Moisture and Density "Nuclear" Gauges Used in Road Construction

Quality control is an important aspect of any construction project. Building roads is no exception, and the moisture content and density of the materials used are very important. Gauges containing radioactive sources are used for determining the density of asphalt, soil, aggregate (usually gravel or crushed rock), and concrete, as well as the moisture content of the soil or aggregate.

These gauges work by measuring either the "backscatter" or the "direct transmission" of radiation directed at a material. "Backscatter" is the amount of radiation that is deflected by the material and is measured by placing the gauge on the surface of the material. "Direct transmission" is the amount of radiation that passes through the material and is measured by drilling a hole in the material and inserting the gauge.

Various kinds of sources are used in moisture and density gauges, and each gives off specific types of radiation. One source often used is cesium-137, which emits both beta and gamma radiation. Another is a compound of americium-241 and beryllium, which emits neutron radiation. (Although americium-241 emits alpha radiation, when mixed with beryllium (a non-radioactive metal), the mixture emits neutrons.)

The radioactive sources in the gauge are surrounded by shielding. It is only when the gauge is mishandled or damaged that it becomes a significant radiological hazard to the operator. Extensive experience with these gauges over many years indicates that radiation exposure to workers is generally low and that accidents involving the gauges are infrequent. When these gauges are used properly, radiation exposure of the general public is not an issue.

Nuclear gauges containing licensed radioactive sources must be disposed of properly. They must not be treated as ordinary trash, recycled as scrap metal, or abandoned. Contact the manufacturer or your state radiation control program for disposal instructions. Some manufacturers also accept gauges for disposal.

Who is protecting you

U.S. Department of Labor (DOL)

The Occupational Safety and Health branch of the DOL issues regulations and standards for the safety of workers in a wide range of occupational settings including construction and demolition. One area of potential hazard to workers is when radioactive material or radiation-generating equipment are not used properly.

U.S. Nuclear Regulatory Commission (NRC)

NRC issues licenses to companies to use nuclear gauges and requires specific safety measures for their use, storage, and disposal.

The States

Each State has one or more programs to address radiation protection issues and respond to and investigate incidents involving gauges with sealed radioactive sources.

Thirty-three states have signed formal agreements with the Nuclear Regulatory Commission, delegating to the states regulatory responsibility over small quantities of special nuclear material and its source and by-products (americium-241 and cesium-137 are by-product materials). These states are known as NRC-Agreement States.

U.S. Environmental Protection Agency (EPA)

EPA's Clean Materials program is investigating the use of new and non-radioactive alternative technologies to reduce the amount of radioactive materials used in industrial gauges.

What you can do to protect yourself

- Handle moisture and density gauges only if you are qualified to do so.
- Keep such gauges under strict supervision when in use and in a secure location when not in use.
- Do not remove the shielding from the sources.
- Dispose of moisture and density gauges according to NRC guidelines.

Resources

You can explore this radiation source further through the resources at the following URL:
http://www.epa.gov/radtown/gauges.htm#resources

We provide these resources on-line rather than here so we can keep the links up-to-date.