$0.5	$18.5	$11.0	**$41.0**
Kit	106	6	128	137	$203	$200	$218	$216	$21.6	$1.3	$28.0	$29.7	**$80.5**
Bath+Kit	38	5	93	33	$313	$310	$328	$327	$11.8	$1.5	$30.6	$10.8	**$54.6**
S-Paint	4	0	5	3	$201	$200	$217	$216	$0.8	$0.0	$1.1	$0.7	**$2.5**
M-Paint	4	0	3	5	$226	$194	$219	$211	$1.0	$0.0	$0.7	$1.0	**$2.7**
L-Paint	2	0	4	1	$302	$230	$278	$246	$0.6	$0.0	$1.2	$0.4	**$2.2**
S-WD	3	0	3	0	$199		$215		$0.7	$0.0	$0.6	$0.0	**$1.3**
L-WD	13	1	8	4	$354	$248	$327	$264	$4.7	$0.2	$2.6	$1.0	**$8.5**
Subtotal	*227*	*15*	*331*	*234*	--	--	--	--	*$52.2*	*$3.5*	*$83.1*	*$54.5*	***$193.4***
All Events													
Total	**650**	**39**	**493**	**414**	**--**	**--**	**--**	**--**	**$140.8**	**$7.8**	**$115.3**	**$87.2**	**$351.1**

The following abbreviations are used: SF-O indicates single-family owner-occupied; MF-O indicates multi-family owner-occupied; SF-R indicates single-family renter-occupied; MF-R indicates multi-family renter-occupied; Bath indicates a bathroom size event; Kit indicates a kitchen size event, Bath+Kit indicates an event the size of a bathroom and a kitchen combined; S-Paint indicates a small painting sized event; M-Paint indicates a small painting sized event; L-Paint indicates a small painting sized event; S-WD indicates a small window/door sized event; L-WD indicates a large window/door sized event. A "bathroom size" or kitchen size" indicates the event *size*, not the event *type*. In addition to bathroom and kitchen events, other event types having these size definitions are: (1) Bathroom size: wall-disturbing events, addition events, (2) Kitchen size: wall-disturbing events, addition events, window/door replacements, (3) Bathroom + kitchen size: wall-disturbing events, addition events. A zero indicates a small positive number rounded to zero in the table. . Events excluding kitchens or bathrooms are calculated separately from events including kitchens and bathrooms, because kitchens and bathrooms have a different probability of being carpeted than the rest of the house, and dust wipe samples are only taken on uncarpeted floors. Clearance costs include the cost of associated dust wipe testing.

Table 4-71: Total First Year Public and Commercial Building COF Costs: Clearance Option

Building Type	Events	Unit Costs	Total Costs
Kindergarten (Public)	192	$1,876	$360,887
Kindergarten (Large Private)	27	$1,876	$51,496
Kindergarten (Small Private)	32	$1,876	$60,849
Pre-K + Kindergarten (Public)	150	$2,147	$322,609
Pre-K + Kindergarten (Large Private)	82	$2,147	$176,259
Pre-K + Kindergarten (Small Private)	41	$2,147	$88,878
Daycare Center (Renter-Occupied)	208	$688	$143,119
Daycare Center (Owner-Occupied)	142	$688	$98,102
Daycare Center (Non-Profit who performs some of own RRP)	181	$688	$124,713
Daycare Center (Non-Profit who uses contractors)	67	$688	$45,898
Daycare Center (In Public School)	10	$688	$6,564
Daycare Center (In Large Private School)	0	$688	$32
Daycare Center (In Small Private School)	0	$688	$65
All Building Types	**1134**	**--**	**$1,479,470**

a. These unit costs for events in public and commercial building COFs are third party costs since the analysis assumes that non-residential contractors and operators of public and commercial building COFs will not perform enough dust wipe testing events annually to make training an in-house dust sampling technician worthwhile.

Because under this option all residential construction establishments will still be expected to train only one in-house dust sampling technician, total training costs will be the same under both the primary option and alternative option. Therefore – as under the primary option – the estimated number of sampling technicians trained in the first year will be 233,821, and training costs will amount to $139 million.

Table 4-72 presents a comparison of the costs of the LRRP Clearance Proposed Rule for both the primary option and the alternative option under which all events affected by the rule would require full clearance. Under this alternative option it is estimated that there would be the same total number of affected events, the same number of sampling technicians seeking training and total training costs, and higher average per-event costs.

Table 4-72: Total Incremental Costs of Clearance for All Events Option ($ million)										
Option	**Year 1**			**Year 2**			**50-Year Total**		**Annualized Total**	
	Work Practice Costs	**Training Costs**	**Total**	**Work Practice Costs**	**Training Costs**	**Total**	**3%**	**7%**	**3%**	**7%**
Proposed Rule: Dust Wipe Testing and Clearance	$254	$139	$393	$253	$26	$279	$6,999	$4,044	$272	$293
Alternative Option: Clearance for all Events in Proposed Rule	$353	$139	$492	$351	$26	$377	$9,431	$5,432	$367	$394
Percentage Difference	39%	0%	25%	39%	0%	35%	35%	34%	35%	34%

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5. Benefits of the Proposed LRRP Clearance Rule

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 proposed 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). This chapter presents a discussion of the benefits associated with reducing lead exposure through revising the lead, renovation, repair, and painting (LRRP) program regulations, by estimating the numbers of the populations expected to be affected.

The proposed LRRP Clearance Rule would require dust wipe testing after many of the RRP activities regulated under the 2008 LRRP rule, and would require clearance after a smaller subset of RRP activities. The clearance requirements of the proposed LRRP Clearance Rule are expected to result in lower exposures to dust lead by reducing the amount of dust lead left behind after renovation, repair, and painting (RRP). Two types of benefits are expected to be realized from the proposed dust wipe testing requirements. The first type is the direct benefits of the information to the owners and occupants, which includes the value of the information on dust lead levels remaining in the renovation work area. For building owners and occupants, this information is likely to improve their understanding and awareness of dust lead hazards. It will also greatly improve their ability to make further risk management decisions. This information is particularly critical where dust lead levels approach or exceed the regulatory hazard standards. The second benefit expected to be realized from the proposed dust wipe testing requirements stems from changed behavior on the part of renovation firms. EPA believes that dust wipe testing results will also provide valuable feedback to renovation firms on how well they are cleaning up after renovations. It is likely that the specific dust lead levels contained in dust wipe testing results will increase renovation firm cleaning efficiency. Renovation firms will be incentivized to lower the dust lead levels remaining after renovation jobs, even if the levels are at or near the regulatory standards. Because proper cleanup plays such a vital role in the minimization of dust lead hazards created by renovations, providing information on dust lead levels remaining after renovations to building owners and occupants will serve as an incentive for firms to perform post-renovation cleaning efficiently and thoroughly, reducing the amount of dust lead left behind after RRP.

An overview of the proposed LRRP Clearance Rule, as it applies to this benefits estimation, is provided in Section 5.1. Section 5.2 presents the estimated number of children, pregnant woman, and adults who reside in or occupy (i.e., attend school or receive childcare in) the structures affected by the proposed rule. Finally, in Section 5.3, the human health and ecological consequences of lead exposure are summarized.

This analysis does not quantify the value of the benefits of the proposed rule, but presents estimated numbers of some of the populations expected to be affected.

5.1 Overview of Proposed LRRP Clearance Rule in Terms of Benefits Estimation

The proposed LRRP Clearance Rule includes several revisions to the 2008 Lead Renovation, Repair, and Painting Program (RRP) rule that established accreditation, training, certification, and recordkeeping requirements as well as work practice standards for persons performing renovations for compensation in most pre-1978 housing and child-occupied facilities. EPA is particularly concerned about dust lead hazards generated by renovations because of the well-documented toxicity of lead, especially to younger children. The proposed LRRP Clearance Rule includes additional requirements designed to ensure that lead-based paint hazards generated by renovation work are adequately cleaned after renovation work is

finished and before the areas are re-occupied. Specifically, EPA is proposing to require dust wipe testing after many renovations covered by the RRP rule. For a subset of jobs involving demolition or removal of plaster through destructive means or the disturbance of paint using machines designed to remove paint through high-speed operation, such as power sanders or abrasive blasters, this proposal would also require the renovation firm to demonstrate, through dust wipe testing, that dust-lead levels remaining in the work area are below regulatory levels.

With regard to potential implications of lead effects on IQ, the Air Quality 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 $14,280 (2008 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). 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).

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.

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 $\mu g/ft^2$. 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.

5.1.1 Regulatory Options for Proposed LRRP Clearance Rule

The economic analysis presented in this report considers various regulatory options. The three primary options considered in this analysis only differ in the size thresholds that trigger the rule's requirements when performing certain renovation activities. The three threshold options considered in this analysis are:

1. Low Threshold Option
   - All event types requiring dust wipe testing where the total amount of lead-based paint disturbed is larger than 6 square feet.
   - Clearance is required for:
     - high-speed machine removal of paint larger than 6 square feet, and
     - plaster removal using destructive means, larger than 6 square feet.

2. Proposed Threshold Option
    - Dust wipe testing is required for:
        - cabinet and trim events larger than 40 square feet,
        - scraping of paint larger than 60 square feet,
        - heat gun removal of more than 6 square feet
        - Window frame or door frame removal events
    - Clearance is required for:
        - high-speed machine removal of paint larger than 6 square feet, and
        - plaster removal using destructive means, larger than 6 square feet.
3. High Threshold Option
    - Dust wipe testing is required for:
        - cabinet and trim events larger than 80 square feet,
        - scraping or heat gun removal of paint larger than 120 square feet, and
        - window frame or door frame removal events.
    - Clearance is required for:
        - high-speed machine removal of paint larger than 60 square feet, and
        - plaster removal using destructive means, larger than 60 square feet.

This analysis considers three alternative options in addition to the three primary options: (1) an option where third party dust wipe testing and clearance is required, (2) an option where dust wipe testing is required in lieu of the clearance required under the proposed option, and (3) an option where clearance is required in lieu of the dust wipe testing required under the proposed option. The number of individuals affected under these alternative options are the same as those affected under the proposed option. Therefore, separate estimates of affected populations are not presented for these alternative options.

All the primary and alternative options are analyzed under the baseline scenario where the opt-out provision of the 2008 LRRP rule has been eliminated as proposed (the opt out provision allows owner-occupied housing units where no child under the age of six or pregnant woman resides to opt out of the rule's requirements). Since the LRRP Opt-Out Rule is not a final rule, the analysis also presents estimates of the populations affected by the proposed LRRP Clearance Rule under the alternative baseline assuming the regulated universe under the 2008 LRRP Rule (which excludes opt-out eligible housing from the universe). Table 5-1 summarizes the options presented in the economic analysis.

Table 5-1: Options Included in Economic Analysis				
Option/Baseline	**Size Threshold**	**Dust Wipe Testing and Clearance**	**Third Party Requirement**	**Baseline**
Low Threshold Option	Size thresholds are lower or equal to proposed rule	Dust wipe testing is required for: 1. cabinet and trim events 2. scraping of paint 3. heat gun removal of paint 4. Window frame or door frame removal events Clearance is required for: 1. high-speed machine removal of paint 2. plaster removal using destructive means	No	2008 + Opt Out
Proposed Threshold Option	Size thresholds are as proposed		No	2008 + Opt Out
High Threshold Option	Size thresholds are higher or equal to proposed rule		No	2008 + Opt Out
Third Party Option	Same as Proposed	Dust wipe testing and clearance are required in the same instances as proposed	Yes	2008 + Opt Out
Dust Wipe Testing Only Option	Same as Proposed	Dust wipe testing is required in instances where dust wipe testing or clearance are required under the proposed option	No	2008 + Opt Out
Clearance Only Option	Same as Proposed	Clearance is required in instances where dust wipe testing or clearance are required under the proposed option	No	2008 + Opt Out
Proposed Option with Alternative Baseline	Same as Proposed	Same as Proposed	No	2008

5.2 Residents and Occupants of Structures Regulated by the Proposed LRRP Clearance Rule

The residents and occupants of the structures regulated under the proposed LRRP Clearance Rule include: (1) children residing in target housing, (2) children receiving childcare in target housing, (3) children attending daycare in a public or commercial building, (4) children attending school in a public or commercial building, (5) adults residing in target housing, (6) adults working in a public or commercial building COF. This section presents the estimated number of individuals who reside in or occupy these regulated structures and presents the estimated number of these individuals residing in or occupying a structure where dust wipe testing or clearance is expected to be performed.

Section 5.2.1 describes the methods and sources for these estimates and section 5.2.2 presents the resulting estimated populations.

5.2.1 Methodology and Sources for Estimating Affected Populations

This analysis presents the estimated number of target housing residents, children receiving childcare in target housing, and children attending daycare or schools in public and commercial buildings. The number of adults who work in a public or commercial building COF was not estimated for this analysis, but these individuals would also be expected to benefit from the proposed rule.

5.2.1.1 Estimating the Number of Target Housing Residents

The 2003 American Housing Survey (AHS) (U.S. Census, 2003) was used to estimate the number of individuals residing in target housing where dust wipe testing and clearance events occur. The AHS includes household level microdata with information on the number and ages of housing occupants, household-level renovation data, and other housing characteristics. Chapter 4 of this report provides a description of how EPA estimated the frequencies of dust wipe testing and clearance activities using AHS data and questionnaires administered to fewer than 10 respondents. This methodology was used to determine which respondent households in the AHS data were performing regulated renovation activities, and therefore the number and demographics of the occupants residing in these households can easily be determined since this is reported at the household level. For example, some households reported remodeling their kitchen in the American Housing Survey, and a subset of these households are estimated to trigger the dust wipe testing requirements associated with trim and cabinet replacement (as described in Chapter 4). Since the American Housing Survey includes information on the number and ages of housing occupants, the number and ages of individuals affected by the rule in these households can be estimated.

5.2.1.2 Estimating the Number of Children Receiving Childcare in Target Housing

EPA estimated the number of children receiving childcare in target housing affected by the dust wipe testing and clearance requirements in three steps: (1) the number of target housing unit COFs and the frequency of regulated activities was estimated; (2) the number of children receiving childcare in target housing was estimated; and (3) the estimated frequencies of the activities in target housing were applied to number of children receiving childcare in these target housing units to estimate the number of children affected by the proposed rule.

Step One: Estimate Number of Target Housing COFs and the Frequency of Regulated Activities

The estimate of the number of target housing units that are COFs was developed for the economic analysis of the 2008 LRRP Rule. EPA (2008b) provides a detailed explanation of these estimates which is summarized here. 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. The 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 by EPA (2008b), these data are used to estimate the number of COFs in target housing. These numbers are further reduced to estimate the number of pre-1978 housing units based on American Housing Survey data. The frequency of dust wipe testing and clearance is assumed to be the same in target housing COFs as estimated for other target housing.

Step Two: Estimate Number of Children Receiving Childcare in Target Housing

Data from Table 2 of Mulligan et al (2001) were used to determine the number of children under six years of age in Target Housing COFs. Population data from Mulligan et al (2001) for target housing includes children in the care of relatives and non-relatives as well as the proportion (5 percent) of children in centers identified as being in private settings (i.e., family care).[1] Other adjustments were made to exclude

[1] This analysis assumes that all daycare centers are located in public or commercial buildings (i.e., not in residential buildings). Due to differences in licensing requirements and survey questionnaire design, some sources used in this analysis categorize children cared for in residential settings as being in center-based care.

paid care by a non-relative (e.g., a nanny) in the child's home. Relative and non-relative care were further classified into paid and non-paid care. Based on information presented in Mulligan et al (2001), the following adjustments were made for each category:

1. Paid non-relative care not in the child's home (i.e., family care):
    a. 81 percent of non-relative care occurs in location outside of the child's home.
    b. 5 percent of center-based care occurs in a private setting – assumed to be non-relative care outside child's home.
    c. 90 percent of non-relative care is paid.

2. Unpaid non-relative care (not in the child's home):
    a. 81 percent of non-relative care occurs in location outside of the child's home.
    b. 5 percent of center based care occurs in a private setting – assumed to be non-relative care outside child's home.
    c. 10 percent of non-relative care is unpaid paid.

3. Paid relative care:
    a. 28 percent of relative care is paid.

4. Unpaid relative care:
    a. The difference between all relative care and paid relative care.

Step 3: Apply the Estimated Event Frequencies to the Estimated Populations

The frequencies of regulated activities described in step one are applied to the estimated populations to estimate the number of children affected by the dust wipe testing and clearance requirements.

5.2.1.3 Estimating Populations of Children Attending Schools in Public or Commercial Building COFs

The population of children attending schools was estimated from the Common Core of Data – Public Elementary/Secondary School Universe Survey Data (NCES, 2006b). The building age distribution percentages found in the CBECS data were used to calculate the number of children in pre-1978 buildings (58 percent). See Chapter 4 of this report for a description of the how the frequencies of RRP, dust wipe testing, and clearance were estimated for schools in public or commercial buildings.

5.2.1.4 Estimating Populations of Children Attending Daycare in Public or Commercial Building COFs

Data from Table 2 of Mulligan et al. (2005) were used to determine the number of children under six years of age in childcare centers. Center-based arrangements include day care centers, Head Start programs, preschools, pre-kindergartens, and other early childhood programs. Table 4 of Mulligan et. al indicated that 6,695,000 children were in center-based care.

To avoid double counting with other structures where childcare is provided, children in center-based childcare reported to be in pre-kindergarten and kindergarten and target housing settings were removed from the daycare center count. The following adjustments were made:

1. Subtract from childcare center population the proportion of children in pre-kindergarten and kindergarten (27 percent)

Whenever possible, these daycare facilities and the children they serve were included in the family daycare, rather than in daycare center counts.

2. Subtract from childcare center population the proportion of children in private or target housing settings (5 percent)

The building age distribution percentages found in the CBECS data were used to calculate the number of children in pre-1978 buildings (58 percent).

5.2.2 Estimated Affected Populations

Table 5-2 through Table 5-5 present the number of individuals affected during the first year of the rule by the proposed LRRP Clearance Rule under the three primary options considered in this analysis. (The other three options – third party sampling, dust wipe testing only, and clearance only) protect the same number of individuals as the proposed option, although the level of protection may differ.) The first row of these tables presents the number of children who reside in or occupy (i.e., receive childcare or attend school in) regulated structures during the first year of the rule. The number of children affected by dust wipe testing and clearance activities is both presented separately and combined. In addition, the tables break out the estimated populations according to whether or not the dust wipe testing or clearance applies to windows only or to both windows and floors (because when floors are carpeted, the requirements only apply to window sills and troughs).

Table 5-2: Number of Children Under the Age of Six Residing or Occupying Regulated Target Housing or Public or Commercial Building COFs by Type of Dust Wipe Testing or Clearance Activity Performed: Low Threshold Option (First Year, thousands)

Activity Performed	Target Housing		Public and Commercial Buildings		Total Number of Children (<6)
	Residents	Daycare Attendees	Daycare Attendees	School Attendees	
All Occupants of Regulated Structures	17,772	3,448	2,647	3,429	27,296
Dust Wipe Testing					
Window Tests Only[1]	303	20	5	7	335
Window and Floor Tests[2]	450	45	11	14	519
Subtotal	*753*	*65*	*16*	*21*	*855*
Clearance					
Window Clearance Only[1]	5	1	1	1	8
Window and Floor Clearance[2]	12	2	2	3	19
Subtotal	*17*	*2*	*3*	*4*	*27*
Dust Wipe Testing or Clearance					
Window Test/Clearance Only[1]	307	21	7	9	343
Window and Floor Test/Clearance[2]	463	46	13	17	538
Subtotal	*770*	*67*	*19*	*25*	*882*

[1]These events are performed where floors are carpeted and therefore floors would not be subject to dust wipe testing or clearance requirements.
[2] These events are performed where floors are not carpeted and therefore floors would be subject to dust wipe testing or clearance requirements.

Note: A zero indicates a positive number less than 500.

Table 5-3: Number of Children Under the Age of Six Residing or Occupying Regulated Target Housing or Public or Commercial Building COFs by Type of Dust Wipe Testing or Clearance Activity Performed: Proposed Threshold Option (First Year, thousands)

Activity Performed	Target Housing		Public and Commercial Buildings		Total Number of Children (<6)
	Residents	Daycare Attendees	Daycare Attendees	School Attendees	
All Occupants of Regulated Structures	17,772	3,448	2,647	3,429	27,296
Dust Wipe Testing					
Window Tests Only[1]	289	18	5	7	320
Window and Floor Tests[2]	401	37	11	14	462
Subtotal	*690*	*55*	*16*	*21*	*782*
Clearance					
Window Clearance Only[1]	5	1	1	1	8
Window and Floor Clearance[2]	12	2	2	3	19
Subtotal	*17*	*2*	*3*	*4*	*27*
Dust Wipe Testing or Clearance					
Window Test/Clearance Only[1]	294	19	7	9	328
Window and Floor Test/Clearance[2]	413	39	13	17	481
Subtotal	*707*	*57*	*19*	*25*	*809*

[1]These events are performed where floors are carpeted and therefore floors would not be subject to dust wipe testing or clearance requirements.
[2] These events are performed where floors are not carpeted and therefore floors would be subject to dust wipe testing or clearance requirements.

Note: A zero indicates a positive number less than 500.

Table 5-4: Number of Children Under the Age of Six Residing or Occupying Regulated Target Housing or Public or Commercial Building COFs by Type of Dust Wipe Testing or Clearance Activity Performed: High Threshold Option (First Year, thousands)

Activity Performed	Target Housing		Public and Commercial Buildings		Total Number of Children (<6)
	Residents	Daycare Attendees	Daycare Attendees	School Attendees	
All Occupants of Regulated Structures	17,772	3,448	2,647	3,429	27,296
Dust Wipe Testing					
Window Tests Only[1]	260	15	5	7	287
Window and Floor Tests[2]	342	29	11	14	395
Subtotal	*602*	*44*	*16*	*21*	*682*
Clearance					
Window Clearance Only[1]	4	1	1	1	7
Window and Floor Clearance[2]	10	1	2	3	17
Subtotal	*14*	*2*	*3*	*4*	*24*
Dust Wipe Testing or Clearance					
Window Test/Clearance Only[1]	264	15	7	9	294
Window and Floor Test/Clearance[2]	352	31	13	17	412
Subtotal	*616*	*46*	*19*	*25*	*706*

[1]These events are performed where floors are carpeted and therefore floors would not be subject to dust wipe testing or clearance requirements.
[2] These events are performed where floors are not carpeted and therefore floors would be subject to dust wipe testing or clearance requirements.

Note: A zero indicates a positive number less than 500.

Table 5-5: Number of Individuals Age of Six and Older Residing in Regulated Target Housing, by option (First Year, thousands)

Activity Performed	Low Threshold Option		Proposed Option		High Threshold Option	
	Age 6 and Older[3]	Pregnant Women	Age 6 and Older[3]	Pregnant Women	Age 6 and Older[3]	Pregnant Women
All Occupants of Regulated Structures	209,040	2,467	209,040	2,467	209,040	2,467
Dust Wipe Testing						
Window Tests Only[1]	3,356	42	3,204	40	2,873	35
Window and Floor Tests[2]	4,677	60	4,183	53	3,586	45
Subtotal	*8,033*	*103*	*7,388*	*94*	*6,458*	*81*
Clearance						
Window Clearance Only[1]	46	1	48	1	39	1
Window and Floor Clearance[2]	114	2	112	1	93	1
Subtotal	*160*	*2*	*160*	*2*	*132*	*2*
Dust Wipe Testing or Clearance						
Window Test/Clearance Only[1]	3,403	43	3,252	41	2,912	36
Window and Floor Test/Clearance[2]	4,790	62	4,295	55	3,678	47
Subtotal	*8,193*	*105*	*7,547*	*96*	*6,590*	*83*

[1]These events are performed where floors are carpeted and therefore floors would not be subject to dust wipe testing or clearance requirements.
[2] These events are performed where floors are not carpeted and therefore floors would be subject to dust wipe testing or clearance requirements.
[3] The Age 6 and Older columns also include pregnant women.
Note: A zero indicates a positive number less than 500.

The information provided as a result of the proposed dust wipe testing requirements will generate benefits by increasing building owners' and occupants' understanding and awareness of dust lead hazards, and improving their ability to make further risk management decisions. The proposed dust wipe testing requirements may also change the behavior of renovation firms. The information from the dust wipe testing may help renovation firms to improve their cleaning efficiency by providing feedback on how well they are cleaning up after renovations. In addition, the information provision may result in indirect benefits due to behavioral changes by owners and occupants such as performing additional cleaning or taking steps to control or remove the lead-based paint. These behavioral changes can result in additional costs as well as in benefits from reductions in exposure.

Because the current state of knowledge about the economics of information is not highly developed, this analysis does not attempt to quantify the direct, informational benefits of the dust wipe testing requirements. In addition, due to the inherent uncertainty in predicting the chain of events, this analysis does not attempt to predict either the benefits or the costs of the behavioral changes resulting from the information provision.

In addition to information provision, the proposed rule requires additional cleaning to be performed for certain jobs where dust levels exceed one of the hazard standards. However, EPA's Dust Study (EPA 2007) did not include these jobs (demolition or removal of plaster through destructive means, and the use of machines that remove lead-based paint through high speed operation with HEPA exhaust control). This analysis does not quantify the benefits of this additional cleaning because data are not available to accurately characterize the dust lead levels generated by these renovation activities, or how they will be affected by the proposed Clearance rule's requirements.

EPA's 2008 RRP rule took effect in April 2010, so those requirements are part of the baseline for this analysis. Most of the experiments in EPA's Dust Study that followed work practices equivalent to those required by the 2008 RRP rule resulted in post-verification dust-lead levels that were below the lead hazard standard levels developed under TSCA section 403. But the proportion of Dust Study experiments

that exceeded the hazard standard is not a proxy for the fraction of the population that would benefit as a result of the proposed rule. As explained below, without the Clearance rule in place some renovators may not be as effective at reducing dust-lead levels as the Dust Study indicates; some of the jobs covered by the proposed Clearance rule differ from those in the Dust Study; and exposures to low levels of lead (below the hazard standards) can still result in adverse health effects. Thus, many occupants of target housing and COFs where Clearance rule renovations occur may receive some type of benefits.

First, some renovators following the work practices in the 2008 RRP rule may not achieve the same dust-lead reductions as the Dust Study indicates. The Dust Study renovators may have been particularly careful in following the work practices because the dust levels were being tested after the work was completed. Since the Clearance rule would require dust wipe testing after the work is completed, the results of the Dust Study may be more representative of dust levels with the Clearance rule in place than without it.

Second, the Dust Study did not address all the same job categories as the proposed Clearance rule. For example, the Dust Study did not include the demolition or removal of plaster through destructive means. If these Clearance rule jobs generate higher dust-lead levels than the experiments in the Dust Study, or leave behind dust particles that are more difficult to clean up because of their fine size or other characteristics, then occupants will have higher lead exposures than the Dust Study experiments would indicate.

Finally, it is not appropriate to treat the regulatory hazards standards as a threshold below which there are no benefits to reducing lead exposure. While levels approaching or exceeding the hazard standards are of particular concern, it appears that some of the adverse health effects caused by exposure to lead (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. Thus, there are health benefits to reducing lead levels to below the hazard standard. If renovators or consumers decide to clean to lead levels below the hazard standard based on the dust wipe testing information, that would provide additional health benefits to the occupants.

Under the proposed rule, reoccupancy of the work area can occur immediately after the dust wipe samples are collected. However, there is a delay between when the samples are taken and when the dust wipe testing results are communicated to owners and occupants. If a fixed site laboratory is used, there may be time needed to send the samples to the laboratory; for the laboratory to analyze the samples and return the results; for the inspector, risk assessor, or dust sampling technician to prepare a dust wipe testing report and provide it to the renovation firm; and for the renovation firm to provide the report to the owner and occupants.

In cases where the occupants re-enter the work area before receiving the dust wipe testing report, and where renovators, owners, or occupants act to reduce lead levels or exposures as a result of the information, the delay between sampling and the receipt of the report by owners and occupants can reduce the health benefits compared to a situation where occupants do not re-enter the work area until after the report has been received.

Preventing occupants in these cases from reoccupying the work area until they receive the testing results would create additional benefits due to reduced exposures. But in some cases the delay while waiting for the test results could be significantly longer than the time spent conducting the renovation. (A covered renovation might be completed in as little as a day, while in some cases owners and occupants might not receive the test results until a week or more after the samples are taken.) Preventing occupants from re-entering the space while the test results are pending would be disruptive and might cause them to incur

additional costs, such as renting alternate space. This analysis does not estimate the benefits or costs of an alternative prohibiting occupancy of the work area until the test results have been received.

5.3 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

5.3.1 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.

5.3.2 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.

5.3.2.1 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.

5.3.2.2 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.

5.3.2.3 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.

5.3.2.4 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.

5.3.2.5 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.

5.3.2.6 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.

5.3.2.7 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.

5.3.2.8 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.

5.3.2.9 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.

5.3.2.10 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.

5.3.2.11 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.

5.3.3 Environmental Effects of Lead

5.3.3.1 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.

5.3.3.2 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).

5.3.3.3 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 proposed revisions to the Lead Renovation, Repair and Painting (LRRP) Rule on:

- Paperwork burden, as required by the Paperwork Reduction Act (PRA)
- Financial condition of small entities, as required by the Regulatory Flexibility Act (RFA)
- 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, as required by Executive Order 13045–Protection of Children From Environmental Health & Safety Risks
- State, local, and Tribal governments, and the private sector, as required by Executive Order 13175–Consultation and Coordination with Indian Tribal Governments
- Federalism, as required by Executive Order 13132–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, as required by Executive Order 13211–Actions That Significantly Affect Energy Supply, Distribution, or Use and
- Whether voluntary consensus standards are used in its regulatory activities.

The proposed LRRP Clearance Rule includes the following changes to the LRRP program: (1) a requirement for dust wipe testing for a subset of renovation activities, and (2) a requirement for dust wipe testing and clearance for a subset of renovation activities where the quantity and characteristics of the dust make it hard to clean up. The demand for certified dust sampling technicians is predicted to increase as a result of the implementation of the Clearance Rule provision, and therefore more individuals are expected to seek dust sampling technician training. Additionally, a specific set of events already regulated under the 2008 LRRP Rule will incur additional per-event dust wipe testing and clearance costs.

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 requirements (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;
- recordkeeping;
- 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 associated with responding to information collection requirements.

The proposed LRRP Clearance Rule would result in additional paperwork-related burden for the three types of entities:

1. The dust sampling technician would be required to collect dust samples, prepare a dust wipe testing report, and provide it to the renovation firm (Section 6.1.1). (In instances where the renovator is also the dust sampling technician, this item and the following one would be combined.)
2. Renovation firms would be required to provide copies of the dust wipe testing report to owners and occupants.
3. Training providers would incur additional paperwork burden related to course accreditation and notification (Section 6.1.2).

6.1.1 Paperwork Burden and Costs for Dust Wipe Testing Report

The proposed LRRP Clearance Rule would require the certified dust sampling technician to prepare a dust wipe testing report and provide it to the renovation firm within three days of the date that the dust wipe test results are obtained. If the dust wipe test results are to be determined by a fixed-site laboratory, the samples have to be sent to the laboratory within one business day of the date they are collected. The dust wipe testing or clearance report would include the name and signature of each certified person collecting the samples or performing the testing, the name and address of each certified firm employing the persons conducting the sampling or testing, the start and completion dates of the renovation, a brief written description of the renovation, the results of the visual inspection, a detailed written description of the specific sampling or testing locations or a detailed drawing that clearly identifies the location of each sample or test, the name of the NLLAP-recognized entity analyzing the results, the results of each sample or test, and the clearance standard that is applicable to each sample or test.

6.1.1.1 Number of Firms Performing Dust Wipe Testing and Clearance Events

As discussed in Section 4.4, there are 223,821 entities performing events requiring dust wipe testing or clearance in residential housing during the first year of the rule. It is estimated that firms working in public and commercial building child-occupied facilities will perform one event that requires dust wipe testing or clearance per year. The number of child-occupied facilities using in-house staff to perform these types of events is estimated to be 686 in the first year of the rule. There will be an estimated 448 events performed by non-residential contractors in year 1. Table 6-1 presents the total number of firms expected to incur paperwork burden and costs due to the proposed rule.

Table 6-1: Total Number of Firms Performing Events Requiring Dust Wipe Testing or Clearance

	Year 1	Year 2	Year 3
Number of Affected Firms			
Residential Contractors	223,821	222,903	221,989
Public and Commercial Building Operators [a]	686	683	680
Non-Residental Contractors [b]	448	446	444
Total - All Events	**224,955**	**224,032**	**223,113**

a. RRP is performed by the owner of a public or commercial building where a COF is located.
b. RRP is performed by a contractor in a public or commercial building where a COF is located.

6.1.1.2 Paperwork Burden and Unit Costs

Two types of costs are estimated in this analysis:

- Labor costs associated with collecting dust wipe samples, shipping samples to the lab, preparing the dust wipe testing or clearance report, and providing reports to owners and occupants of structures where dust wipe testing or clearance was performed.
- Material costs associated with collecting, shipping, and analyzing dust wipe samples, and photocopying and mailing the report.

Labor Costs

The lead evaluation firm survey of nine establishments described in Chapter 4 asked respondents how much labor time would be necessary for taking four dust wipe samples, sending them to the lab, and providing a report to the contractor. The average response was 1.75 hours. Subtracting the estimated marginal labor time for four samples (0.19 hours per sample; see Section 4.3.3) and the assumed labor time for shipping results (0.083 hours), the average labor time for writing a short report as described above would be 0.9 hours, or 54 minutes. Thus, EPA estimates that dust sampling technicians will spend an average of 0.83 hours during each sampling event collecting samples (based on a typical time of 0.19 hours per sample), about 0.9 hours preparing the report, and renovators will spend about five minutes shipping samples or reports, for an average renovation firm burden of 1.8 hours per event.

The burden attributed to renovation firms includes the time required to perform the dust sampling, ship the samples to the laboratory, and prepare and send a summary report to the necessary parties. All renovation firms are required to provide a copy of the dust wipe testing report to the owner and if different, the occupant of the building being renovated or the operator of the child-occupied facility.

EPA assumes that renovation firms working in residential housing will have certified dust sampling technicians on staff to perform the dust sampling and report preparation activities. Residential contractors are estimated to perform an average of 7 renovations per year where dust wipe testing will be required, with an average burden of 1.8 hours per event.

Entities performing work in public and commercial building child-occupied facilities are expected to hire third-party lead evaluation firms to perform dust sampling. Therefore, these entities will only incur a labor burden of 5 minutes for shipping the dust sampling report to owners and occupants. The cost of hiring a third-party firm is accounted for as a material cost.

Material Costs

In addition to the time needed to collect dust wipe samples, ship them to the lab, and prepare and mail a summary report, entities performing RRP events will also incur the costs of the lab analysis, dust wipe sample materials, shipping charges, and report materials. Based on a survey of nine establishments, EPA

estimates a lab cost of $19.00 per sample. EPA estimates the cost of the dust wipes to be $0.25 per wipe. Based on per-page photocopy costs, EPA estimates that a single copy of the dust wipe testing report (assumed to average four pages in length, accounting for a one page job description, one page of lab results, one page for a diagram of sample locations, and one additional page to account for the instances where more than three pages might be necessary, such as a renovation event occurring in multiple rooms) costs $0.36. EPA estimates a shipping cost of $4.95 based on the rate for Priority Mail using the U.S. Postal Service. After events requiring clearance to be achieved, EPA assumes renovation firms will send reports via overnight mail; EPA estimates the overnight shipping cost to be $15.68.

EPA assumes that renovation firms working in residential housing will have certified dust sampling technicians on staff to perform the dust sampling and report preparation activities. Entities performing work in public and commercial building child-occupied facilities are expected to hire third-party lead evaluation firms to perform dust sampling. Therefore, these entities will incur labor costs associated with sending the dust sampling report to building owners and operators, whereas the cost of hiring a third-party firm is accounted for as a material cost.

Because the written report labor time, shipping labor time, and paper copy and shipping material costs of clearance events are all dependent upon the expected number of clearance failures, per-event paperwork burden estimates must be calculated separately for each size and type of event, as described in the cost analysis in Chapter 4. Table 6-2 presents the average per-entity burden and the total labor burden on firms to comply with the proposed Clearance Rule. Table 6-3 presents the average labor, material, and total per-entity costs.

Table 6-2: Total Paperwork Burden

	Year 1	Year 2	Year 3
Average Burden Hours per Response			
Residential Contractors	1.80	1.80	1.80
Public and Commercial Building Operators [a]	0.08	0.08	0.08
Non-Residential Contractors [b]	0.08	0.08	0.08
All Firms	1.80	1.80	1.80
Total Burden Hours			
Residential Contractors	2,878,970	2,867,166	2,855,411
Public and Commercial Building Operators [a]	57	57	57
Non-Residential Contractors [b]	37	37	37
Total - All Events	**2,879,064**	**2,867,260**	**2,855,505**

a. RRP is performed by the owner of a public or commercial building where a COF is located.
b. RRP is performed by a contractor in a public or commercial building where a COF is located.

Table 6-3: Average Paperwork Cost Per Entity			
	Year 1	**Year 2**	**Year 3**
Average Labor Cost per Entity			
Residential Contractors	$449.17	$449.17	$449.17
Public and Commercial Building Operators [a]	$2.91	$2.91	$2.91
Non-Residential Contractors [b]	$2.91	$2.91	$2.91
All Firms	$446.92	$446.92	$446.92
Average Material Cost per Entity			
Residential Contractors	$674.30	$674.30	$674.30
Public and Commercial Building Operators [a]	$493.35	$493.35	$493.35
Non-Residential Contractors [b]	$480.27	$480.27	$480.27
All Firms	$673.36	$673.36	$673.36
Total Cost per Entity			
Residential Contractors	$1,123.47	$1,123.47	$1,123.47
Public and Commercial Building Operators [a]	$496.26	$496.26	$496.26
Non-Residential Contractors [b]	$483.18	$483.18	$483.18
Total - All Firms	**$1,120.28**	**$1,120.28**	**$1,120.28**

a. RRP is performed by the owner of a public or commercial building COF.
b. RRP is performed by a contractor in a public or commercial building COF.

6.1.1.3 Total Paperwork Costs for RRP Establishments

The proposed LRRP Clearance Rule would apply to establishments affected by the 2008 LRRP rule and to establishments predicted to seek certification as a result of the proposed elimination of the opt-out provision. Under the proposed option, the entire stock of construction firms working in target housing necessary to meet demand would incur dust wipe testing and clearance costs starting in the first year. Other entities doing RRP in public and commercial building COFs, such as public schools, private schools, daycare centers, non-residential property managers and lessors, and non-residential contractors would also be affected by the proposed LRRP Clearance Rule. Given the relative infrequency of dust wipe testing and clearance events in public and commercial buildings, entities working in public and commercial building COFs are not expected to perform more than one activity requiring dust wipe testing or clearance per year. Therefore, the number of affected entities is estimated as the number of buildings with a renovation event requiring dust wipe testing or clearance in the first year.

Per-establishment paperwork costs and per-establishment paperwork burdens (defined as the total number of hours spent complying with paperwork requirements associated with the proposed rule) were estimated by dividing the total costs and burden by the number of certified entities expected to be affected by the proposed LRRP Clearance Rule. Table 6-4 through Table 6-6 present these final per-entity values separately for residential construction firms, non-residential contractors, and entities performing RRP in public and commercial building COFs.

Table 6-4: Residential Contractor Per-Establishment Paperwork Costs, by Year						
Total Paperwork Costs[a]	**Total Paperwork Burden (hours)**	**Number of Certified Residential RRP Firms[b]**	**Per-Estab. Paperwork Burden (hours)**	**Per-Estab. Labor Cost**	**Per-Estab. Material Cost**	**Per-Estab. Total Paperwork Cost**
Year 1						
$251,456,179	2,878,970	223,821	13	$449	$674	$1,123
Year 2						
$250,424,833	2,867,166	222,903	13	$449	$674	$1,123
Year 3						
$249,397,982	2,855,411	221,989	13	$449	$674	$1,123

Table 6-5: Public and Commercial Building COF Operator Per-Entity Paperwork Costs, by Year						
Total Paperwork Costs	**Total Paperwork Burden (hours)**	**Number of Certified Entities**	**Per-Estab. Paperwork Burden (hours)**	**Per-Estab. Labor Cost**	**Per-Estab. Material Cost**	**Per-Estab. Total Paperwork Cost**
Year 1						
$340,434	57	686	0.08	$3	$493	$496
Year 2						
$339,039	57	683	0.08	$3	$493	$496
Year 3						
$337,649	57	680	0.08	$3	$493	$496

Table 6-6: Non-Residential Contractor Per-Establishment Paperwork Costs, by Year						
Total Paperwork Costs	**Total Paperwork Burden (hours)**	**Number of Certified Entities**	**Per-Estab. Paperwork Burden (hours)**	**Per-Estab. Labor Cost**	**Per-Estab. Material Cost**	**Per-Estab. Total Paperwork Cost**
Year 1						
$216,465	37	448	0.08	$3	$480	$483
Year 2						
$215,577	37	446	0.08	$3	$480	$483
Year 3						
$214,693	37	444	0.08	$3	$480	$483

6.1.2 Training Provider Paperwork Burden and Costs

EPA has also estimated the information collection burden imposed on training providers. Additional training providers are estimated to become accredited as a result of the LRRP Clearance Rule; therefore, there will be incremental paperwork burden for accreditation and re-accreditation. Further, since the proposed LRRP Clearance Rule implies an increase in dust sampling 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 Course Accreditation

It is assumed that 168 training providers, the approximate number accredited to provide lead abatement training, will be accredited to provide dust sampling technician training. As described in Section 2.9.1 of the Economic Analysis for the Final Rule, 94 percent of firms in the Other Technical and Trade Schools industry category are small businesses (EPA 2008). Therefore, it is assumed that 94 percent of the 168 training providers, or 158, are small. It is assumed that Training Providers will spend eight hours[1] familiarizing themselves with the rule and determining the rule's applicability to their services in the year that they receive initial accreditation. Training providers will spend an additional four hours of professional time and two hours of clerical time completing the accreditation statement in the year they receive initial accreditation, and every three years thereafter for re-accreditation. They will spend one additional hour of clerical time each year on annual recordkeeping associated with accreditation.

Table 6-7 presents the estimation of training provider burden for accreditation. In year 1, it is assumed that 168 training providers will seek initial accreditation. For each year thereafter, one quarter of the necessary stock of training providers will seek accreditation. Based on EPA's Federal Lead-Based Paint Program (FLPP) database, fifty-five percent of that quarter will seek initial accreditation, and the remainder will seek re-accreditation. In addition, the necessary stock of training providers will diminish by 0.41 percent, annually, to reflect the estimated housing demolition rate.

[1] Time assumptions are based on information provided in EPA's (2005) *Supporting Statement for OMB Review under The Paperwork Reduction Act: TSCA Sections 402/404 Training, Certification, Accreditation and Standards for Lead-Based Paint Activities. (EPA ICR No. 1715.09, OMB Control No:2070-0155).*

Table 6-7: Training Providers: Accreditation Burden Estimates			
Number of Training Providers			
	Year 1	**Year 2**	**Year 3**
Receiving Initial Accreditation	168	23	23
Receiving Re-Accreditation	0	19	19
Already Accredited	0	125	124
Total	168	167	166
Accreditation/Re-Accreditation Burden- Hours per Training Provider			
	Accreditation Year	**Re-Accreditation Year**	**Other Years**
Rule Familiarization	8	0	0
Accreditation Statement	4	4	0
Clerical Time- Statement	2	2	0
Clerical Time- Recordkeeping	1	1	1
Total	15	7	1
Total Accreditation Burden- Hours			
	Year 1	**Year 2**	**Year 3**
Rule Familiarization	1,344	184	184
Accreditation Statement	672	168	168
Clerical Time- Statement	336	84	84
Clerical Time- Recordkeeping	168	167	166
Total	**2,520**	**603**	**602**
Sources: Economic Analysis for the Final Rule (EPA 2008).			

6.1.2.2 Costs Associated with Course Accreditation

The loaded wage rate for training provider clerical staff is $25.56 per hour. The loaded wage rate for professional training staff is $48.67 per hour. It is assumed that professional staff will familiarize themselves with the rule and will prepare the accreditation statement. Material costs of accreditation include one postage stamp ($0.42), one envelope ($0.02), and two copies ($0.18). Table 6-8 presents the total costs associated with training provider course accreditation.

Table 6-8: Training Providers: Accreditation Cost Estimates			
Number of Training Providers			
	Year 1	**Year 2**	**Year 3**
Receiving Initial Accreditation	168	23	23
Receiving Re-Accreditation	0	19	19
Already Accredited	0	125	124
Total	168	167	166
Accreditation/Re-Accreditation Cost per Training Provider			
	Accreditation Year	**Re-Accreditation Year**	**Other Years**
Rule Familiarization	$389.34	$0.00	$0.00
Accreditation Statement	$194.67	$194.67	$0.00
Clerical Time- Statement	$51.11	$51.11	$0.00
Clerical Time- Recordkeeping	$25.56	$25.56	$25.56
Material Costs	$0.62	$0.62	$0.00
Total Cost	$661.30	$271.96	$25.56
Total Accreditation Cost – 2008 Dollars			
	Year 1	**Year 2**	**Year 3**
Rule Familiarization	$65,409	$8,955	$8,955
Accreditation Statement	$32,705	$8,176	$8,176
	$8,586	$2,147	$2,147
Clerical Time- Recordkeeping	$4,294	$4,269	$4,243
Material Costs	$104	$26	$26
Total	$111,098	$23,572	$23,547
Sources: Economic Analysis for the Final Rule (EPA 2008).			

6.1.2.3 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 proposed 2009 LRRP Clearance Rule would increase the demand for dust wipe testing and clearance services, 223,821 dust sampling technicians are predicted to seek training in the first year and 44,581 in the second year. It is assumed that training providers would offer an extra 53 courses in the first year, or a total of 158 hours, for the added dust sampling technician demand.[2] 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.

Table 6-9 and Table 6-10 present the burden incurred by training providers due to the notification requirements.

[2] This assumes an average class size of 25.

Table 6-9: Training Providers: Notification Burden							
Category	**Events per Training Provider**				**Reporting Hours/Event**	**Recordkeeping Hours/Event**	**Total Hours/Event**
	Year 1	**Year 2**	**Year 3**	**Avg.**			
Pre-notification	53	11	11	25	0.15	0.01	0.16
Re-notification	6	1	1	3	0.15	0.01	0.16
Post-notification	53	11	11	25	1.54	0.01	1.55
Digital Photo	53	11	11	25	1.25	0.00	1.25
Annual Total	**165**	**34**	**34**	**78**			
Note(s): Numbers may not calculate due to rounding.							

Table 6-10: Training Providers: Notification Burden Estimates			
	Year 1	**Year 2**	**Year 3**
Burden per Training Provider	158	33	33
Number of Training Providers	168	167	166
Total Burden Hours	**26,527**	**5,473**	**5,440**
Note(s): Numbers may not calculate due to rounding.			

6.1.2.4 Costs Associated with Notification Requirements

Clerical staff will prepare and mail notifications and will perform recordkeeping activities. The loaded wage rate for training provider clerical staff is $25.56 per hour. Training provider notification costs also include $0.42 per postage stamp and $0.02 per envelope for mailing notifications and $0.09 per one page copy of each notification for the firm's records. Training providers are also required to take a digital photo of each dust sampling technician receiving certification. The use of a one-time digital camera costs $20.58 per 25 photos[3] and takes approximately three minutes per photo or 1.25 hours per 25 photos.

Table 6-11 and Table 6-12 present the costs incurred by training providers due to the notification requirements.

Table 6-11: Training Providers: Notification Cost per Event								
Category	**Events per Training Provider**				**Reporting Cost/Event**	**Recordkeeping Cost/Event**	**Materials Cost/Event**	**Total Cost/Event**
	Year 1	**Year 2**	**Year 3**	**Avg.**				
Pre-notification	53	11	11	25	$3.83	$0.26	$0.53	$4.62
Re-notification	6	1	1	3	$3.83	$0.26	$0.53	$4.62
Post-notification	53	11	11	25	$39.36	$0.26	$0.53	$40.14
Digital Photo	53	11	11	25	$31.94	$0.00	$19.91	$52.00
Annual Total	53	11	11	25	$3.83	$0.26	$0.53	$4.62
Note(s): Numbers may not calculate due to rounding.								

[3] The analysis assumes a total cost of $2.00 per photo; adjusted for inflation, this equates to a material cost of $19.91 for 25 photos.

Table 6-12: Training Providers: Notification Cost Estimates			
	Year 1	**Year 2**	**Year 3**
Burden per Training Provider	$5,158	$1,070	$1,070
Number of Training Providers	168	167	166
Total Burden Hours	**$866,487**	**$178,767**	**$177,696**
Note(s): Numbers may not calculate due to rounding.			

6.1.2.5 Total Paperwork Costs for Training Providers

As shown in Table 6-13, the incremental cost to training providers in the first year is approximately $1.0 million. Costs to training providers would be approximately $0.2 million in years 2 and 3.

Table 6-13: Total Cost Incurred by Training Providers			
	Year 1	**Year 2**	**Year 3**
Accreditation Cost	$111,098	$23,572	$23,547
Notification Cost	$866,487	$178,767	$177,696
Total Cost	**$977,586**	**$202,339**	**$201,243**
Note(s): Numbers may not calculate due to rounding.			

6.1.3 Agency Burden and Cost

There are also government costs to administer the program. States, Tribes, and Territories are allowed, but are under no obligation, to apply for and receive authorization to administer these requirements. EPA will directly administer programs for States, Tribes, and Territories that do not become authorized. Because the number of States, Tribes, and Territories that will become authorized is not known, administrative costs are estimated assuming that EPA will administer the program everywhere. To the extent that other government entities become authorized, EPA's administrative costs will be lower. States, Tribes, and Territories that choose to implement the rule themselves are expected to incur similar costs on a per-unit basis.

EPA will incur costs to process training provider accreditations and notifications for dust sampling technician training. To reduce the burden on the regulated community, EPA does not require formal certification for dust sampling technicians (this cost is implicit in the fee charged to renovation firms). However, EPA will incur incremental costs of contractor support and database maintenance as a result of the increase in dust sampling technician certification.

For the purpose of estimating costs, it is assumed that EPA Regions will incur variable processing costs, and fixed administrative and enforcement costs. Regional administrative activities include answering phone inquires from the public regarding the LRRP program, following up on the status of applications, providing information to other regions, coordinating with headquarters, and performing other customer service activities. Enforcement activities include conducting audits of training providers and firms. In addition, it is assumed that EPA Headquarters will incur fixed administrative costs related to coordination with regions and maintenance of the central database and registry. EPA Headquarters will also support enforcement activities.

Accreditation cost estimates are based on responses from a Time-Motion Study conducted in support of the 2009 Economic Analysis for the TSCA section 402 Lead-Based Paint Program Accreditation and Certification Fee Rule (i.e., the Fee Rule). In the Time-Motion Study, data were collected from three EPA Regions: Region 2, Region 4, and Region 9. Regions were asked to provide the number of hours and personnel required to process applications under the TSCA section 402(a) Lead-Based Paint

Activities program (i.e., the Abatement Rule). While TSCA section 402(a) defines training and certification requirements for five different categories of lead abatement professionals, the type of administrative activities associated with the TSCA section 402(a) rule are similar to those expected for the Renovation, Repair and Painting Rule. See the 2009 Fee Rule for an in-depth explanation of fee structure methodology and calculations.

6.1.3.1 Agency Costs of Accrediting Training Providers

To estimate cost of processing accreditation applications for the LRRP rule, EPA followed the approach used to estimate these costs for the Abatement rule. To estimate these costs, EPA first considered the variable and fixed costs associated with each applicant type. The variable costs reflect the regional processing costs for each application type. The fixed costs include the regional and headquarters administrative and enforcement costs, which apply across all the applications. EPA divided the total regional enforcement and administrative costs and the headquarters costs by the total estimated number of applicants over the five year projection period for the 2008 LRRP Rule.

Table 6-14 presents the Agency cost per training provider developed in the Economic Analysis for the Fees Rule.

Table 6-14: Fee Schedule for Accrediting Training Providers

	Calculated Fee	Actual Fee
Estimated Initial Accreditation	$558	$560
Estimated Re-Accreditation	$398	$400

Sources: The Economic Analysis for the TSCA section 402 Lead-Based Paint Program Accreditation and Certification Fee Rule (EPA 2009)

As described above, it is estimated that 168 training providers would become accredited in Year 1. In Year 2, 42 training providers are expected to seek accreditation or re-accreditation, and in Year 3, 42 training providers are expected to be accredited or re-accredited. As shown in Table 6-15, based on these estimates, it will cost EPA less than $0.1 million to process dust sampling technician notifications in Year 1. EPA's costs for notification processing are estimated to approximately $20,500 in Years 2 and 3.

Table 6-15: Total EPA Costs of Training Provider Accreditations

	Year 1	Year 2	Year 3
Initial Accreditation	168	23	23
Re-Accreditation	0	19	19
Total Cost of Accreditation	$94,080	$20,480	$20,480

Note(s): Numbers may not calculate due to rounding.
Sources: Analysis for Clearance Proposed Rule (EPA 2010); *The Economic Analysis for the TSCA section 402 Lead-Based Paint Program Accreditation and Certification Fee Rule* (EPA 2009)

6.1.3.2 Agency Cost of Processing Training Notifications

EPA will incur the cost of processing notifications submitted by training providers prior to and following each course session. It is assumed that EPA technical staff with a fully loaded hourly wage of $36.91[4] will spend an average of two minutes processing each notification.

It is estimated that there will be 18,876 training notifications in Year 1, 3,894 in Year 2, and 3,871 in Year 3. As shown in Table 6-16 it will cost EPA $23,226 to process training notifications in the first year of the rule, $4,792 in Year 2, and $4,763 in Year 3.

Table 6-16: Total EPA Cost of Training Notifications – 2008 Dollars

	Year 1	Year 2	Year 3
Process Training Notification	$23,226	$4,792	$4,763

Note(s): Numbers may not calculate due to rounding.
Sources: Economic Analysis for the Clearance Proposed Rule (EPA 2010); U.S. Office of Personnel Management: 2008 General Schedule - Base Annual (OPM 2008).

6.1.3.3 Agency Costs of Certifying Dust Sampling Technicians

Under the 2008 LRRP Rule, dust sampling technicians are not required to apply to EPA for formal certification. However, EPA Headquarters will incur administrative costs related to contract support and maintenance of the central database and registry. EPA estimates the contractor support cost to be $5 per dust sampling technician notification. Central database maintenance, which is a fixed cost, is spread across all dust sampling technicians.

To estimate the costs of processing notifications for the LRRP rule, EPA followed the approach used to estimate the costs of processing notifications for the Abatement rule. To estimate these costs EPA considered both the variable and fixed costs associated with each applicant type. The variable costs reflect the regional processing costs for each application type. The fixed costs include the regional and headquarters administrative and enforcement costs, which apply across all the applications. EPA divided the total regional enforcement and administrative costs and the headquarters costs by the total estimated number of applicants over the five year period that the training is valid.

Fixed costs for sampling technicians were estimated by dividing the headquarters administrative costs by the total number of applicants over the five year period that the training is valid to obtain an estimated cost of $6[5]. As sampling technicians are not required to obtain formal certification, their costs are recouped by the fee charged to RRP firms. See the 2009 Fee Rule for an in-depth explanation of fee structure methodology and calculations. Table 6-17 presents the Agency cost per dust sampling technician developed in the Economic Analysis for the Fees Rule.

[4] EPA used the Office of Personnel Management's General Salary Table 2008-GS to estimate government employee wage rates. EPA used the wage for a GS-11, Step 1 employee and loaded the wage using the standard government multiplier of 1.6 to cover overhead and fringe benefits.

[5] See *Economic Analysis for the TSCA Section 402 Lead-Based Paint Program Accreditation and Certification Fee Rule* (EPA, 2009).

Table 6-17: EPA Costs for Processing Dust Sampling Technician Notifications	
	Total Cost
Estimated Cost Per Initial Training	$6
Estimated Cost Per Refresher Training	$6

Sources: The Economic Analysis for the TSCA section 402 Lead-Based Paint Program Accreditation and Certification Fee Rule (EPA 2009)

It is estimated that 223,821 dust sampling technicians would become certified in Year 1. In Year 2, 44,581 technicians are expected to seek certification or re-certification, and in Year 3, 44,398 technicians are expected to be certified or re-certified. As shown in Table 6-18, based on these estimates, it will cost EPA $1.3 million to process dust sampling technician notifications in Year 1. EPA's costs for notification processing are estimated to be less than $0.3 million in Years 2 and 3.

Table 6-18: Total EPA Costs of Dust Sampling Technician Notifications			
	Year 1	**Year 2**	**Year 3**
Number of Dust Sampling Technicians	223,821	44,581	44,398
Total Cost	$1,342,926	$267,486	$266,388

Note(s): Numbers may not calculate due to rounding.

Sources: Analysis for Clearance Proposed Rule (EPA 2010); The Economic Analysis for the TSCA section 402 Lead-Based Paint Program Accreditation and Certification Fee Rule (EPA 2009)

6.1.4 Total Paperwork Burden and Costs for RRP Firms and Training Providers

Table 6-19 presents the estimated total paperwork burden and costs incurred by all RRP firms and training providers in each of the first three years of the proposed revisions' implementation. The Agency estimated that approximately 224,200 entities would be affected by the proposed LRRP Clearance Rule annually. EPA estimated the total annualized burden of the information collection activities due to the proposed rule at 2.9 million hours.

For training providers, total notification and accreditation burden was estimated by multiplying the per-entity burden estimates in Table 6-8 and Table 6-9 by the number of training providers in each year. For entities performing RRP in target housing and public and commercial building COFs, total reporting burden was estimated by multiplying the per-establishment burden estimates by the number of establishments affected in each year. For the rule requirements, a total event paperwork burden was first estimated by multiplying the number of events discussed in Chapter 4 by the total hours spent per-event complying with the paperwork requirements of the proposed Clearance Rule in each year. Next, the total event paperwork burden was divided by the estimated number of certified RRP establishments in year 1 to produce burden hours per entity. Finally, the estimate for the burden hours per entity in year 1 was multiplied by the total number of entities in years 2 and 3, yielding the total paperwork burden. A similar methodology was used to calculate total paperwork costs.

Table 6-19: Total Paperwork Burden and Costs Incurred by Training Providers and RRP Firms			
	Year 1	**Year 2**	**Year 3**
Total Burden Hours			
Training Provider Accreditation	2,520	603	602
Training Provider Notifications	26,517	5,473	5,440
RRP Firms	2,879,064	2,867,260	2,855,505
Total	**2,908,101**	**2,873,336**	**2,861,547**
Total Paperwork Cost			
Training Provider Accreditation	$111,098	$23,572	$23,547
Training Provider Notifications	$866,208	$178,767	$177,696
RRP Firms	$252,012,587	$250,978,569	$249,949,032
Total	**$252,989,894**	**$251,180,908**	**$250,150,274**
Note(s): Numbers may not calculate due to rounding.			

Table 6-20 presents the total paperwork costs estimated to be incurred by EPA under the proposed LRRP Clearance Rule.

Table 6-20: Total EPA Costs			
	Year 1	**Year 2**	**Year 3**
Training Provider Accreditation	$94,080	$20,480	$20,480
Training Provider Notifications	$23,226	$4,792	$4,763
Dust Sampling Technician Notifications	$1,342,926	$267,486	$266,388
Total	**$1,460,232**	**$292,758**	**$291,631**
Note(s): Numbers may not calculate due to rounding.			

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 proposed LRRP Clearance Rule on small entities in the affected construction, real estate, and child-occupied facility industry sectors. The proposed LRRP Clearance Rule requires dust wipe testing or clearance after certain renovation activities where the

quantity and characteristics of the dust make sufficient cleaning difficult. It is predicted that this proposed rule would result in additional individuals seeking dust sampling technician training. It also would result in additional dust sampling, re-cleaning, lab, and paperwork costs incurred by firms frequently performing these types of high-dust-generating renovation activities.

Therefore, the proposed LRRP Clearance Rule affects many of the same small entities affected by the 2008 LRRP rule: 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 rent target housing or 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 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.

Table 6-21 lists the eight NAICS codes of the general and specialty contractors this rule will likely impact. Their respective SBA thresholds are also listed. Table 6-21 also lists 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. Note that this analysis excludes the following construction sectors expected to be affected by the 2008 LRRP rule but not the proposed LRRP Clearance Rule: (1) siding contractors, (2) other building equipment contractors, (3) other building finishing contractors, and (4) glass and glazing contractors. These contractors do not typically perform the types of renovations covered by the proposed rule.

Table 6-21: 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
238350	Finish carpentry contractors	$14
238340	Tile and terrazzo contractors	$14
238220	Plumbing and HVAC 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 6-22: Small Entity Classifications			
Type of Entity	**Business**	**Non-Profit**	**Governmental**
Construction-Related Contractors	X	--	--
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	--	--

6.2.2 General Assumptions and Approach

This analysis measures the potential incremental impacts of the proposed LRRP Clearance Rule on small businesses in terms of annual compliance costs as a percentage of annual revenues, referred to as the cost

impact ratio.[6] 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 seven different groups of entities: public school districts, private schools, daycare centers, 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 proposed LRRP Clearance 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 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 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

To estimate the costs incurred by the small entities subject to the requirements of the rule, this analysis calculates the number of dust sampling technicians trained and number of dust wipe testing or clearance events performed by each of the small entities in a typical year. The renovation events using a heat gun for paint removal, removing or replacing window or door frames, removing paint through scraping, or removing trim or molding will only require dust wipe testing. Clearance (which includes dust wipe testing) is only necessary for events using machines that disturb lead-based paint through high-speed operation or events involving demolition or removal of plaster through destructive means. Therefore, the following analysis presents incremental costs for these events under the proposed LRRP Clearance Rule.

Average Annualized Unit Cost Estimates

Unit training costs were calculated by annualizing the total 50-year costs of training dust sampling technicians performing RRP projects in target housing or public or commercial building COFs, then

[6] For private schools, where adequate revenue data were not available, costs are compared to annual expenditures.

dividing this total by the average annual number of dust sampling technicians trained by these establishments. Similarly, the annualized total costs of complying with dust wipe testing and clearance provisions were divided by the average annual number of events. This single set of average annualized unit costs was used to calculate total costs to small entities working in target housing and public and commercial building COFs. 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 6-23 presents these calculations and the resulting average annualized unit costs. Because the different types of COF operators generally perform renovations with very different job sizes, per-event unit costs were calculated separately for each group doing RRP in public and commercial building COFs.

Table 6-23: Average Annualized Unit Cost Calculations under the Proposed LRRP Clearance Rule

Unit Cost	Total Annualized 50-Year Cost[a]	50-year Average Number of Individuals Trained or Events Performed	Average cost per individual or event[b]
Dust Sampling Technician Training	$29,563,881	202,745 individuals trained	$146
Target Housing Event	$241,830,056	1,445,580 events performed	$167
Non-Residential Contractor Event	$244,690	406 events performed	$603
Non-Residential Lessor and Property Manager Event	$74,336	152 events performed	$490
Non-Profit Daycare Center In-House Event	$64,776	132 events performed	$490
Private School In-House Event	$63,586	81 events performed	$789
Public School In-House Event	$196,762	257 events performed	$766

a. These costs were estimated using a 3% discount rate.
b. Averages may not equal numbers calculated from the totals in the table because they are calculated from totals before rounding.

6.2.3 Residential Contractors

Establishments that perform RRP work in target housing will incur the costs of training, as well as the per-event costs of dust wipe testing or clearance following certain renovation activities. 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 the eight residential contractor NAICS groups, EPA calculated the average annualized numbers of trained dust sampling technicians for small entities and the number of proposed LRRP Clearance Rule events being performed by small 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 entities affected by the proposed LRRP Clearance Rule. 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 residential contractor industries. To estimate the impacts of the proposed rule on small 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. Non-employer 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 personnel by the establishment employment size.

Step 4: An average cost per event, and the training cost per dust sampling technician were calculated using the total annualized 50-year costs to entities working in target housing, the 50-year average number of renovation events requiring dust wipe testing or clearance, and the 50-year average number of dust sampling technicians obtaining training.

Step 5: For small entities performing regulated activities, total establishment compliance costs were calculated by multiplying the number of events performed and the number of technicians trained by the corresponding average annualized costs.

Step 6: Cost-impact ratios were calculated for a typical small establishment in each industry sector by dividing the average compliance costs incurred by each 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 Proposed LRRP Clearance Rule

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 construction industry sector 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 seven 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.[7] 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.

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 eight 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 6-24 shows the 50-year average number of small businesses affected by the proposed rule. 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).

Table 6-24: 50-Year Average Number of Small Residential Contractors Affected

Non-Employer Establishments [a]	150,522
Employer Establishments	51,715
Total Small Establishments	**202,237**

a. Also referred to as "self-employed" individuals.
Source: EPA Calculations

[7] 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.

6.2.3.2 Training Costs – Small Residential Contractors

Number of 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 expected to obtain certification is presented in Table 6-25. Each of these establishments is assumed to seek dust sampling technician training for one employee.

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 dust sampling technicians and workers in each sector to calculate the number of trained dust sampling technicians and workers employed by small certified establishments. For each of the construction and real estate industry sectors, the total number of employees (including non-employers) was divided by the total number of small establishments to calculate an average small business employment size.

Table 6-25 presents the 50-year average number of small certified employer firms, each of which is assumed to employ one trained dust sampling technician. Only entities that would use their own dust sampling technician for compliance with the proposed LRRP Clearance Rule would incur additional training costs. As described in Chapter 4, it was found to be cost-effective for all residential non-employer and employer construction firms to train their own dust sampling technician rather than use third party dust wipe testing services. It was also shown that none of these establishments are expected to perform enough dust wipe testing or clearance events annually to justify training more than one dust sampling technician.

Table 6-25: 50-Year Average Number of Dust Sampling Technicians Trained by Small Employer Establishments

NAICS	Description	Annualized Number of Trained Dust Sampling Technicians, Small Establishments[a]
236118	Residential remodelers	20,408
238350	Finish carpentry contractors	7,717
238340	Tile and terrazzo contractors	1,101
238220	Plumbing and HVAC contractors	10,214
238320	Painting and wall covering contractors	4,288
238210	Electrical contractors	6,221
238310	Drywall and insulation contractors	1,766
Total, Small Employer Establishments		**51,715**

a. Since employer construction establishments are assumed to have need for one trained dust sampling technician, the total number of trained employees working for small construction establishments is simply the sum of the number of certified small employers.

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 6-26 presents the 50-year average number of dust sampling technicians trained for non-employer residential contractor establishments. Since non-employer establishments consist of single individuals, each self-employed individual must obtain dust sampling technician training.

Table 6-26: 50-Year Average Number of Dust Sampling Technicians Trained by Small Non-Employer Construction Establishments		
NAICS	**Description**	**Annualized Number of Trained Dust Sampling Technicians, Small Establishments[a]**
236118	Residential remodelers	48,020
238350	Finish carpentry contractors	40,873
238340	Tile and terrazzo contractors	5,839
238220	Plumbing and HVAC contractors	13,137
238320	Painting and wall covering contractors	22,683
238210	Electrical contractors	10,382
238310	Drywall and insulation contractors	9,589
Total, Non-Employer Establishments		**150,522**

a. Since non-employer construction establishments are assumed to have need for one trained dust sampling technician, the total number of trained employees working for small construction establishments is simply the sum of the number of certified self-employed contractors.

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.

Total Training Costs to Small Residential Contractors

To estimate small residential contractor training costs, the numbers of individuals in Table 6-25 and Table 6-26 were multiplied by the average annualized costs of training a single certified dust sampling technician from Table 6-23. The resulting average annualized training costs are presented in Table 6-27.

Table 6-27: Average Annualized Training Costs for Small Residential Contractors			
Regulatory Option	**Annualized Number of Trained Dust Sampling Technicians**	**Total Certified Technician Training Cost[a]**	**Average Training Cost Per Establishment**
Proposed rule	202,237	$29,489,816	$146
a. A 3 percent discount rate is used for estimating total costs.			

6.2.3.3 Dust Wipe Testing and Clearance Costs – Small Residential Contractors

Number of Events Performed Annually by Small Residential Contractors

As discussed in Section 6.2.2 and the beginning of this section, this analysis attributes the dust wipe testing and clearance costs of the proposed 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. If a certain industry performs fewer events than estimated here, the impacts on these establishments will be slightly smaller and the impacts on the other construction industries will be slightly larger.

The number of events per small establishment in a particular industry was calculated as follows:

Number of Events = (Events/Employee) X (Average Establishment Employment Size)

EPA estimated the 50-year average number of events per employee by calculating the ratio of the total number of regulated events to the total number of construction workers (using the 50-year averages). Because the number of establishments, 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.

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 individual.

Table 6-28 presents the 50-year average estimated number of events per small establishment.

Table 6-28: 50-Year Average Annual Number of Events performed by Small Residential Contractors for the Proposed LRRP Clearance Rule

Regulatory Option	Average Small Employment Size	Average Number of Annual Events Per Employee	Total Annual Number of Events Per Small Establishment
Proposed rule	1.8	3.4	6.1

Total Clearance Rule Costs – Residential Contractors

Table 6-23 presents the annualized average per-event costs of the proposed rule. For affected entities, these costs include the cost of performing dust wipe testing following certain renovation activities and complying with the re-cleaning and clearance requirements for another set of renovation practices. Multiplying the average event cost per small establishment by the total 50-year average number of small entities (see Section 6.2.3.1) yields the total incremental dust wipe testing and clearance costs of the proposed LRRP Clearance Rule. These costs are presented in Table 6-29.

Table 6-29: Average Annualized Dust Wipe Testing and Clearance Costs for Small Residential Contractors

Regulatory Option	Avg. Number of Events per Small Estab.	Annualized Average Per-Event Cost[b]	50-year Avg. Number of Small Estab.	Total Event Costs [a]	Avg. Event Costs per Small Estab.
Proposed	6.1	$167	202,237	$206,429,441	$1,021

a. Total costs are calculated using unrounded unit costs; a 3 percent discount rate is used.
b. Includes the cost of performing dust wipe testing for a subset of renovation events and dust sampling, re-cleaning, and clearance for a separate subset of renovation events.

6.2.3.4 Residential Contractors

Cost-impact ratio analysis compares the cost of a regulation to an 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 2008 dollars using the Consumer Price Index.[8] Per-establishment revenues for non-employers were estimated for the cost impact ratio analysis by dividing non-employer revenues (inflated to 2008 dollars) by the number of non-employer establishments in each industry. Average revenues of certified small establishments are presented in Table 6-30. 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 employer revenues (calculated by dividing the revenues of establishments in each industry and revenue bracket by the corresponding number of establishments) were inflated to 2008 dollars using the Consumer Price Index. The resulting estimates are presented in Table 6-30.

Table 6-30: Average Revenues of Small Businesses Affected by the Proposed Clearance Rule

NAICS	Industry Description	Small Business Revenues (2008$)
236118	Residential remodelers	$201,669
238350	Finish carpentry contractors	$111,032
238340	Tile and terrazzo contractors	$143,466
238220	Plumbing and HVAC contractors	$476,976
238320	Painting and wall covering contractors	$95,731
238210	Electrical contractors	$387,707
238310	Drywall and insulation contractors	$265,127
Total	**Average, Construction Establishments**	**$214,391**

Weighted average of employer and non-employer revenues.
Source: 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

Impacts of the rule on small residential contractors were measured by comparing the costs of the rule incurred by an establishment to the establishment's revenues. The impacts on small residential contractor

[8] Annual values from the CPI-U series (All items, US city average, Series Id: CUUR0000SA0) were used to inflate dollar values to 2008 dollars.

establishments were estimated by first taking the sum of the total annualized event and training costs incurred by these entities 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 6-31.

Table 6-31: Cost-to-Revenue Ratios for Small Residential Contractors

Regulatory Option	Total Affected Small Entities	Total Cost of Rule to Small Entities, Annualized[a]	Average Cost of Rule per Small Entity	Estimated Average Small Entity Revenues	Cost-to-Revenue Ratio
Proposed rule	202,237	$235,919,257	$1,167	$214,391	0.544%

a. A 3 percent discount rate is used.

Table 6-32 presents the impacts of the rule on small residential contractors, 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 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 6-32: Cost-to-Revenue Ratios: Small Residential Construction Establishments (Proposed Option)

NAICS	Industry Description	Number of Small Entities	Costs[a]	Revenues	Cost-Impact Ratio
Non-Employers					
236118	Residential remodelers	48,020	$34,185,929	$1,811,671,241	1.89%
238350	Finish carpentry contractors	40,873	$29,098,396	$1,373,680,993	2.12%
238340	Tile and terrazzo contractors	5,839	$4,156,563	$246,542,544	1.69%
238220	Plumbing and HVAC contractors	13,137	$9,352,522	$835,804,455	1.12%
238320	Painting and wall covering contractors	22,683	$16,148,118	$630,410,871	2.56%
238210	Electrical contractors	10,382	$7,391,113	$461,069,222	1.60%
238310	Drywall and insulation contractors	9,589	$6,826,244	$966,038,669	0.71%
Total, Small Construction Establishments		**150,522**	**$107,158,886**	**$6,325,217,995**	**1.69%**
Employers					
236118	Residential remodelers	20,408	$30,592,288	$11,988,045,317	0.26%
238350	Finish carpentry contractors	7,717	$15,073,799	$4,021,354,972	0.37%
238340	Tile and terrazzo contractors	1,101	$2,999,533	$749,095,264	0.40%
238220	Plumbing and HVAC contractors	10,214	$35,242,942	$10,302,305,492	0.34%
238320	Painting and wall covering contractors	4,288	$11,192,013	$1,951,464,139	0.57%
238210	Electrical contractors	6,221	$24,619,776	$5,975,872,677	0.41%
238310	Drywall and insulation contractors	1,766	$9,040,021	$2,044,473,203	0.44%
Total, Small Construction Establishments		**51,715**	**$128,760,371**	**$37,032,611,063**	**0.35%**
Employers and Non-Employers Combined					
236118	Residential remodelers	68,428	$64,778,217	$13,799,716,558	0.47%
238350	Finish carpentry contractors	48,590	$44,172,194	$5,395,035,965	0.82%
238340	Tile and terrazzo contractors	6,940	$7,156,096	$995,637,808	0.72%
238220	Plumbing and HVAC contractors	23,352	$44,595,464	$11,138,109,947	0.40%
238320	Painting and wall covering contractors	26,970	$27,340,131	$2,581,875,010	1.06%
238210	Electrical contractors	16,603	$32,010,890	$6,436,941,899	0.50%
238310	Drywall and insulation contractors	11,355	$15,866,265	$3,010,511,872	0.53%
Total, Small Construction Establishments		**202,237**	**$235,919,257**	**$43,357,829,058**	**0.54%**

a. Total costs are calculated using a 3 percent discount rate.

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. Jobs that are not performed in-house by public and private schools, non-residential property managers/lessors, or daycare centers will be performed by general and specialty contractors including painters, electricians, plumbers/HVAC specialists, and non-residential building contractors. Under the proposed rule, 448 establishments are expected to incur dust wipe testing and clearance costs in the first year. 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.

Because renovation events in public or commercial building COFs are generally larger compared to those in target housing, 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 building contractors (NAICS 238320, 238220, 238210 and 236220, respectively). As illustrated in Chapter 4, non-residential contractors will not typically perform enough dust wipe testing or clearance events annually to make it cost-effective for them to train their own dust sampling technician. While non-residential contractors are not expected to incur training costs, they are assumed to incur third party dust wipe testing and clearance costs for the events in public and commercial buildings that they perform.

6.2.4.1 Number of Small Non-Residential Contractors Affected by the Proposed LRRP Clearance Rule

To estimate the number of construction establishments working in public or commercial building COFs, the number of affected jobs they perform, and their average revenues, the following assumptions were made:

- The number of contractors in each sector is proportional to the number of jobs likely to be performed by each type of contractor.
- 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 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 in Table 6-34. Note that because only establishments with employees are assumed to work in public or commercial building COFs, average revenues of small establishments in Table 6-34 are higher than the average revenues of residential construction establishments, which include self-employed contractors.

Table 6-33 presents the distribution of events by COF type, shows the ratio of contractor to in-house events, and presents estimates of the total number of contractor events in the first year. Table 6-34 displays the estimated number and characteristics of small non-residential contractor firms affected by the 2008 LRRP Rule. Although 3,223 non-residential property manager and lessor firms are regulated under the 2008 LRRP Rule, only a fraction of these firms will perform renovation in public and commercial building COFs requiring dust wipe testing or clearance in a given year. It is estimated that an average of 448 non-residential contractors will be affected by the proposed rule in an average year.

[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.

Table 6-33: Estimated Number of First-Year Non-Residential Contractor Events

Type of COF	Total Number of Events	Percent of Events Performed by Non-Residential Contractors	Total Number of Contractor Events
Public Schools			
Kindergarten (Public)	192	20%	39
Pre-K + Kindergarten (Public)	150	18%	28
Daycare Center (In Public School)	10	19%	2
Private Schools			
Kindergarten (Large Private)	27	20%	6
Pre-K + Kindergarten (Large Private)	82	18%	15
Kindergarten (Small Private)	32	100%	32
Pre-K + Kindergarten (Small Private)	41	100%	41
Daycare Center (In Large Private School)	0	19%	0
Daycare Center (In Small Private School)	0	100%	0
Daycare Centers			
Daycare Center (Renter-Occupied)	208	19%	40
Daycare Center (Owner-Occupied)	142	100%	142
Daycare Center (Non-Profit who performs some of own RRP)	181	19%	35
Daycare Center (Non-Profit who uses contractors)	67	100%	67
Total Jobs	**1134**	**39%**	**448**

This analysis assumes that private schools, public schools, and non-profit daycare centers which use in-house staff to perform RRP will perform all window/door carpentry work every year in-house. Non-residential contractor firms will perform all other RRP. Non-residential contractor firms will perform all RRP events in owner-occupied daycare centers, daycare centers that do not perform some of their own RRP, and small private schools.

Table 6-34: 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 Dust Wipe Testing and Clearance Costs – Non-Residential Contractors

Number of Events Performed by Small Establishments – Non-Residential Contractors

On average, 69 percent of the 448 non-residential contractor dust wipe testing or clearance events in the first year are performed by small businesses. Since the number of affected firms is defined to be the number of firms performing a dust wipe testing or clearance event in the first year, the number of jobs performed is equivalent to the number of establishments affected. Table 6-35 presents the total number of small contractor establishments incurring event costs and the number of events in the first year.

Table 6-35: First Year Number of Small Non-Residential Contractor Establishments and Jobs Performed

Regulatory Option	Total, non-residential COF contractor		Small, non-residential COF contractor	
	Establishments	Events	Establishments	Events
Proposed	448	448	281	281

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 6-36.

Table 6-36: 50-Year Average Annual Number of Small Certified Establishments and Jobs Performed

Regulatory Option	Number of Firms with Clearance Rule Costs	Number of Jobs Performed
Proposed rule	281	281

Total Clearance Rule Costs – Non-Residential Contractors

To estimate total event costs incurred by small non-residential construction establishments working in public or commercial building COFs, the 50-Year average annual number of events performed by these establishments (1 per firm) was multiplied by the average annualized per-event cost ($603; see Table 6-23). Table 6-37 presents the resulting annualized total and average costs of the Clearance Rule to small non-residential construction establishments.

Table 6-37: Average Annualized Dust Wipe Testing and Clearance Costs for Small Non-Residential Contractors

Regulatory Option	Average Annual Events Performed	Annualized Avg. Per-Event Cost	Total Event Costs [a]	Average Event Costs per Small Establishment
Proposed rule	281	$603	$169,235	$603

a. Total costs are calculated using unrounded unit costs of third party dust sampling services; a 3 percent discount rate is used.

6.2.4.3 Impacts of the Proposed LRRP Clearance Rule 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 dust wipe testing and clearance costs under the proposed option 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 6-38.

Table 6-38: 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
Proposed rule	281	$169,235	$603	$139,188	0.433%

6.2.5 Non-Residential Property Lessors and Managers

Non-residential property lessors and managers are currently regulated under the 2008 LRRP Rule. Lessors and managers of pre-1978 public or commercial buildings that rent space to daycare centers and perform regulated projects on their own properties will incur dust wipe testing and clearance costs under the proposed LRRP Clearance Rule. The analysis in Chapter 4 demonstrated that non-residential property managers and lessors are not expected to typically perform enough dust wipe testing or clearance events annually to justify obtaining dust sampling technician training for one of their employees. Instead, non-residential real estate firms are assumed to incur only third party dust wipe testing costs for the dust wipe testing events (and third party and re-cleaning costs for the clearance events) in public and commercial buildings that they perform. 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. 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. 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.

6.2.5.1 Number of Non-Residential Property Lessors and Managers Affected by the Proposed LRRP Clearance Rule

Although 12,028 non-residential property manager and lessor firms are regulated under the 2008 LRRP Rule, only a fraction of these firms are operators of daycare center buildings which will undergo renovation requiring dust wipe testing or clearance in a given year. It is estimated that an average of 152 daycare center buildings renting space will be affected by the proposed rule in an average year.

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 non-residential real estate 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 proposed LRRP Clearance Rule 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 in 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 6-39 presents the resulting estimates of the number of small non-residential property lessors and managers affected by the proposed LRRP Clearance Rule in a typical year.

Table 6-39: Average Annual Number of Small Non-Residential Property Lessors and Managers Performing RRP Events Requiring Dust Wipe Testing or Clearance

A. Total number of firms leasing to daycare centers	152
B. Number of firms in NAICS 531120 (73% of A)	111
C. Number of firms in NAICS 531312 (27% of A)	41
D. Number of firms in NAICS 531120 that are small (96% of B)	106
E. Number of firms in NAICS 531312 that are small (81% of C)	33
Total Number of Regulated Small Firms (D+E)	140
Regulated Small Firms as % of All Regulated Firms	**92%**

6.2.5.2 Dust Wipe Testing and Clearance Costs – Non-Residential Property Lessors and Managers

Given the relative infrequency of dust wipe testing and clearance events, each affected property lessor or manager is assumed to perform no more than one event per year. Thus, the estimation of costs incurred by each regulated property lessor or manager establishment is based on the average dust wipe testing/clearance costs per event.

The total number of regulated events was multiplied by the average annualized per-event costs (see Table 6-23) to calculate these firms' total annualized event costs. Table 6-40 presents these estimates, as well as the average rule costs per small firm.

Table 6-40: Dust Wipe Testing and Clearance Costs of Small Non-Residential Property Lessor and Manager Establishments

Regulatory Option	Total In-House Events[a]	Annualized Avg. Costs Per Event	Total Event Costs [b]	Average Clearance Costs per Small Firm
Proposed rule	140	$490	$68,327	$490

a. This number was calculated as the average number of events per firm (1.0) times the number of small non-residential property lessors and managers.
b. Total costs are calculated using unrounded unit costs of third party dust sampling services; a 3 percent discount rate is used.

6.2.5.3 Impacts of the Proposed LRRP Clearance Rule on Non-Residential Property Lessors and Managers

This small entity analysis measures the incremental impacts of the proposed LRRP Clearance 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 2008 dollars using the Consumer Price Index to obtain estimated revenues of $139,118. The impacts on small non-residential property lessors and managers were estimated by first dividing total event costs incurred by these entities 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 6-41.

Table 6-41: 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
Proposed rule	140	$68,327	$490	$139,188	0.352%

6.2.6 Daycare Centers (Small Non-Profits)

6.2.6.1 Number of Small, Non-Profit Daycare Centers Affected by the Proposed LRRP Clearance 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 percent 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 would be affected by the proposed rule in the first year.[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 addressing contractors and landlords.

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.

The number of non-profit daycare centers is estimated as the number of daycare centers located in religious establishments, which are identified in the 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 buildings owned by religious establishments (the US Census reports that about 35 percent of daycare

[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.

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 and training 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 daycare 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 6-42 presents the number of daycare centers performing regulated activities 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 the 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 6-42: 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)
Proposed rule	34,612	14,339	10,481

Although 10,481 non-profit daycare centers are regulated structures under the 2008 LRRP Rule, only a fraction of these buildings will undergo renovation requiring dust wipe testing or clearance in a typical year. It is estimated that an average of 132 non-profit daycare center buildings doing RRP work in-house will be affected by the proposed rule in a typical year.

6.2.6.2 Dust Wipe Testing and Clearance Costs – Non-Profit Daycare Centers

The estimated dust wipe testing and clearance costs incurred by each daycare center are based on the average per-event cost of renovation events requiring dust wipe testing or clearance. The analysis in Chapter 4 demonstrated that daycare centers are not expected to typically perform enough dust wipe testing or clearance events annually to justify obtaining dust sampling technician training for one of their employees. Instead, daycare centers are assumed to incur only third party dust wipe testing and clearance costs for the events that they perform.

Total Clearance Rule 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. Each affected firm is assumed to perform one event per year.

[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.

As discussed in Section 6.2.2, the average annualized cost per event in daycare center buildings is $490 (see Table 6-23). 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 event costs incurred by these centers in an average year. Since centers are assumed to perform no more than one event per year, the annual number of events is equal to the number of centers performing dust wipe testing or clearance in an average year. These average total and per-center costs are presented in Table 6-43.

Table 6-43: 50-Year Average Annualized Dust Wipe Testing and Clearance Costs for Small Non-Profit Daycare Centers

Regulatory Option	Total In-House Events	Annualized Avg. Cost per Event	Total Event Costs[a]	Average DWT and Clearance Costs per Small Center
Proposed rule	132	$490	$64,776	$490

a. Total costs are calculated using unrounded unit costs of third party dust sampling services; a 3 percent discount rate is used.

6.2.6.3 Non-Profit Daycare Center Expenditures

In analyzing impacts of the proposed LRRP Clearance 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 $236 million for its 929 religious daycare facilities or average revenues (inflated to 2008$) of $317,062 (U.S. Bureau of Labor Statistics 2006). This figure was used to measure the incremental impacts of the proposed LRRP Clearance 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 costs incurred by these entities 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 6-44.

Table 6-44: Cost-to-Revenue Ratios for Non-Profit Daycare Centers

Regulatory Option	Total Daycare Centers Affected	Total Cost of Rule to Daycare Centers	Average Cost of Rule per Daycare Center	Estimated Average Daycare Center Revenues	Cost-to-Revenue Ratio
Proposed rule	132	$64,776	$490	$317,062	0.154%

[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.

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.

6.2.7.1 Number of Small Public School Districts Affected by the Proposed LRRP Clearance 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.[14] Thus, small school districts that have at least one pre-1978 building may incur costs under the proposed rule.

Number of Small Public Schools Affected by the Proposed LRRP Clearance Rule

The number of small school districts with at least one building regulated under the 2008 LRRP Rule 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, 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

[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 are contracted out.

[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.

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 6-45 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. 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 6-45: Number of Regulated School Districts and Public School Buildings

	Number of School Districts with at Least 1 Regulated Building [a]	Total Number of Regulated Buildings in these Districts	Average Number of Regulated Buildings per District
Total Districts	7,051	20,541	2.9
Small Districts	6,492	10,552	1.6

a. A regulated building is defined as having a kindergarten or pre-kindergarten program.

Although 10,552 buildings in small public school districts are regulated under the 2008 LRRP Rule, only a fraction of these buildings will undergo renovation requiring dust wipe testing or clearance in a typical year. It is estimated that an average of 257 public school buildings (large and small) will be affected by the proposed rule in a typical year. Based on the number of buildings in small districts relative to the total number of public school buildings, 132 public school buildings in small districts are expected to be affected by the rule in a typical year. Given the relative infrequency of dust wipe testing and clearance events, each affected small public school district is assumed to perform no more than one event per year. Thus, 132 public school districts are expected to be affected by the rule in a typical year.

6.2.7.2 Dust Wipe Testing and Clearance Costs – Public Schools

Since each affected public school district is assumed to perform one event per year, the estimation of costs incurred by each affected district is based on the average costs per event. The analysis in Chapter 4 demonstrated that public schools are not expected to typically perform enough dust wipe testing or clearance events annually to justify obtaining dust sampling technician training for one of their employees. Instead, public schools are assumed to incur only third party dust wipe testing and clearance costs for the events that they perform.

Total Clearance Rule Costs – Public Schools

As discussed in 6.2.2, the average annualized cost per event in public schools is $766 (see Table 6-23). Multiplying this average cost by the average annual number of events in small school districts yields the total annualized event costs incurred by small districts in a typical year. These costs, and resulting average costs per district, are presented in Table 6-46.

Table 6-46: Average Annualized Dust Wipe Testing and Clearance Costs for Public Schools in Small Districts				
Regulatory Option	**Total In-House Events**	**Annualized Avg. Clearance Cost per Event**	**Total Event Costs** [a]	**Average Event Costs per Small District**
Proposed rule	132	$766	$101,077	$766
a. Total costs are calculated using unrounded unit costs of third party dust sampling services; a 3 percent discount rate is used.				

6.2.7.3 Public School Revenues

The impact of the proposed rule on small government jurisdictions is estimated by comparing the estimated incremental costs of the proposed rule 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) calculating the sum of 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 6-47 presents small district revenue calculations and resulting estimates. The total estimated average revenues in column 7 ($15.5 million) are adjusted to 2008 dollars before being used to estimate cost-to-revenue ratios in Section 6.2.7.4.

Table 6-47: Estimated Annual Revenues for Small Public School Districts (2005$)						
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 Proposed LRRP Clearance Rule on Small Public School Districts

Table 6-46 presents the total annualized event 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 shown in Table 6-48, to obtain a cost-to-revenue ratio.

Table 6-48: Cost-to-Revenue Ratios for Small Public School Districts (2008$)

Regulatory Option	Total Affected 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
Proposed rule	132	$101,077	$766	$17,071,289.68	0.004%

6.2.8 Private Schools (Small Non-Profits)

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. 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 dust wipe testing and clearance costs as a result of the proposed 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 and to hire contractors to perform all other regulated RRP activities.

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 6-49 presents the total number of private schools regulated 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 6-49: 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
Proposed rule	10,454	41%	4,280	6,174

Although 6,174 private schools are regulated under the 2008 LRRP Rule, only a fraction of these buildings will undergo renovation requiring dust wipe testing or clearance in a typical year. It is estimated that an average of 81 private school buildings doing RRP work in-house will be affected by the proposed rule in a typical year.

6.2.8.2 Dust Wipe Testing and Clearance Costs – Private Schools

Given the relative infrequency of dust wipe testing and clearance events, each affected private school is assumed to perform one event per year. The analysis in Chapter 4 demonstrated that private schools are not expected to typically perform enough dust wipe testing or clearance events annually to justify obtaining dust sampling technician training for one of their employees. Instead, private schools are assumed to incur only third party dust wipe testing and clearance costs for the events that they perform. Table 6-50 presents the total number of private schools regulated in the first year, the total number of events performed in these schools, and the total annualized costs associated with these events. Total costs are estimated by multiplying the average annual number of events by the average annualized cost per dust sampling or clearance event ($789; see Table 6-23). Average annualized costs per private school are calculated by dividing total rule costs by the number of affected schools.

Table 6-50: Average Dust Wipe Testing and Clearance Costs for Private Schools

Discount Rate	Number of Private Schools w>100 Students	Total Annual Number of In-house Events	Total Annualized Event Costs [a]	Average Annualized Event Costs per School
Proposed rule	81	81	$63,586	$789

a. Total costs are calculated using unrounded unit costs of third party dust sampling services; a 3 percent discount rate is used.

6.2.8.3 Impact of the Proposed LRRP Clearance Rule on 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 $3,727 (2008$) 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 $3,727*283, or $1,054,684.

Impacts on private schools were estimated by dividing the total annualized dust sampling and clearance costs incurred by these schools 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 6-51.

Table 6-51: Cost-to-Expense Ratios for Private Schools

Regulatory Option	Total Affected 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
Proposed rule	81	$63,586	$789	$1,054,684	0.075%

6.2.9 Summary of the Proposed LRRP Clearance Rule Impacts on Small Governments, Non-Profit Organizations, and Small For-Profit Businesses

The vast majority of entities in the industries affected by the proposed rule are small. As a result of the proposed revisions, approximately 203,002 small entities would incur additional costs.

6.2.9.1 Incremental Impacts of the Proposed Rule

The average annualized incremental cost of the proposed rule to a typical small entity is estimated to range from $490 to $1,928 depending on the number of renovation, repair, and painting events undertaken by a small entity in the industry sector involved. As shown in Table 6-52, the incremental cost impact of the proposed LRRP Clearance Rule on small currently regulated entities ranges from about 0.004 percent to 1.059 percent of revenues, depending on the industry sector.

Table 6-52: Typical-Year Number of Small Entities with RRP Events

Description	Entity Type	Number of Small Entities	Cost-Impact Ratio
Public and Commercial Building Child-Occupied Facilities			
Public School Districts	Government	132	0.004%
Private Schools	Non-Profit	81	0.075%
Daycare Centers	Non-Profit	132	0.154%
Non-Residential Landlords	Business	140	0.352%
Non-Residential Contractors (working in public or commercial building COFs)	Business	281	0.433%
Residential Contractors (working in target housing)			
Residential remodelers	Business	68,428	0.469%
Finish carpentry contractors	Business	48,590	0.819%
Tile and terrazzo contractors	Business	6,940	0.719%
Plumbing and HVAC contractors	Business	23,352	0.400%
Painting and wall covering contractors	Business	26,970	1.059%
Electrical contractors	Business	16,603	0.497%
Drywall and insulation contractors	Business	11,355	0.527%
Total		**203,002**	**0.516%**

Table 6-53 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 a total of 203,002 small entities would be affected by the program, including 202,657 small businesses with average impacts of 0.544 percent, 213 small non-profits with average impacts of 0.101 percent, and 132 small governments with average impacts of 0.004 percent.

Table 6-53: Aggregate Small Entity Impacts

	Total Number of Small Entities Affected	Average Impacts, All Small Entities
Small Governments	132	0.004%
Non-Profit Organizations	213	0.101%
Small For-Profit Businesses	202,657	0.544%
Total	**203,002**	**0.516%**

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 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 proposed revisions to the 2008 LRRP rule.

6.3.1 Affected Government Entities

The proposed 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

[16] When the original $100 million UMRA threshold is adjusted for inflation from 1995 to 2008 dollars using an implicit price deflator for gross domestic product, the result is a threshold of $130 million.

[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 discussion is limited to public school districts.

proposed LRRP Clearance Rule will increase the cost of operating these facilities by requiring dust wipe testing or clearance after a subset of their in-house renovation activities. Each school district that uses its own in-house staff to perform covered RRP activities in regulated buildings is required to comply with the Clearance Rule provisions. Since the cost comparison in Chapter 4 indicated that public schools are not likely to choose to obtain training for an in-house dust sampling technician, state and local governments will only incur incremental costs of paying for third party dust wipe testing and clearance services following the affected renovation events.

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 proposed LRRP Clearance Rule will increase the cost of operating this housing by requiring that dust wipe testing and clearance be performed. The increased cost is estimated to be $167 on average per renovation in Target Housing.[18]

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 proposed revisions to the 2008 LRRP rule when public school districts engage in certain RRP activities.[19] Based on available data and the economic analysis presented in Chapter 4 and Section 6.1, it is assumed that all public school districts will perform all painting and window/door carpentry tasks themselves. Public schools are assumed to hire third-party contractors to perform the remainder of their RRP work. Since all public school districts are assumed to use their own staff to perform some of their RRP activities, all public school districts would need to comply with the dust wipe testing and clearance requirements outlined in Chapter 4.[20] Although 7,051 districts and 20,541 buildings were regulated under the 2008 LRRP Rule, the very low expected number of dust wipe testing and clearance events in public and commercial building COFs implies a lower number of affected entities. The number of districts affected by the proposed LRRP Clearance Rule is estimated as the annual average number of buildings performing an in-house RRP event which would require dust wipe testing or clearance. Table 6-54 presents the estimated total annualized incremental costs of the proposed rule that would be incurred by public school districts under the proposed option.

[18] This average cost is calculated as the total target housing event costs in the first year divided by the total number of target housing events in the first year.

[19] As discussed in Chapter 4, states would be able to apply for, and receive authorization to administer these proposed requirements, but would be under no obligation to do so.

[20] It is important to note that this analysis uses a 75 percent compliance rate. See Chapter 4 and the small entity analysis (Section 6.1) for a more comprehensive discussion of these cost estimates.

Table 6-54: Total Annualized Incremental Costs to All Public School Districts

Regulatory Option	Average Annual Number of Districts Affected [a]	Average Annual Number of Buildings Affected [a]	Total Average Annual Number of Events	Average Annualized Cost Per District (2008$)	Total Annualized Cost (2008$) [b]
Proposed option	257	257	257	$766	$196,762

a. In the first year, the proposed LRRP Clearance Rule is expected to affect 283 public school districts and buildings. 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. Total costs are calculated using un-rounded unit costs; a 3 percent discount rate is used.

The cost to revenue ratio for affected school districts is 0.002 percent under the proposed option. These calculations are summarized in Table 6-55.

Table 6-55: Cost-to-Revenue Ratios for Affected Public Schools (2008$)

Regulatory Option	Average Annual Regulated Districts	Total Annualized Cost of Rule to Districts [a]	Average Annualized Cost of Rule per District	Estimated Average District Revenues (mil)	Cost-to-Revenue Ratio
Proposed	257	$196,762	$766	$35.2	0.002%

a. Total costs are calculated using un-rounded unit costs; a 3 percent discount rate is used.

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 dust wipe testing and clearance procedures be followed after certain high-dust-generating renovation activities. Given the low frequency of these events, 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 proposed LRRP Clearance 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 dust wipe testing and clearance procedures must be followed after certain high-dust-generating renovation activities. Given the low frequency of these events, this rule is not expected to have a significant impact on Tribal Governments.

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 proposed revisions to the 2008 LRRP rule is the protection of children's health. Implementing the Clearance Rule provision protects children under the age of six by ensuring that their homes, schools, or daycares, are truly free from lead hazards before a child may re-occupy the space. This analysis summarizes the effects of the regulation on children under the age of six in target housing units and in COFs in public or commercial buildings.

6.6.1 Children Affected by the Proposed Clearance Rule Revision

The 2008 LRRP Rule included all COFs in public and commercial buildings, all rental units, plus all target housing COFs, and all owner-occupied target housing units where a child under the age of 6 or a pregnant woman resides within pre-1987 buildings. A target housing unit where a child visits regularly, but spends fewer that 6 hours a week is not considered a child-occupied facility, and will only be regulated if the opt-out provision is eliminated as has been proposed (providing that there is no child under the age of six or pregnant woman that resides in the unit). Thus, children visiting these housing units may also benefit from the proposed LRRP Clearance Rule through a reduction in potential exposures to lead dust during these visits.

It is expected that the proposed LRRP Clearance Rule will benefit children both located in target housing and public and commercial building COFs. Increasing the awareness of lead hazards through dust wipe testing reports and ensuring elimination of hazards prior to re-occupancy through clearance testing will increase the health outcomes of these groups of children. In the first year of the proposed rule, 1.1 million children are expected to reside or occupy (i.e., receive childcare or attend school in) structures where dust wipe testing or clearance was performed following a renovation that disturbed lead based paint.

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 proposed 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 establishments, when undertaking certain types of renovation activities in regulated facilities, reduce the risk of exposure to lead by using dust wipe testing and clearance practices following cleaning verification to ensure the safety of the work area prior to re-occupancy. 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 proposed revision to the LRRP rule.

The dust wipe sampling, laboratory testing, report-writing, and re-cleaning required by the proposed rule will increase the costs for renovation, repair and painting activities that are already regulated under the 2008 LRRP rule and the subsequent proposed Opt-Out rule. These additional costs may lead some lower income homeowners of properties in lower income neighborhoods to avoid using certified renovators or recommended practices. When taking an average of costs to all residential RRP events in target housing affected by the rule, the incremental costs of the dust wipe testing and clearance requirements would be $160.[21] These costs are likely to be a small part of the total cost of the major renovation, repair, and painting projects that are affected by the proposed rule. EPA believes that these costs are unlikely to result in significant changes in consumer behavior.

6.9.1 Target Housing Dust Wipe Testing and Clearance Events

This section evaluates the distribution of regulated 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.

[21] This average cost is calculated as the total target housing event costs in the first year divided by the total number of target housing events in the first year.

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 implementation of the LRRP Clearance Rule revision will have a disproportionately greater effect on low income individuals.

For the purposes of the target housing portion of this analysis, 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). It is therefore relevant to determine if the potential costs and benefits resulting from the LRRP regulations will have a disproportionately greater effect on low income individuals.

The data in Table 6-56 presents the numbers of households below the poverty level that own or rent their home. As a result of the proposed LRRP Clearance Rule revision, the likelihood of high levels of lead dust remaining in residential housing post-renovation decreases significantly, and occupants become more aware of potential lead hazards. Only households built prior to 1978 would potentially be affected by the proposed revisions. About 4.5 percent of pre-1980 owner-occupied housing units have residents below the poverty line.

Table 6-56: Annual Number of Children that are Protected by the Clearance Rule Revision

	Owner-Occupied Housing		Renter-Occupied Housing	
Year Housing Built	**Total Below Poverty**	**Percentage of All Pre-2000 Owner Housing Below Poverty**	**Total Below Poverty**	**Percentage of All Pre-2000 Rental Housing Below Poverty**
Pre-2000	4,371,712	6.26%	8,086,254	22.67%
Pre-1980	3,133,302	4.49%	6,059,817	16.99%
Pre-1960	1,765,185	2.53%	3,100,214	8.69%
Pre-1950	1,167,604	1.67%	2,093,142	5.87%

Source: U.S. Census Bureau 2000b.

6.9.1.2 Race:

This section of the environmental justice analysis considers the impacts of the proposed revisions across three race categories. The data in Table 6-57 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.

Table 6-57: 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 proposed rule seeks to provide greater assurance that dust-lead hazards created by renovations are adequately cleaned up, primarily by requiring renovation firms to provide building owners and occupants with information on dust lead levels remaining in the work area after many renovation projects, but also by requiring renovation firms to demonstrate that they have achieved regulatory clearance levels after some of the dustiest renovations. As such, EPA concludes that the proposed revisions to the rule will not lead to disproportionately high and adverse human health or environmental effects on minority and low income populations in regulated target housing units.

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.[22] Therefore the Lutheran School Model was used in this analysis.

To estimate per-student expenditures for schools likely to be affected by the proposed revisions to the LRRP Rule, the school sectors most likely to contain schools with pre-kindergarten and kindergarten

[22] The NCES estimate inflates private school data collected in the late 1970's.

programs were 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[23] 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.

[23] 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[24], 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. [25] 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. [26]

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).

[24] Defined as having a highest grade of less than or equal to 8th.

[25] 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.

[26] 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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