

North Carolina's Preventive Maintenance Program: A Case For Preventing Childhood  
Lead Poisoning Through the Use of Mandatory Interim Lead Control Methods

By

Alan Huneycutt  
PUBH 992  
November 9, 2007

A master's paper submitted to the faculty of the University of North Carolina at Chapel  
Hill in partial fulfillment of the requirement for the degree of Master of Public Health in  
the School of Public Health, Public Health Leadership Program

Approved by:

William Williams, MPH  
First Reader

Edward H. Doman, MPH  
Content Reader

## Abstract

North Carolina's Lead-Based Paint Preventive Maintenance Program was created in 1997 when the North Carolina General Assembly adopted the Childhood Lead Exposure Control Act. The Preventive Maintenance Program was designed to prevent childhood lead exposure from deteriorating lead-based paint in older rental housing. As a primary prevention method, the Preventive Maintenance Program was designed to protect children from exposure to lead-based paint hazards. Today most lead poisoning prevention programs use screening to identify a lead-poisoned child after the child has already been exposed to the environmental toxin lead. By requiring mandatory participation of pre-1978 rental property in the Preventive Maintenance Program, there will be a reduction of risk of children becoming poisoned by lead-based paint.

## Table of Contents

Identification of the Problem.....	4
How Children Are Exposed to Lead.....	5
History of North Carolina’s Childhood Lead Poisoning Prevention Programs.....	7
History of the Preventive Maintenance Program.....	8
Steps Required to Participate.....	9
Current Program Enrollment.....	13
Primary Reason for Not Enrolling in the Program.....	13
Primary Reason for Participating in the Program.....	14
Tax Incentives as a Means of Promoting the Program.....	15
Required Interim Controls.....	16
Incentives for Owner-Occupied Properties.....	17
Vermont’s Approach to Preventing Lead Poisoned Children.....	17
Recommendations.....	22
Conclusion.....	23
References.....	25

## **North Carolina's Lead Based Paint Preventive Maintenance Program**

### Identification of the Problem

In North Carolina and throughout most of the United States, childhood lead poisoning prevention programs rely on the model of secondary prevention programs, where children are screened for elevated blood-lead levels. The residences of these children are visited and an environmental investigation is conducted to determine the source of the lead hazards. Medical treatments such as chelation therapy are sometimes given to lower the child's blood-lead level. To prevent the poisoning of children by lead hazards, primary prevention methods that identify and control lead hazards before children are poisoned should be emphasized. The present system of screening children for elevated blood-lead levels and then determining the source of the lead hazards exposes children to environmental hazards that often have permanent health effects.

Lead poisoning is often described as the most important preventable pediatric health problem in the nation (CDC, 1997). Even with great reductions in average blood lead levels in children that followed elimination of lead as an additive to gasoline in the late 1970s, lead poisoning persists largely because of aging housing in rural areas, inner cities and older suburbs (Feingold & Anderson, 2004). Lead poisoning affects children of all socioeconomic levels but children at the low end of the spectrum are affected disproportionately; children who live in deprived circumstances with an elevated blood

lead level can only increase the many social, economic, educational and environmental challenges they already face (Feingold & Anderson, 2004). Childhood lead exposure has been shown to increase aggressive and delinquent behavior in children (Needleman et al., 1996). Children with high dentine lead levels scored appreciably lower on intelligence test than children with low dentine lead levels ( Needleman et al., 1979). Children living in rural communities in North Carolina have shown a surprisingly high prevalence of elevated blood lead levels (Norman et al., (1994). Primary prevention (not placing lead in the environment of children) is the only way to avoid the dangerous effects of lead (Feingold & Anderson, 2004) Secondary prevention (isolating or removing lead already present in the environment) requires a high degree of perseverance, attention to detail and a cooperative effort among the health department, landlord, family and health care provider (Feingold & Anderson, 2004).

#### How Children Are Exposed to Lead: Common and Uncommon Sources

Listed below are some of the common sources of lead that can increase a child's blood lead level (Feingold & Anderson, 2004):

- Lead-based paint and paint dust (Dugbatey et al., 1995)
- Ingestion of paint chips
- Burning or sanding of painted wood
- Home remodeling and renovation
- Contaminated soil from deteriorating exterior house paint
- Contaminated soil from old leaded gasoline automobile emissions
- Lead water pipes

Listed below are some of the less common sources of lead that can increase a child's blood lead level (Feingold & Anderson, 2004):

- Gunshot wounds, primarily from a bullet wound to the mother (Tsafaris & Alexaki, 1992)
- Firing ranges
- Occupation or hobby of a family member, including battery and aircraft manufacturing, lead smelting, brass foundry, radiator repair, construction and bridge repair, stained-glass making, boat restoration and art restoration
- Mini-blinds
- Playground chalk and crayons made in foreign countries
- Jewelry
- Imported foods and spices
- Lead soldered cans
- Dishware that contains lead, including pottery, ceramics and lead crystal
- Some antique pewterware
- Some dyes used in food wrappers and newspapers
- Cosmetics and folk remedies containing lead such as greta, kohl, azarcon, pay-loo-ah, ghasard, kandu and balagoli
- Candles with lead wicks
- Some telephone cords

## A History of North Carolina's Childhood Lead Poisoning Prevention Program

In North Carolina, the Childhood Lead Poisoning Prevention Program began in the 1980's. The North Carolina General Assembly adopted "An Act to Provide for the Prevention and Control of Lead Poisoning in Children" in 1989 requiring the adoption of rules to prevent childhood lead poisoning. In 1992, the State Health Director issued the first statewide recommendations for the prevention of childhood lead poisoning. The North Carolina General Assembly adopted the Childhood Lead Exposure Control Act in 1997 creating the lead-based paint Preventive Maintenance Program.

Surveillance data show there has been a decrease in the number of children with elevated blood lead levels. In 1997, there were 661 children confirmed to have exposures at or above 10 micrograms per deciliter (NC DENR, 2006). In 2004, only 401 children were confirmed to have exposures at the same exposure level of 10 micrograms per deciliter (NC DENR, 2006). This decrease in the number of children confirmed with elevated blood lead levels occurred even though the total number of children tested grew almost 40% from 95,166 in 1997 to 124,486 in 2004 (NC DENR, 2006).

While there has been a substantial decrease in the number of children in North Carolina with elevated blood lead levels, the present system of targeted screening to detect these children could be improved by using a more proactive approach of primary prevention methods.

## History of the Preventive Maintenance Program

The North Carolina Preventive Maintenance Program was created in 1997 when the North Carolina General Assembly adopted the Childhood Lead Exposure Control Act. This program is designed to reduce childhood lead exposure in housing built prior to 1978. Participation in the program is voluntary and available to owners of residential rental property and homeowners can also participate (NC DENR, 1999).

The Preventive Maintenance Program's primary purpose is to protect children from the health effects of exposure to lead-based paint hazards. Participants in the program receive liability relief from litigation resulting from lead poisoned children. Participants can market their property as having a state issued certificate of compliance from the Preventive Maintenance Program. A small number of homeowners have enrolled in the program with the plan of marketing their homes as having a state issued certificate of compliance demonstrating that their home is lead-safe.

A Certificate of Compliance is available to property owners who have performed lead-safe maintenance activities and submit an application to the North Carolina Division of Environmental Health. When applying for a certificate of compliance, a property owner or managing agent must provide a written report of an inspection performed by a certified lead inspector or risk assessor and also submit the laboratory analyses of lead dust samples. If the property is occupied, a signed statement from the occupants is required stating they have received information about the danger of lead paint hazards.



### Steps Required to Participate

A property owner must visually inspect the condition of their pre-1978 rental property and perform renovations to the property if needed using lead-safe work practices. Areas of deteriorated paint inside the dwelling must be repaired and repainted. The cause of the deteriorated paint must be corrected, such as fixing any roof leaks. To prevent the generation of lead dust, doors and windows must be adjusted to minimize where surfaces are binding and rubbing by re-adjusting doors and installing window jamb liners if needed. Interior surfaces must be made smooth and easy to clean. This includes replacing or recovering worn-out linoleum floors, recoating deteriorated hardwood floors, repainting interior windowsills and capping window troughs with vinyl or aluminum liners.

For residential rental property built before 1950, exterior deteriorated surfaces must also be repaired and repainted (NC DENR, 1999). The cause of the deteriorated paint must be corrected. Areas of bare soil within three feet of the dwelling foundation must be covered with mulch or grass and the covering stabilized to prevent water and wind erosion.

To prevent the further spread of lead dust, all renovation and repair work must be conducted using lead-safe work practices. Lead-safe work practices minimize the generation of hazards when disturbing lead-based paint. Some examples of lead-safe work practices include misting paint surfaces before scraping, protecting occupants belongings by covering with plastic, and covering the work area floors and grounds with plastic. These safe work practices protect the occupants and workers who perform the

renovation and remodeling work. Unsafe work practices, such as uncontrolled abrasive blasting and uncontrolled water blasting to remove lead-based paint are to be avoided.

Workers are also required to use specialized cleaning methods to remove lead-contaminated dust. Specialized cleaning methods are effective in removing lead-contaminated dust resulting from disturbing lead-based paint. While lead-safe work practices reduce the amount of lead-dust generated when disturbing lead-based paint, specialized cleaning methods use procedures that are more effective than traditional cleaning methods used to clean up non-leaded dust. Vacuum cleaners with high efficiency particulate air (HEPA) filters are effective in trapping small particles that conventional vacuum cleaner filters allow to pass through the vacuum and contaminate surfaces with lead dust. Specialized cleaning methods also include using three separate buckets of water when mopping floors with lead dust. Mopping floors with a single bucket often spread the lead dust around on the floor, where using three separate buckets increase the cleaning effectiveness of mopping. Frequently changing mop-heads and mop water are essential specialized cleaning methods.

After completing the work needed to make the property lead-safe, property owners must verify compliance with the preventive maintenance standard by having a certified risk assessor or inspector conduct an inspection. This inspection must verify that all interior paint is intact, all doors and windows open and close with minimum friction, and that interior surfaces are smooth and easy to clean, linoleum floors are intact, hardwood floors do not have large cracks in the wood and window troughs are capped with vinyl or aluminum. For single family and multi-family units built prior to 1950, the inspection must also verify that exterior paint is intact and areas of bare soil within three feet of the

building foundation are covered with grass or mulch. The inspection must also include a minimum of four dust-wipe samples. Two dust samples from floors and two dust samples from either windowsills or window troughs must be taken and submitted to a certified laboratory. Results from the lead dust samples must be below 40 micrograms per square foot for floors and below 250 micrograms per square foot for windowsills or below 400 micrograms per square foot for window troughs (NCAC, 1999). Lead dust samples that exceed these limits require that applicants use specialized cleaning practices again after adjusting any doors or windows to reduce friction that may have created the lead dust. Lead dust samples must again be submitted to a certified laboratory and results must be below the above stated limits.

After submitting the application with the lead dust sample results and inspection report and a fee of ten dollars, a Certificate of Compliance is issued for a period of one year. Up to fifty percent of the applications are selected for on-site monitoring by the NC Department of Environment and Natural Resources. On-site monitoring consists of conducting a visual inspection of the property and taking lead-dust samples to confirm that lead dust levels are below the required limits.

Once a Certificate of Compliance is issued, a letter is mailed to the occupants of the property advising that the property is enrolled in the program. This notification includes an educational pamphlet describing the Preventive Maintenance Program and a brochure on lead poisoning hazards. The tenant is also advised of their responsibilities for the upkeep of the residence. Tenants are requested to wipe clean all windowsills with a sponge or damp cloth at least once a week and regularly wash all surfaces accessible to children. Tenants are responsible for notifying the property owner of any deteriorated

paint in the residence within 72 hours of discovery and preventing children's ingestion of lead by encouraging frequent hand and face washing (NCAC, 1999)

Another group of owners of residential rental property who can participate in the program are owners of property where a lead poisoned child less than six years of age resides or regularly visits. Property owners who are required to remediate lead poisoning hazards due to a confirmed lead poisoned child may apply for a Certificate of Compliance after remediating all identified lead hazards. When a child in North Carolina is determined to have a confirmed lead poisoning, a risk assessment is performed by the local health department and a representative of the NC Department of Environment and Natural Resources Children's Environmental Health Branch. After the identified lead hazards have been remediated (including drinking water, soil, vinyl miniblinds, pottery), the property owner may apply for a Certificate of Compliance. All exterior and interior lead hazards must be remediated regardless of the age of the dwelling. Since a risk assessment has been conducted on the residence, deteriorated paint on components determined not to be a lead hazard does not have to be remediated. Bare areas of soil within three feet of the dwelling foundation that is determined not to be a lead hazard does not have to be covered with mulch or grass. After remediating the identified lead poisoning hazards where a child has a confirmed lead poisoning, the property owner may apply for a Certificate of Compliance.

A Certificate of Compliance is valid for one year. To renew the Certificate of Compliance, participants in the program must perform any repairs to the rental property and correct any conditions such as deteriorated paint, leaky roofs, and window or doors that stick and create lead dust. Compliance with the preventive maintenance program

must be verified each year by having a certified lead inspector or risk assessor perform an inspection and submit a written report with the results of lead dust samples.

A certificate of compliance may be revoked by NC Department of Environment and Natural Resources if information submitted by the owner or managing agent has submitted false information or if a representative of NC Department of Environment and Natural Resources is denied entry by the owner or managing agent to conduct a visual inspection (NCAC, 1999).

#### Current Program Enrollment

There are currently 28 single-family units and 642 multi-family units enrolled in the Preventive Maintenance Program. The number of units enrolled can change on a monthly basis since Certificates of Compliance are valid for one year from the date of issue. Since participation in the program is voluntary, property owners may decide not to renew a certificate of compliance or may wait several months before renewing an expired certificate.

#### Primary Reason Given For Not Enrolling in Preventive Maintenance Program

In meeting with owners of pre-1978 residential rental property, the primary reason given for not enrolling in the Preventive Maintenance Program is the high yearly cost of hiring a certified lead inspector or lead risk assessor to conduct an inspection, take lead-dust samples and prepare a written inspection report. Certified lead inspectors and risk assessors are licensed in North Carolina by the Health Hazards Control Branch, a state agency in the Department of Health and Human Services. Two certified risk assessors

based in Charlotte, NC quoted over the telephone rates of \$250 to \$300 to inspect a 1,500 square foot house, take dust samples and prepare a written report. Travel outside the local Charlotte area would increase the cost of the inspection.

The other requirements to enroll in the program seem reasonable to prospective and current program participants. Most prospective program participants understand the reasoning behind the required interim lead hazard controls.

A waiver can be granted by the Preventive Maintenance Program coordinator when program requirements are not necessary. In the case of a rental property where all original windows have been replaced, it is not necessary to place vinyl or aluminum liners in the window troughs. New replacement window units would not contain any lead-based paint and there is no risk of these new windows generating lead dust.

The Raleigh Housing Authority presently has 614 multi-family units enrolled in the program. Waivers were granted for placing vinyl or aluminum window liners in window troughs since all original windows in the 614 units have been replaced. The requirement to cover areas of bare soil within three feet of the building foundation was also granted a waiver. Extensive soil testing on a yearly basis has shown the soil around the 614 units not to be a lead hazard.

#### Primary Reason Given For Participating In the Preventive Maintenance Program

The reason most often given for not participating in the program is the cost of hiring a certified inspector or risk assessor every year to take dust samples and do a visual inspection of the property. The reason most often given by participants who are enrolled in the program is the fear of litigation related to a lead poisoned child. Participants in the

program cite the protection offered by the limited liability relief as the primary reason for obtaining a certificate of compliance. Fear of litigation seems to be a strong motivator in most of the program participants. Some program participants have been involved with a child having a confirmed lead poisoning while living in their rental properties and fear the possibility of other children being exposed to lead hazards in their property in the future. These property owners are required to remediate the lead poisoning hazards in their rental property and obtaining a Certificate of Compliance is a simple matter of sending in an application and fee since the lead poisoning hazards have been controlled.

#### Tax Incentives As A Means Of Promoting The Preventive Maintenance Program

Legislation has been proposed in North Carolina to create a program to provide owners of residential property containing lead hazards an income tax credit to eliminate or control the lead hazard. For owners of pre-1978 housing who remove the lead hazards from their residence, up to \$1,500 in tax credits would be granted for the cost of abatement or permanent removal of lead hazards (NC DENR, 2006). Abatement work would have to be performed by a certified lead abatement contractor. A certified risk assessor would be required to verify the existence of lead hazards and verify the abatement of those hazards.

For owners who choose to reduce lead hazards on their property by interim control measures, a credit of one-half the cost of using interim controls to reduce lead hazards would be granted. The maximum tax credit would be up to \$500 per unit (NC DENR, 2006). A risk assessment would not be required to verify lead hazards in pre-1978 units. A certified risk assessor would be would be required to verify that the interim control

methods were successful. The interim control work would have to be performed by the owner, a certified lead abatement contractor, or a worker trained in lead-safe work practices. Since interim controls are not considered to be permanent fixes for lead hazards but are temporary, it would be recommended that property owners receiving this tax credit be required to enroll in the Preventive Maintenance Program which would ensure that the temporary interim lead hazard controls are maintained on an annual basis.

#### Required Interim Controls For Pre-1978 Rental Housing

The present system in North Carolina of screening children for elevated blood lead levels to identify children requiring environmental remediation of lead hazards will always be a necessary response to the problem of childhood lead poisoning. The problem with this approach is that children may have suffered damage before the hazard can be controlled. The primary prevention method of requiring mandatory interim controls in pre-1978 rental property through the use of the Preventive Maintenance Program would be an effective method of protecting children before the damage from lead poisoning hazards can occur. One way this could be accomplished is to have the NC Department of Environment and Natural Resources Children's Environmental Health Branch employees provide the inspections and dust sampling free or at a reduced cost to owners of pre-1978 rental property. The owners of the rental property would receive the liability relief provided by the North Carolina state government from lead poisoning litigation.



### Incentives For Owner Occupied Property

Requiring owner-occupied properties built before 1978 to use interim controls or abatement methods to control lead poisoning hazards is not a realistic idea. Providing tax credits for homeowners who voluntarily decide to reduce lead hazards by interim control measures is a more realistic approach. The proposed legislation to provide a tax credit to North Carolina homeowners would provide another method of preventing childhood lead poison from occurring in residential property.

Another incentive for owner-occupied properties would be to make grants available to homeowners who eliminate or reduce lead poisoning hazards in their homes. Low income and middle-income property owners would have an incentive to protect their children from lead poisoning hazards.

### Vermont's Approach To Preventing Lead Poisoned Children

Vermont's legislature passed Act 165 "An Act to Prevent Lead Poisoning in Children in Rental Housing and Child Care Facilities" which took effect on July 1, 1996.

Erville (1997) reports that this law requires owners of child care facilities and rental properties to:

- Perform visual on-site inspections of all interior and exterior surfaces and fixtures of the building to identify deteriorated paint on an annual basis and upon unit turnover.
- Safely stabilize or remove deteriorated paint (unless a certified risk assessor or inspector has determined it is not lead-based paint) and repair and restore these surfaces.

- Install window well inserts into all windows or protect window wells by an alternate method approved by the health department.
- Use safe work practices during any remodeling, renovation, repair or maintenance project that disturbs paint (unless a certified risk assessor or inspector has determined that it is not lead-based paint). Lead-based paint removal by dry scraping, sandblasting, water blasting, power sanding or burning is prohibited.
- Perform specialized cleaning of the works areas to remove the dust from lead-based paint.
- Clean all windowsills and wells in all units where a child six years of age or younger resides, and in all areas of the building where access by tenants is not restricted by the rental agreement. (Cleaning methods, devices and products must be effective in the removal of dust from lead-based paint and be approved by the health department.
- Post a notice to occupants in buildings containing affected rental units and in child care facilities, emphasizing the importance of quickly reporting deteriorated paint to the owner or owner's agent. The owner or owner's agent must display their name, phone number and address on the posted notice.
- Ensure that any person performing essential maintenance work has completed an approved training course or is being supervised on-site by a person who has completed the training course.

The Vermont law also requires affected owners or their property manager to attend a health department approved program that trains participants in lead-safe work practices.

Owners who comply with these requirements receive a statutory grant of liability relief from litigation due to a lead poisoned child. Verification of compliance is checked by a licensed risk assessor or inspector. This liability relief is subject to certain conditions and limitations. Immunity from liability is lost if fraud has occurred, if the owner violated conditions of the certification, if the owner created lead-based paint hazards during remodeling, renovation or repair after the certification, or if the owner failed to respond in a timely fashion to notification that lead-based paint hazards may have reappeared on the premises (Erville, 1997).

Ellen Tohn, an environmental compliance and policy consultant, interviewed Vermont property owners, managers and trainers approximately fifteen months after the new lead law took effect. Representatives from Vermont health departments estimated that approximately 7,000 people had attended the Essential Maintenance Practices classes, which is roughly half of the owners affected by the requirements (Tohn, 1997). Most of the participants reported a positive experience to the three-hour class. Tohn (1997) states that owners and managers also reported the following opinions towards the new lead law:

- Owners /managers were receptive to lead related work that could be accomplished when the unit was unoccupied at turnover. They were very resistant to doing any lead-related work when the unit was occupied.
- Many owners hired a contractor to perform specialized cleaning.
- Specialized cleaning at unit turnover added between 2-3 hours per unit to their normal cleaning time.

- Interior paint stabilization precautions were seen as being reasonable. Wet misting surfaces, laying down plastic and cleaning after the work was completed were seen as adding little extra time or expense.
- Exterior paint stabilization precautions were often seen as being unreasonable. Wet misting surfaces was seen as not being practical, and carrying a mister up a ladder was described as awkward and unsafe. Wetting a surface before scraping prevents priming directly after finishing the scraping and sanding. Painters are forced to move a ladder three times to complete work on every wall and surface. If the scraping could be done on a dry surface, then the procedure could be done in two steps (scrape and prime, then paint). Wet scraping requires three separate steps (wet scrape, prime, then paint) and moving equipment three times to complete the painting of a surface. Painters are also required to wear protective booties over work boots and shoes. These protective booties are removed when painters step off of the plastic sheeting spread on the ground underneath areas that are being painted. These booties were seen as creating a safety hazard when standing on ladders. Ladders placed directly on top of the plastic sheeting were viewed as more prone to slipping and causing a ladder or painter to fall. Most of the owners, managers and contractors stated that they did not follow the full safe painting procedures when working on exterior surfaces.
- Required window well inserts were viewed by most owners / managers as being too expensive, too difficult to install and felt the effort yields limited health benefits. Some owners felt that window well inserts accelerated window rot. Window well inserts use readily available materials such as vinyl and aluminum

coil stock and create a smooth surface that allows easier cleaning of the window well where large amounts of lead dust can accumulate. Owners stated the average cost of the materials to line a window well is approximately four dollars per window. Most owners indicated they did not plan on covering all of the window wells due to these concerns.

- Owners felt there was little support for the program from the insurance industry and did not think they would lose their insurance coverage if essential maintenance practices were not performed.
- Cleaning requirements were viewed as a tenant's responsibility. Apartment owners and managers were hostile to the idea of having to clean the apartments on an annual basis. It was not understood by most owners that the cleaning only applied to units with children six years old and younger and that only cleaning of window troughs and sills was required. They assumed that the annual cleaning requirement meant vacuuming and mopping all horizontal surfaces in all units.
- Required tenant notification posters were viewed as ugly and alarmist. Owners and landlords thought it was unreasonable to post the poster in a single family home. There was less opposition to posting the notice in common areas of large apartment buildings.

While Vermont's program can be improved, it demonstrates that a state mandated program of required essential maintenance practices to reduce childhood exposure to lead paint hazards is feasible and can protect the health of children.

## Recommendations

The following actions are recommended to reduce the number of childhood lead poisoning cases in North Carolina:

- Require owners of pre-1978 rental housing in North Carolina to enroll their properties in the North Carolina Preventive Maintenance Program. This primary prevention method would reduce the number of childhood lead poisoning cases in the state while providing liability relief from lead poisoning litigation.
- Enact legislation providing grants and tax incentives to homeowners who eliminate or reduce lead hazards in their pre-1978 homes.
- Provide free lead-based paint risk assessments to participants in the NC Preventive Maintenance Program if requested. While having a risk assessment would not be a requirement to enroll in the program, property owners requesting a variance from certain program requirements would need a risk assessment to confirm the absence of specific lead hazards. A property owner who has replaced windows in a pre-1978 property would not be required to install liners in the window troughs if no lead hazard existed. A lead hazard risk assessment would be needed to confirm the absence of lead paint on the windows. Licensed risk assessors employed by the NC Children's Environmental Health Branch or private licensed risk assessors could provide this service. This would require hiring additional licensed risk assessors by the NC Children's Environmental Health Branch or and finding funds to pay private risk assessors. Increasing the current yearly ten dollars per unit enrollment fee could provide these funds.

- Provide free clearance testing for participants enrolling in the NC Preventive Maintenance Program. State employed and private risk assessors would provide this service.
- Require property owners of pre-1978 rental properties or their managing agents to attend a State approved lead-safe work practices class. This would help ensure that proper work and cleaning methods would be used when enrolling in the Preventive Maintenance Program.
- Require that the drinking water provided in rental properties enrolled in the Preventive Maintenance Program is lead safe. Water with high lead levels can be a health hazard (Norman & Bordley, 1995).
- Remove vinyl mini-blinds that contain lead in enrolled properties. Vinyl mini-blinds containing lead have been shown to contribute to childhood lead poisoning (Norman et al., 1997).
- Exempt pre-1978 rental properties that are free of lead paint hazards from the requirement to enroll in the Preventive Maintenance Program. A risk assessment conducted by a licensed lead risk assessor could confirm the absence of lead paint hazards in a property.

### Conclusion

This paper has recommended that all pre-1978 rental housing in North Carolina be required to enroll in the NC Preventive Maintenance Program to reduce the number of childhood lead poisoning cases in the state. To reduce the risk of lead hazards in owner-occupied properties, legislation providing tax incentives and grants to homeowners who

eliminate or reduce lead hazards from their homes will also reduce childhood lead poisoning cases. The use of these primary prevention methods will complement the present system of using targeted screening to identify children with elevated blood-lead levels who require environmental interventions to locate the source of lead hazards in their environment. It is estimated that the total benefit of a one microgram per deciliter reduction in blood lead levels for one year's cohort of children is approximately five billion dollars due to avoiding future earnings losses (Salkever, 1995). To prevent a child's poisoning by lead hazards is always preferable to correcting an environmental problem after possible irreversible damage has occurred.



## References

Centers for Disease Control and Prevention. (1997, November). Screening young children for lead poisoning: Guidance for state and local public health officials. Atlanta, GA: CDC.

Dugbati, K., Evans, R.G., Lienhop, M.T., & Stelzer, M. (1995). Community partnerships in preventing childhood lead poisoning: a report on the development of a community-oriented education program. Environmental Health, (1995, January), 6-10.

Erville, P. (1997). State and local legislative efforts reflect growing consensus on lead safety standards. (Available from the Alliance to End Childhood Lead Poisoning, 227 Massachusetts Avenue, N.E., Suite 200, Washington, DC 20002).

Feingold, M., & Anderson, R. (2004). Lessons and tactics to lead the charge against lead poisoning. Contemporary Pediatrics, 21(4), 49-68.

Needleman, H.L., Riess, J.A., Tobin, M.J., Biesecker, G.E., & Greenhouse, J.B. (1996). Bone lead levels and delinquent behavior. Journal of the American Medical Association, 275(5), 363-369.

Needleman, H.L., Gunnoe, C., Leviton, A., Reed, R., Peresie, H., Maher, C., & Barrett, P. (1979). Deficits in psychologic and classroom performance of children with elevated dentine levels. The New England Journal of Medicine, 300(13), 689-695.

Norman, E.H., & Bordley, W.C. (1995). Lead toxicity intervention in children. Journal of the Royal Society of Medicine, 88, 121-124.

Norman, E.H., Bordley, W.C., Hertz-Picciotto, I., & Newton, D. (1994). Rural-urban blood lead differences in North Carolina children. Pediatrics, 94(1), 59-64.

Norman, E.H., Hertz-Picciotto, I., Salmen, D.A., & Ward, T.A. (1997). Childhood lead poisoning and vinyl miniblind exposure. Archives of Pediatrics and Adolescent Medicine, 151, 1033-1037.

North Carolina Department of Environment and Natural Resources. (1999) North Carolina's lead-based paint preventive maintenance program: A guide for owners and managers of pre-1978 rental property. [Brochure] Raleigh, NC

North Carolina Department of Environment and Natural Resources. (2006) North Carolina Strategic Plan To Eliminate Childhood Lead Poisoning. Raleigh, NC (Available from Children's Environmental Health Branch, 1632 Mail Service Center, Raleigh, NC 27699)

North Carolina General Statutes, G.S. 130-A-131.9H and Administrative Rules Governing the Childhood Lead Poisoning Prevention Program, 15A NCAC 18A .3100 (1999) Raleigh, NC (Available from Children's Environmental Health Branch, 1632 Mail Service Center, Raleigh, NC 27699)

Salkever, D.S. (1995). Updated estimates of earnings benefits from reduced exposure of children to environmental lead. Environmental Research, 70, 1-6.

Tohn, E. (1997). A preliminary review of the Vermont experience with essential maintenance practices and lead disclosure. (Available from ERT Associates, 4608 DeRussey Parkway, Chevy Chase, MD 20815).

Tsafaris, F., & Alexaki, E. (1992). The transplacental effect of lead compounds on inorganic pyrophosphatase in brain, liver and kidneys of newborn rats. Veterinary and Human Toxicology, 34(6), 510-512.

