

Attachment 2

Correlation Curves of

Instrument Response to Measured

Soil Activity

Deployment of *in situ* Radiation Analysis Technologies at BNL

Preliminary Comparisons

During recent months, *in situ* analysis technologies have been used at BNL under a DOE Accelerated Site Technology Deployment (ASTD) project in support of various decommissioning activities at the Brookhaven Graphite Research Reactor (BGRR). Details on the ASTD Project, "Deployment of Innovative Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites" can be found at the BNL D&D website: http://www.dne.bnl.gov/ewtc/d_d.htm

In situ technologies have several advantages in D&D projects:

- radioactivity can be monitored remotely, reducing personnel exposures;
- by looking at larger sample sizes, they provide improved characterization of heterogeneous distributions of contaminants; and
- under local control, they usually provide faster turn-around times, leading to lower analytical costs and schedule acceleration.

At BNL, two innovative technology instruments are being fielded and evaluated:

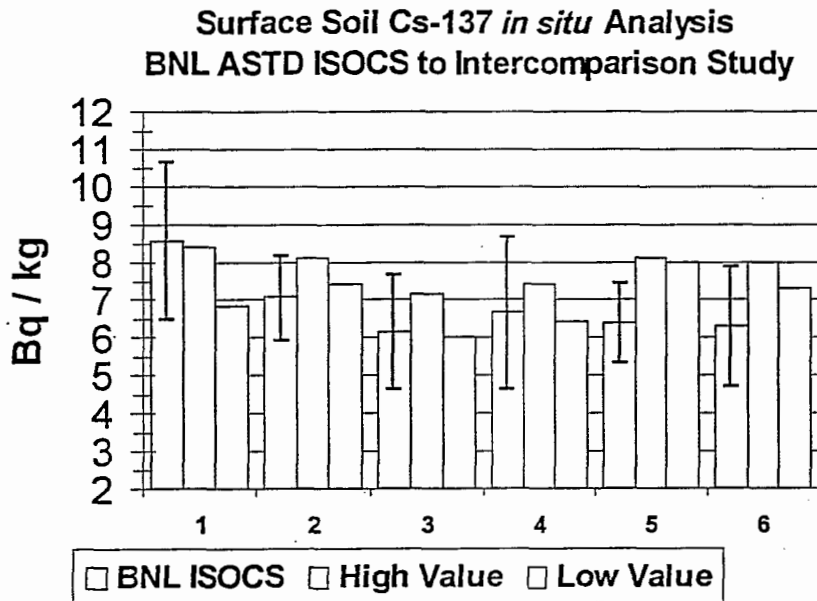
- a. Canberra ISOCS Instrument. This is a field deployable gamma spectroscopy system, using a broad energy germanium detector for efficient response over the range 30 keV to 3 MeV. The spectroscopy system uses recognized technology to perform *in situ* gamma spectrum accumulation. In a new application, the detector is mathematically "characterized" using Monte Carlo statistical modeling to enable quantified analysis of complex geometrical objects without the need to fabricate calibrated sources.
- b. BetaScint Instrument. This field laboratory instrument uses layered ribbons of beta-sensitive phosphors, fiber optics, photo-multiplier tubes and coincidence circuitry to enable rapid, quantified analysis of Sr-90 and U-238. The instrument has a detection sensitivity of approximately 1 pCi/g and provides results in minutes, instead of the 1-4 weeks of the conventional laboratory techniques.

In situ technologies have applications to support three phases of decommissioning actions:

- Pre-D&D scoping surveys for health and safety planning,
- During D&D operations to control advance and determine material disposition, and
- Post D&D final status survey for regulatory compliance.

At BNL, innovative technologies have been used in scoping surveys and during D&D actions to control the limit of excavations and to segregate materials for disposition. Due to the BGRR Project schedule of D&D activities, an opportunity for final status surveys has not yet presented.

Data packages are being accumulated to demonstrate and compare the use of innovative technology instruments with baseline characterization techniques. Several of these comparisons are previewed below. Detailed descriptions of the methods, analysis parameters and results will be presented in a future paper.

1. ISOCS *in situ* vs National Intercomparison *in situ*

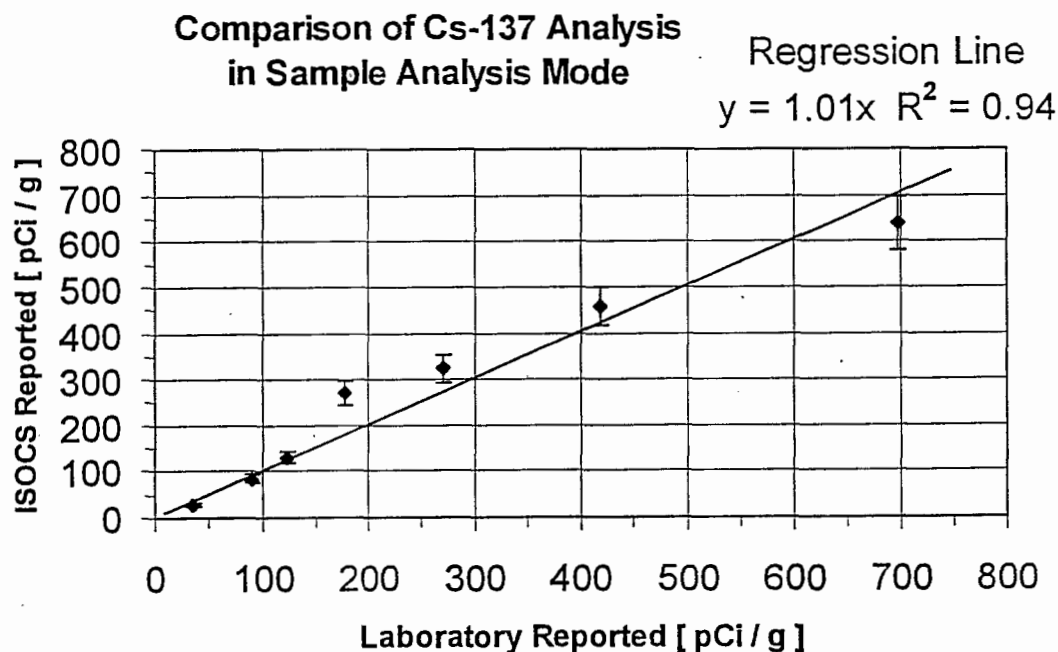
BNL measurements are compared to an intercomparison study conducted by DOE Environmental Measurements Laboratory in 1997. In the 1997 study, each of six field positions was measured by two of the six participants in the study. In 1999, BNL ASTD went to the site and measured each of the six field positions with the ISOCS instrument. Graph indicates excellent agreement of BNL ISOCS with of the 1997 study.

2. ISOCS sample Analysis vs Laboratory Sample Analysis

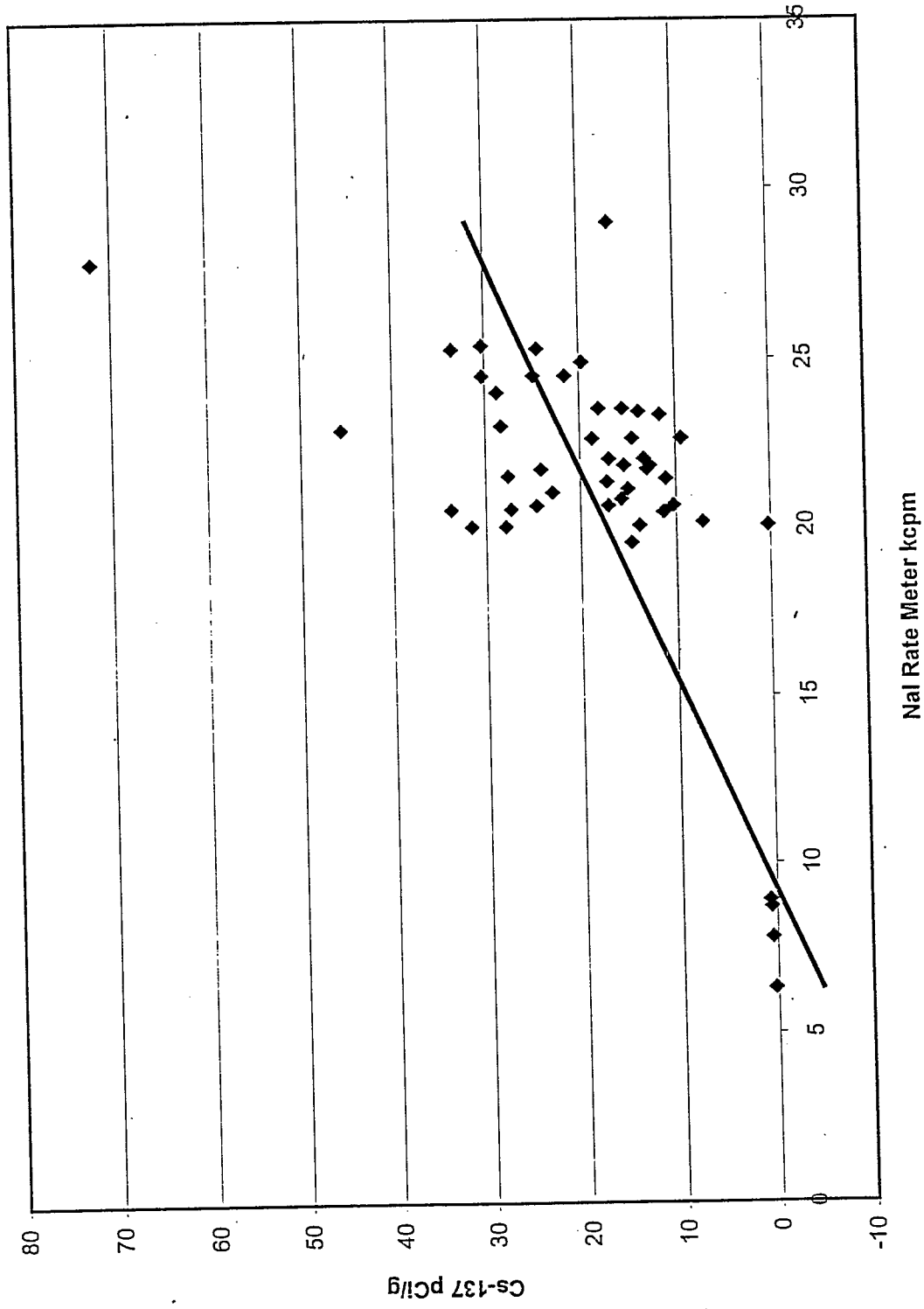
ISOCS Reported: In Situ Object Counting System used in sample analysis mode; 1 liter poly bottle of soil in field-mobile shielded enclosure; results available in 15 minutes.

Laboratory reported: Analysis of soil samples in remote laboratory; 150 gram sample in low-background shielded chamber; results available in 15 days

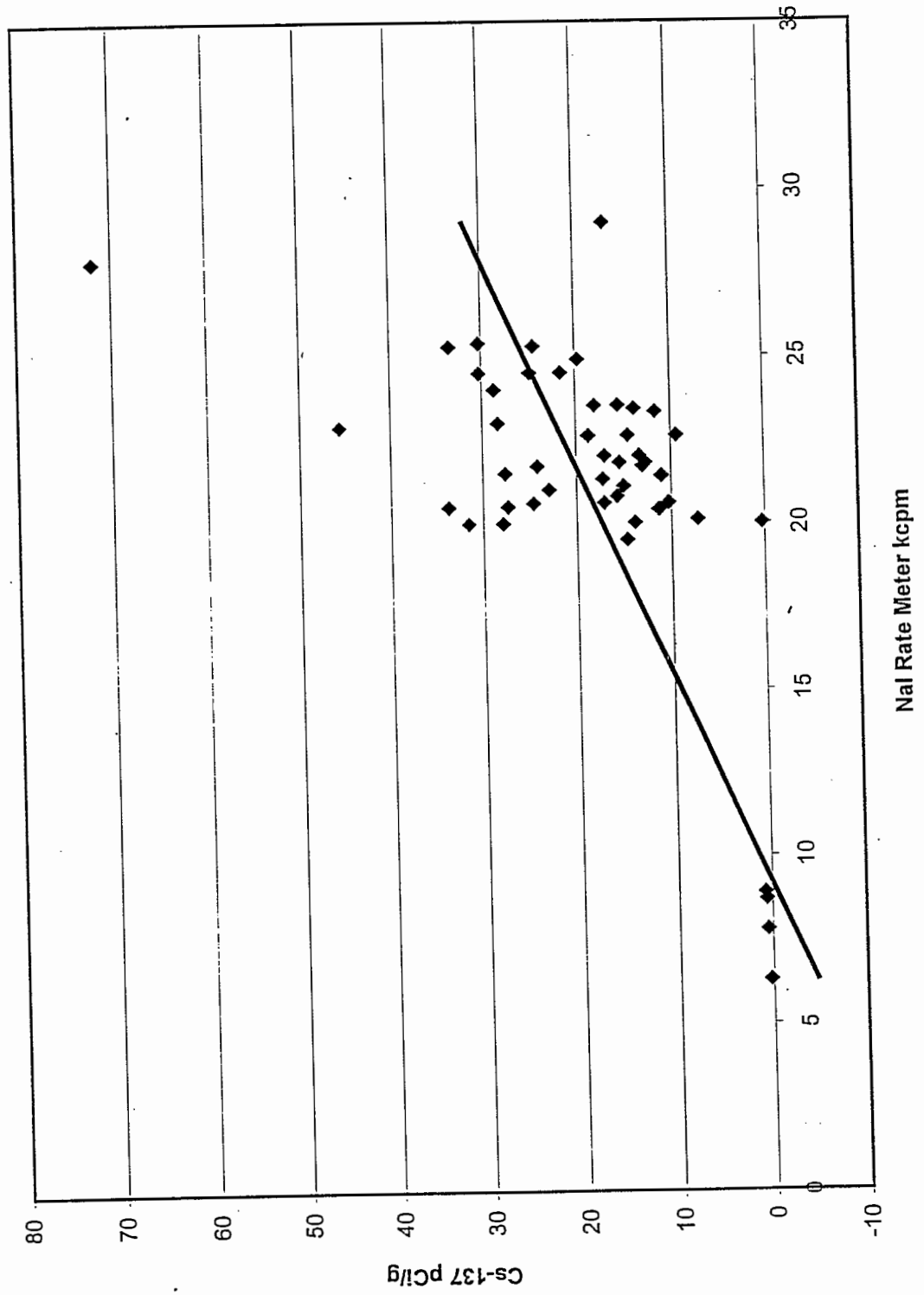
Graph demonstrates excellent agreement of BNL ISOCS with the laboratory results.



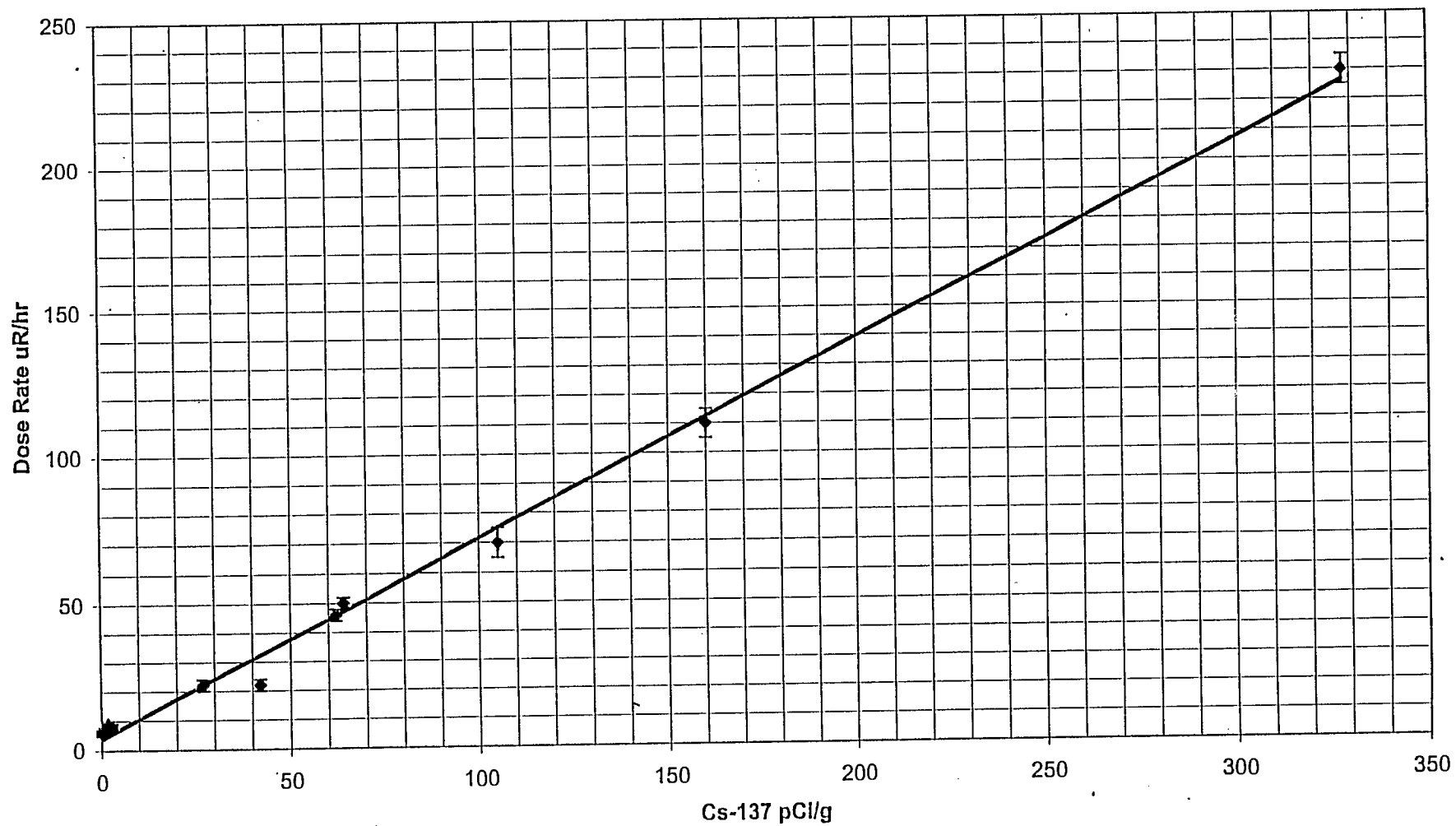
Cs-137 vs Nal rate meter



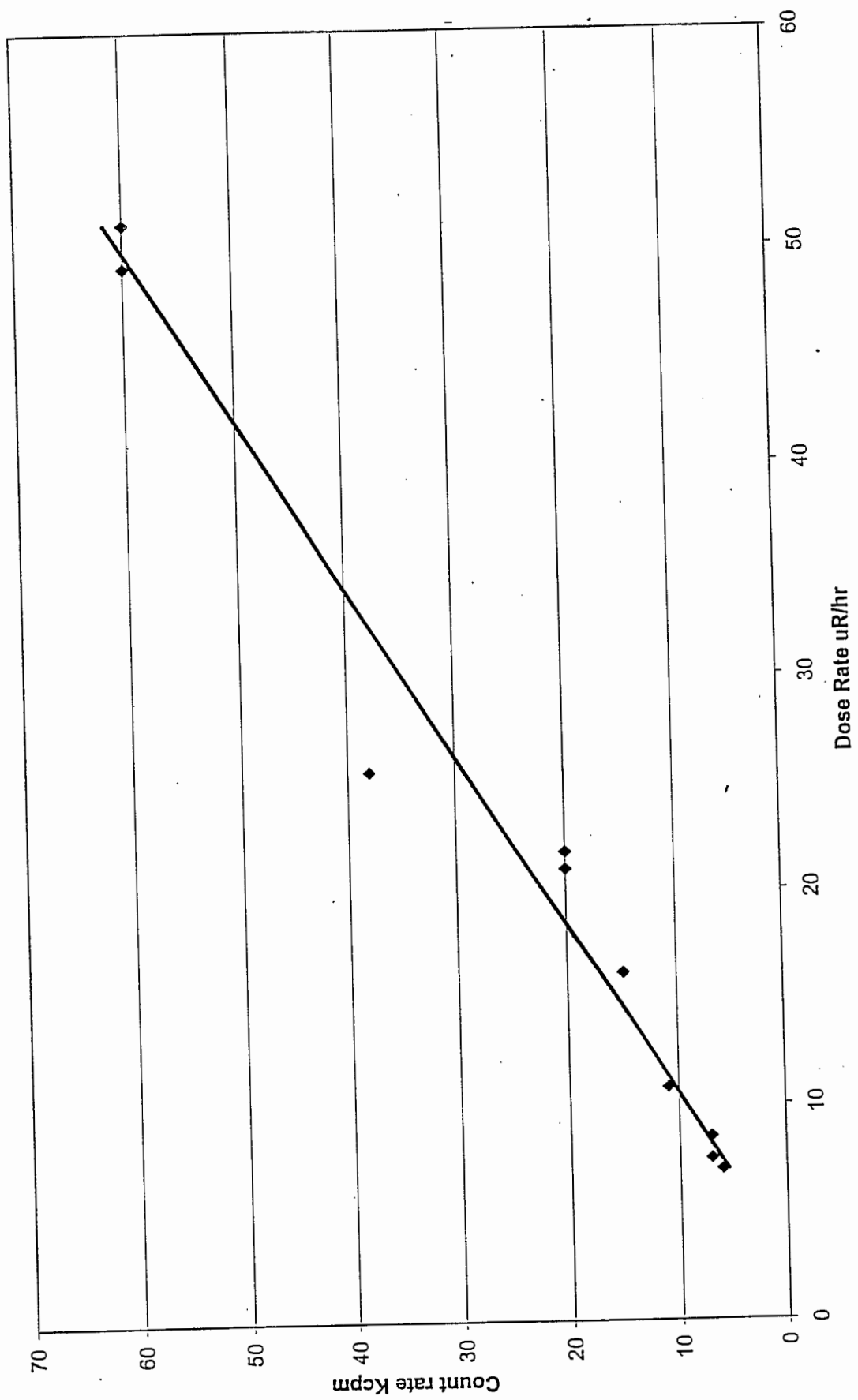
Cs-137 vs Nal rate meter



Dose Rate vs Cs-137
@ 2 inches
uR Meter



Eberline vs Ludlum



Comparison of Cs-137 Analysis ISOCS *in situ* vs 0"- 6" samples

