Appendix D. X-Ray Fluorescence Lead Analysis Devices.

D-1. Description.

X-ray fluorescence analysis is an acceptable method for measuring the lead content in painted surfaces. It is a clean, non-destructive testing technique which provides immediate results. X-ray fluorescence analysis devices (XRFs) employ a sealed source of radioactive material. Unfortunately, the regulation of XRFs is permeated with inconsistencies. For example, many models of XRFs contain a sealed NARM source which is not regulated by the U.S. Nuclear Regulatory Commission (NRC) but which *may* be regulated by an Agreement State (AS). Additionally, XRFs may be either generally licensed (G), specifically licensed (S), or both (B) (which, actually, means *either* generally licensed or specifically licensed - this is left to the discretion of the licensing agency which has jurisdiction). Prior to purchasing or renting an XRF, the agency which has jurisdiction in the proposed use location (either the NRC or an AS) should be contacted to determine regulatory requirements.

D-2. Dose Potential.

a. Most persons are not aware that radiation dose-rates from XRFs *can* be significant. Dose-rates, with the shutter open and in the unattenuated beam, for selected XRFs are given in Table D-1.

Table D-1
XRF Instruments

DEVICE (Model)	ISOTOPE	ACTIVITY (mCi)	SURFACE (mR/hr)	@ 12 INCHES (mR/hr)
Warrington Microlead I (G)	Cobalt-57	10.8	180	6.0
Niton XL Model 309 (S)	Cadmium-109	10	(Not available)	10.44
Texas Nuclear Metallurgist (B)	Iron-55 Cadmium-109	45 5	2900 232	50 50
Scitec FA1C (S)	Cobalt-57	40	(Not available)	29.3
Texas Nuclear Products Model 9290 (B)	Iron-55 Cadmium-109 Americium-241 Curium-244	100 10 10 100	375,000 13,000 1,000 9,600	188 14 1 10

b. According to the Registry of Radioactive Sealed Sources and Devices, the dose rate on the surface of the Warrington Microlead I (a device which may be *generally* licensed) is 5 mR/hr with the shutter closed. The need for extremity monitoring (that is, finger or wrist TLDs) should be evaluated for users of XRFs.

D-3. NRC Requirements.

a. Whether an XRF is generally licensed, specifically licensed or even if the device is rented, each user of an XRF has distinct responsibilities. Pursuant to NRC and AS regulations, any person who uses an XRF:

(1) shall assure that all labels on the device are maintained;

(2) shall assure that it is tested for leakage of radioactive material at required intervals;

(3) shall assure proper operation of the on-off mechanism, if any;

(4) shall suspend operation of the XRF upon occurrence of (or an indication of) failure or damage to the shielding or the on-off mechanism;

(5) shall suspend operation of the XRF upon detection of 0.005 microcuries or more of removable radioactive material;

(6) shall neither abandon nor export the XRF;

(7) shall not transfer the XRF to a general licensee except where the device remains in use at a particular location and, when in storage, is in the original shipping container; and,

(8) shall report radiation incidents, theft, or loss.

D-4. Specific Licensees.

a. An XRF specific licensee, or a person who rents a specifically licensed XRF, will have to fulfill radiation safety and XRF operation training requirements. An eight hour course will satisfy most regulatory agencies. The course may be provided by the XRF manufacturer, a consultant, or you may contact the HTRW-CX to discuss training needs.

b. There may be no training requirements for an XRF general licensee. In this situation, it is strongly recommended that XRF operators are at least made aware of the rudiments of radiation safety and XRF operation in order to ensure that occupational doses and doses to the general public are kept ALARA.

D-5. Safety mechanisms.

a. The engineering safety mechanisms differ significantly from device to device. For example, both the Scitec FA1C and the Texas Nuclear Metallurgist must be manually operated to place the source in the open and closed positions. Neither requires a sample to be in place to expose the source.

b. Conversely, the Warrington Microlead I, the Niton XL Model 309, and the Radiation Monitoring Devices, Inc. Model LPA-1 require the face plate of the probe to be pressed against a hard surface before the source can be exposed. The Radiation Monitoring Devices, Inc. Model LPA-1 also has two independent circuits which must indicate the same shutter position status for the system to operate.

c. Users of XRFs must be aware that these devices have varying safety mechanisms. Prior to use, a person should know how the shutter operates, whether the device has any alarms and what those alarms indicate, and what steps to take in the event of a power failure.