Facilities
Tech Tips

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Using XRF Hand-Held Devices To Detect Lead-Based Paint

Robert Beckley, Project Leader, and James "Scott" Groenier, Project Leader

Highlights...

- Although lead-based paint has not been used in recent years, it may be lurking beneath many layers of paint that do not contain lead.
- Before undertaking maintenance or restoration projects that disturb painted surfaces, you should test for lead-based paint.
- Two types of hand-held devices, one based on a radioactive isotope and the other based on an x-ray tube, can detect lead-based paint, even if it's buried beneath several other layers of paint.
- Because these devices are being improved so quickly, the best option may be to hire contractors to test for lead-based paint.

Lead was a common additive in paints used until the 1980s and in some cases into the 1990s. In many cases lead-based paints were used on Forest Service, U.S. Department of Agriculture, bridges (figure 1), steel towers, tanks, and buildings. Lead is no longer added to paints made in America.

Before beginning a maintenance or restoration project, you should test previously painted surfaces for lead, especially if your project will involve scraping, sanding, or otherwise disturbing a painted surface.

The Missoula Technology and Development Center (MTDC) has published 10 other tech tips on lead-based paint. They are available at *http://www.fs.fed.us/t-d/* (Username: t-d, Password: t-d). Search for "lead-based."

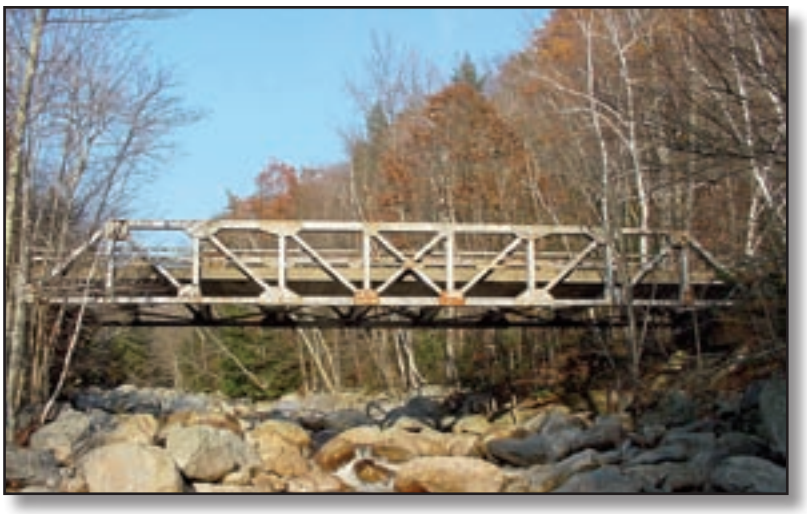

Figure 1—Because steel bridges may be coated with lead-based paint, they need to be tested before restoration or maintenance projects that may disturb the painted surface.

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Health Risks

Lead-based paint that is in good condition poses little risk to individuals or the environment. Dust from lead-based paint, or particles of lead-based paint that are flaking or chipping, can pose a serious health risk. When ingested or inhaled, paint particles contaminated with lead can damage the central nervous system. Children are at greater risk than adults because lead can interfere with neurological development. Lead poisoning causes seizures, comas, and in extreme cases—death.

Exposure to lead also can cause reproductive problems, including impotence, sterility, and increased risk of birth defects. Lead poisoning has a cumulative effect and the damage may be irreversible.

The U.S. Environmental Protection Agency (EPA) and the U.S. Department of Housing and Urban Development (HUD) have regulations for mitigating the exposure to lead in residential and daycare settings. The EPA plans to issue additional direction on mitigating exposure to lead and other heavy metals in commercial and industrial settings. The U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) also has guidelines for worker safety and health. To learn more about lead-based paint regulations and guidelines, check out the "Additional Information" section of this tech tip.

Because of the potentially serious consequences of lead poisoning and environmental contamination, it is important to test painted surfaces (figure 2) before starting a maintenance or restoration project. If you detect lead when sampling structures (figure 3), send a paint chip to a certified lab for analysis.

Figure 2—Steel towers may be coated with lead paint buried beneath many other layers of paint.

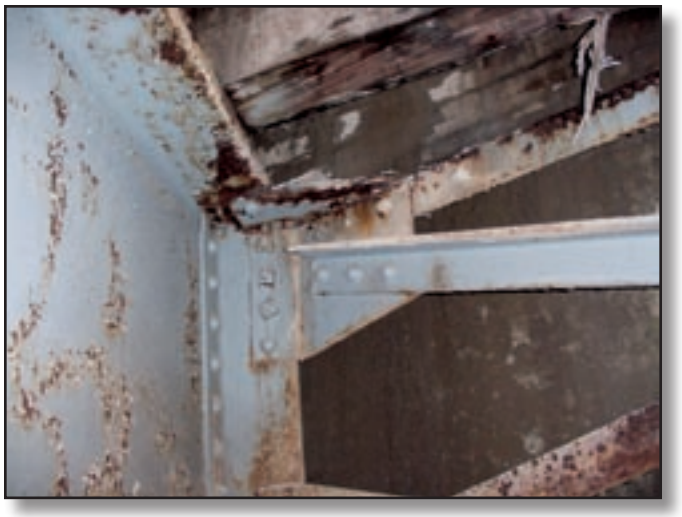

Figure 3—Chipping or flaking lead-based paint poses a health risk and may become an environmental contaminant. If field testing identifies lead in paint, a chip of paint should be sent to a certified lab for analysis.

XRF Hand-Held Lead Detection Devices

Several companies make commercial lead detection devices that are suitable for the majority of typical Forest Service maintenance and restoration projects. Different types of lead detection devices rely on different principles. The XRF hand-held lead detection devices discussed in this tech tip have been found to be reliable and accurate by the Forest Service employees who used them for soil and mine sampling.

Basic Principles of Operation

There are two types of XRF hand-held lead detection devices: those that use radioisotopes and those that use x-ray tubes. According to the EPA's Innovative Technology Verification Reports (EPA/540/R-06/002 and 004, February 2006), "an XRF analyzer consists of three major components: (1) a source that generates x-rays (a radioisotope or x-ray tube); (2) a detector that converts x-rays emitted from the sample into measurable electronic signals; and (3) a data processing unit that records the emission or fluorescence energy signals and calculates the elemental concentrations in the sample."

Both XRF hand-held lead detection devices are relatively simple to use and operate. They are placed on the area where lead is suspected. Depending on the type of device and the depth of analysis required, the results can be viewed in seconds. Companies that sell or rent these devices provide onsite training and technical support.

Radioisotope Devices

The radioisotope device (figure 4) for identifying the presence of lead and other metals is the older of the two types of lead detection devices. One advantage of the radioisotope device is its ability to read large or heavy concentrations of lead accurately. The radioisotope device also does a better job of detecting lead buried under numerous layers of paint than the x-ray tube device.

One disadvantage of the radioisotope device is that as the cadmium radioisotope loses strength, readings take longer. Because the half-life of the cadmium radioisotope is about 15 months, it takes twice as long to get a reading after 15 months, 4 times as long to get a reading after 30 months, and so forth. Replacing the cadmium radioisotope can cost $3,000.

Security is another issue. Both the radioisotope and the x-ray tube devices use radioactivity, but the radioisotope is radioactive all the time. The radioisotope device requires special licensing and may pose travel issues. In addition, when a radioisotope device reaches the end of its service life or is broken or damaged, it must be disposed of as hazardous material. Check with the appropriate State agencies to determine how to dispose properly of a radioisotope device.

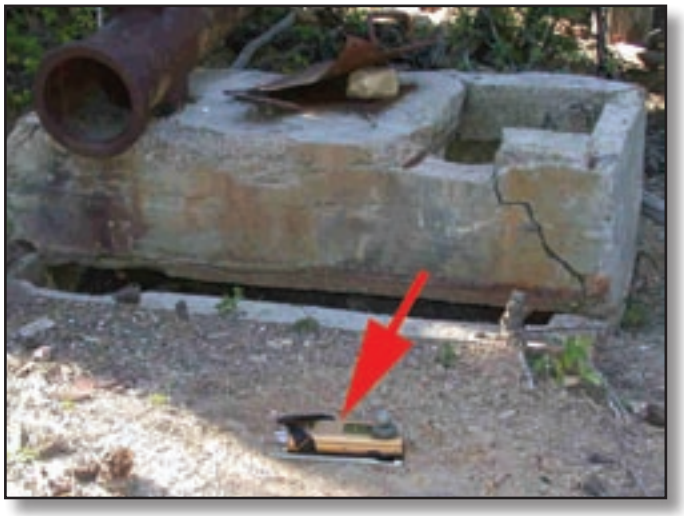

Figure 4—A radioisotope device (arrow) being used to check for heavy metals in the soil.

X-Ray Tube Devices

The x-ray tube devices (figure 5) are the latest generation of XRF hand-held lead detection devices. Although the x-ray tube devices offer numerous advantages, radioisotope devices may still be the best choice for some users. For instance, x-ray tube devices currently cannot accurately detect lead-based paint that is covered by 10 or more coats of paint.

X-ray tube devices cost more to purchase than radioisotope devices, but because components of x-ray tube devices do not break down as rapidly, they do not need to be serviced as frequently as the radioisotope devices. In addition, because the x-ray tube device's components do not suffer from half-life issues, they provide quicker, more constant readings.

Another advantage of the x-ray tube devices is that their radioactive components are not "on" all the time. These devices only need to be registered, not licensed. No special requirements apply when traveling with x-ray tube devices, nor do x-ray tube devices require special hazardous materials handling or disposal.

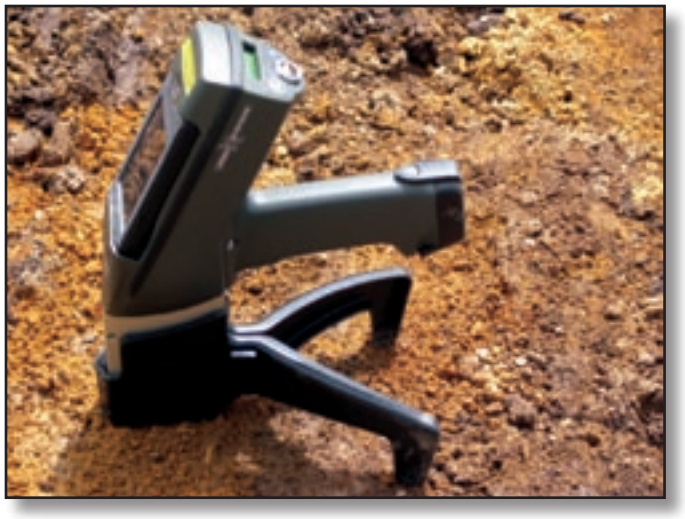

Figure 5—An x-ray tube device being used to check for heavy metals in the soil.

Rent, Own, or Contract

Depending on the amount of use anticipated, it may be better to rent a hand-held lead detection device than to buy one.

Prices can vary widely based on the model and software packages, which can add several thousand dollars to the cost of either device. Additional software packages may be needed for different types of testing.

The accuracy of these devices has improved greatly over the last 10 years, and private industry is continuing to improve their safety and efficiency. Because these devices are being improved so quickly, the best option may be to hire contractors to test buildings or other structures for lead-based paint. Contractors have their own equipment and are trained in the use of their equipment and testing methods.

Not Just for Lead Paint

Both XRF hand-held lead detection devices can be used to detect lead in the soil. In addition, they can be programmed with software that allows them to detect highly toxic elements such as arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, vanadium, and zinc.

Additional Information

Manufacturers

- Edax at *http://www.edax.com/*
- Innov-X Systems, Inc., at *http://www.innovxsys.com/*
- Oxford Instruments Industrial Analysis at *http://www.oxford-instruments.com/wps/wcm/connect/Oxford+Instruments/Internet/Home/*
- Thermo Fisher Scientific, Inc., at *http://www.niton.com/*

Government Agencies

- U.S. Environmental Protection Agency
  - » For more information about lead in paint, dust, and soil, visit *http://www.epa.ogv/opptintr/lead/*
  - » The EPA governs the use of XRF hand-held lead detection devices for soil analysis under Method 6200. For more information about Method 6200, visit *http://www.epa.gov/epaoswer/hazwaste/test/pdfs/6200.pdf*
- The U.S. Department of Housing and Urban Development has information on lead hazards and direction for mitigation that may apply to your project. Before beginning a new project, check for current direction and policies on the Web site *http://www.hud.gov/offices/lead/*

About the Authors

Robert Beckley received a bachelor's degree in political science from the University of Montana in 1982. He began his Forest Service career as a timber technician on the Nez Perce National Forest. Beckley was a smokejumper when he came to the Missoula Technology and Development Center in 1990. He assists in the explosives program and works as a project leader and public affairs specialist.

James "Scott" Groenier began working for MTDC in November 2003 as a civil engineering project leader. Groenier earned a bachelor's degree from the University of Wisconsin at Madison and a master's degree from Montana State University. He worked for the Wisconsin and Illinois State Departments of Transportation before starting his career with the Forest Service. He worked as the east zone structural engineer for the Eastern Region and as a civil engineer for the Ashley and Tongass National Forests.

Library Card

Beckley, Robert; Groenier, James "Scott." 2008. Using XRF hand-held devices to detect lead-based paint. Tech Tip 0873–2310–MTDC. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Development Center. 6 p.

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Two types of hand-held lead detection devices, one based on radioactive isotopes and the other based on x-ray fluorescence, can detect lead-based paint, even if it's buried beneath many layers of paint. This tech tip discusses the advantages and disadvantages of these two types of devices and how they could be used.

Keywords: bridges, hazardous materials, lookout towers, radioisotopes, safety at work, x-ray fluorescence

Additional single copies of this document may be ordered from:

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Electronic copies of MTDC's documents are available on the Internet at:

http://www.fs.fed.us/eng/t-d.php

For additional information about XRF hand-held lead paint detection devices, contact Robert Beckley or Scott Groenier at MTDC:

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Forest Service and Bureau of Land Management employees can search a more complete collection of MTDC's documents, CDs, DVDs, and videos on their internal computer networks at:

http://fsweb.mtdc.wo.fs.fed.us/search/