Background Information on Battelle's Radioanalytical Laboratory:

Battelle had an on-site radioanalytical laboratory (RAL) that supported the Battelle Columbus Laboratories Decommissioning Project at the West Jefferson, Ohio site. The RAL was accredited to the National Environmental Laboratory Accreditation Conference (NELAC) standard in 1996. The purpose of NELAC was to foster the generation of environmental data of known and documented quality through an open, inclusive, and transparent process that is responsive to the needs of the community.

The RAL also participated in the United States Department of Energy (USDOE) Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP). The QAP is an external assessment of environmental radiological analyses. Since 1994, the RAL consistently maintained a ninety plus percentile rating for the QAP proficiency test samples. Since 1998, the RAL received 100% accuracy overall on the QAP proficiency test samples. The analyses performed included gross alpha and beta in water, and isotopic analyses for Co-60, Co-57, Am-241, Cs-137, Cs-134, Pu-238, Pu-239, Sr-90, U-234, U-238 radionuclides in soil, water, vegetation, and air filter matrices. These ratings and the analysis performed are comparable to over 150 laboratories that participate in each QAP proficiency test sample study.

In February 2004, this laboratory function was assumed by USDOE contractors who hired two former Battelle staff for the laboratory. The staff were already trained on the analytical procedures, quality control methods, and instrumentation.

RAL Reporting of Minimum Detectable Activities (MDAs) in the Annual Site Environmental Report:

The MDA is the *a priori* net activity level above the critical level (dependent on background activity) that an instrument can be expected to detect 95% of the time, and is used when stating the detection capability of an instrument. Historically, the annual Site Environmental Reports recorded sample values as "less than MDA" when radioactivity detected could not, with 95% confidence, be distinguished as "above background." MDA values are specifically dependent on the natural background activity for each isotope in question, instrument counting efficiencies, and count times for each sample. The on-site lab was located in building JN2, this was a shielded (brick and concrete walls) facility reducing natural background radiation. The location changed to a mobile lab (trailer) in late fall 2004 and at times backlogged environmental samples were contracted out to other labs for analyses. Thus, the reported MDA values may be different for similar samples depending on whether analysis was contracted or not within the last few years of the remediation project. Some higher MDAs were reported as a result of changes in the provider of analysis in the annual Site Environmental Report.

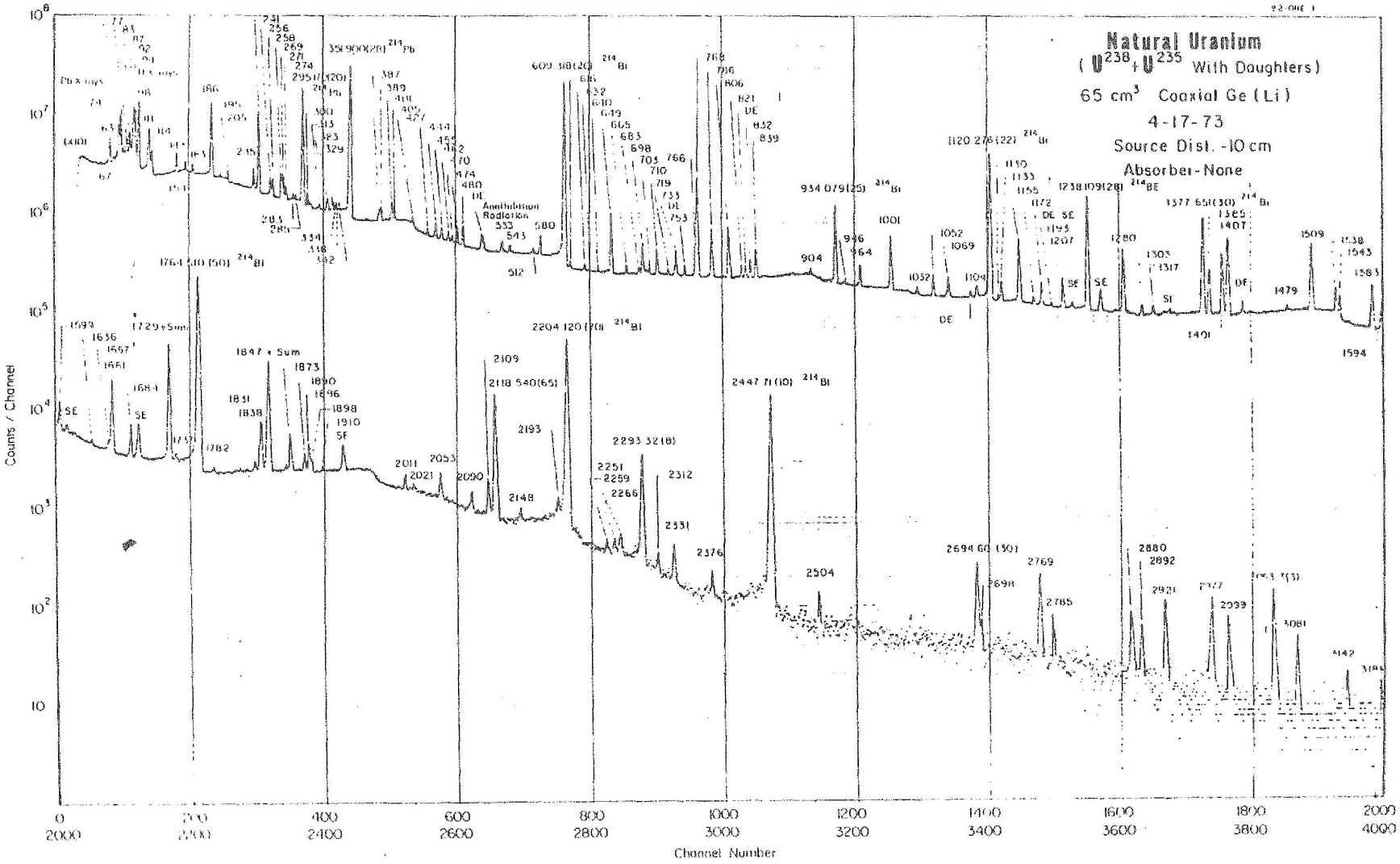
Use of Alpha Spectroscopy versus Gamma Spectroscopy for Detection of Radionuclides such as Uranium Isotopes:

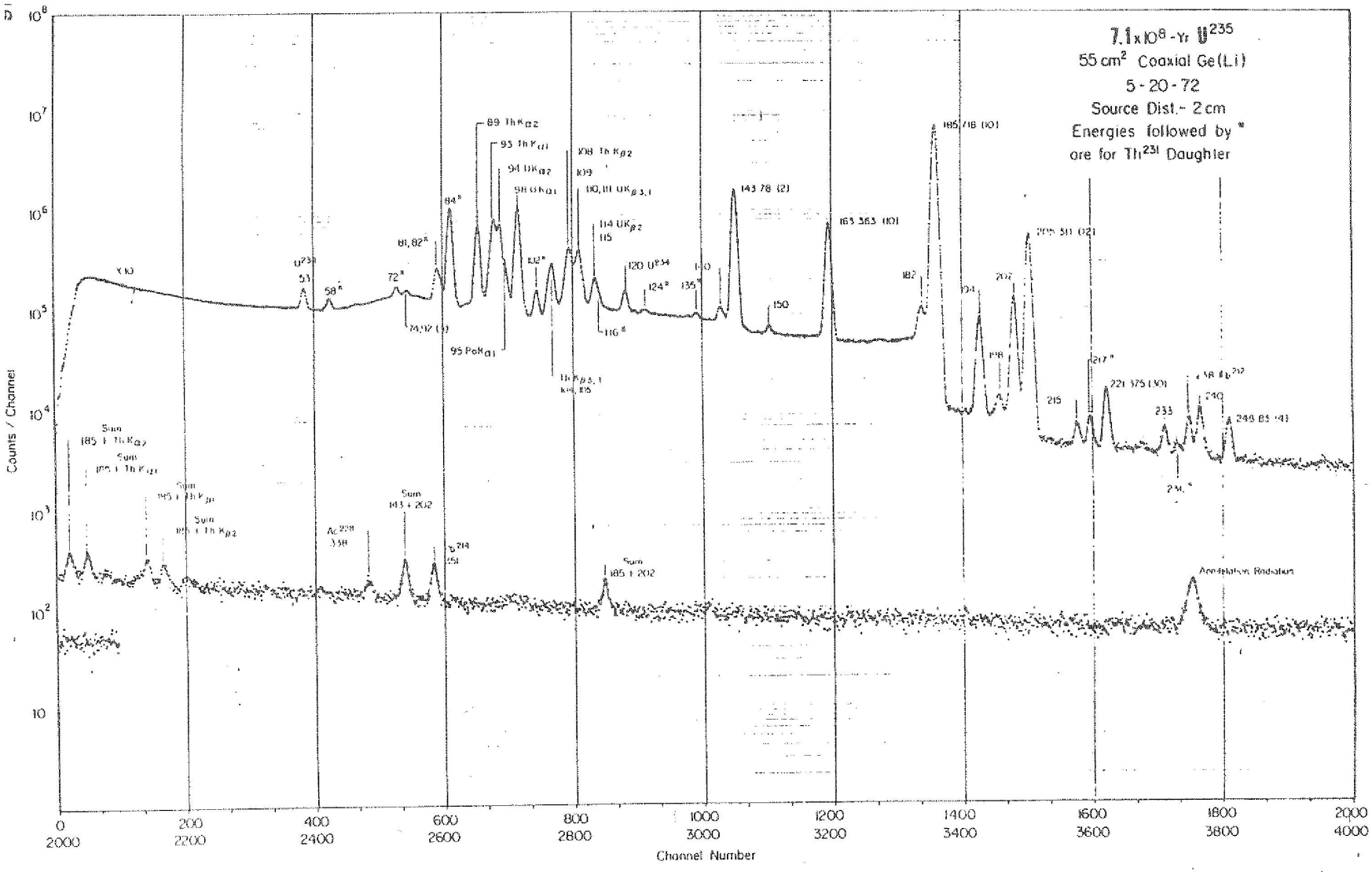
Historically, both uranium gamma spectroscopy and uranium alpha spectroscopy (in conjunction with advanced radiochemical separation technology) sample results have been reported for environmental samples collected at and around the West Jefferson, Ohio site in the annual Site Environmental Reports. The uranium alpha spectroscopy data are the results preferred by regulators and Battelle (isotopic separations remove interferences from other radioisotopes) to determine if action levels have been exceeded. Uranium gamma spectroscopy results are used as a quick screening tool to determine if any immediate remedial actions are required. The gamma spectroscopy analyses were performed on unfiltered water samples. Gamma spectra for pure samples of natural uranium and uranium-235 have been included on pages 3 and 4. A typical gamma spectrum from a sample containing cobalt-60 and cesium-137, as well as uranium and

other naturally occurring isotopes is presented on page 5. Uranium isotopes and radioactive decay daughters emit low energy gamma rays that are located in the Compton Continuum found to the left of the Cs-137 peak (see gamma spectrum on page 5) in the gamma spectrum. The higher background in the low energy region (due to Compton Scattering from gamma rays giving up only a portion of its energy to an electron) causes higher MDAs to be reported for isotopes such as uranium, i.e. the ability to resolve quantitatively significant peaks for uranium isotopes is diminished. For this reason, chemical separation of alpha emitters such as uranium, plutonium, and americium are required to isolate specific elements (such as the uranium isotopes shown in the alpha spectroscopy spectrum on page 6) in the sample to minimize interferences between multiple alpha emitting nuclides. In order to account for the inevitable loss of sample during separation, a known quantity of a specific (non-naturally occurring) uranium isotope, or tracer (such as U-232 shown in the natural uranium alpha spectroscopy spectrum on page 6), is added to the sample. Since all isotopes of an element behave chemically alike, the percent tracer lost in the chemical processes is equal to the percent of sample lost. In summary, alpha isotopic separation and counting techniques are the preferred method for accurate reporting for alpha emitting radionuclides such as uranium, plutonium, and americium.

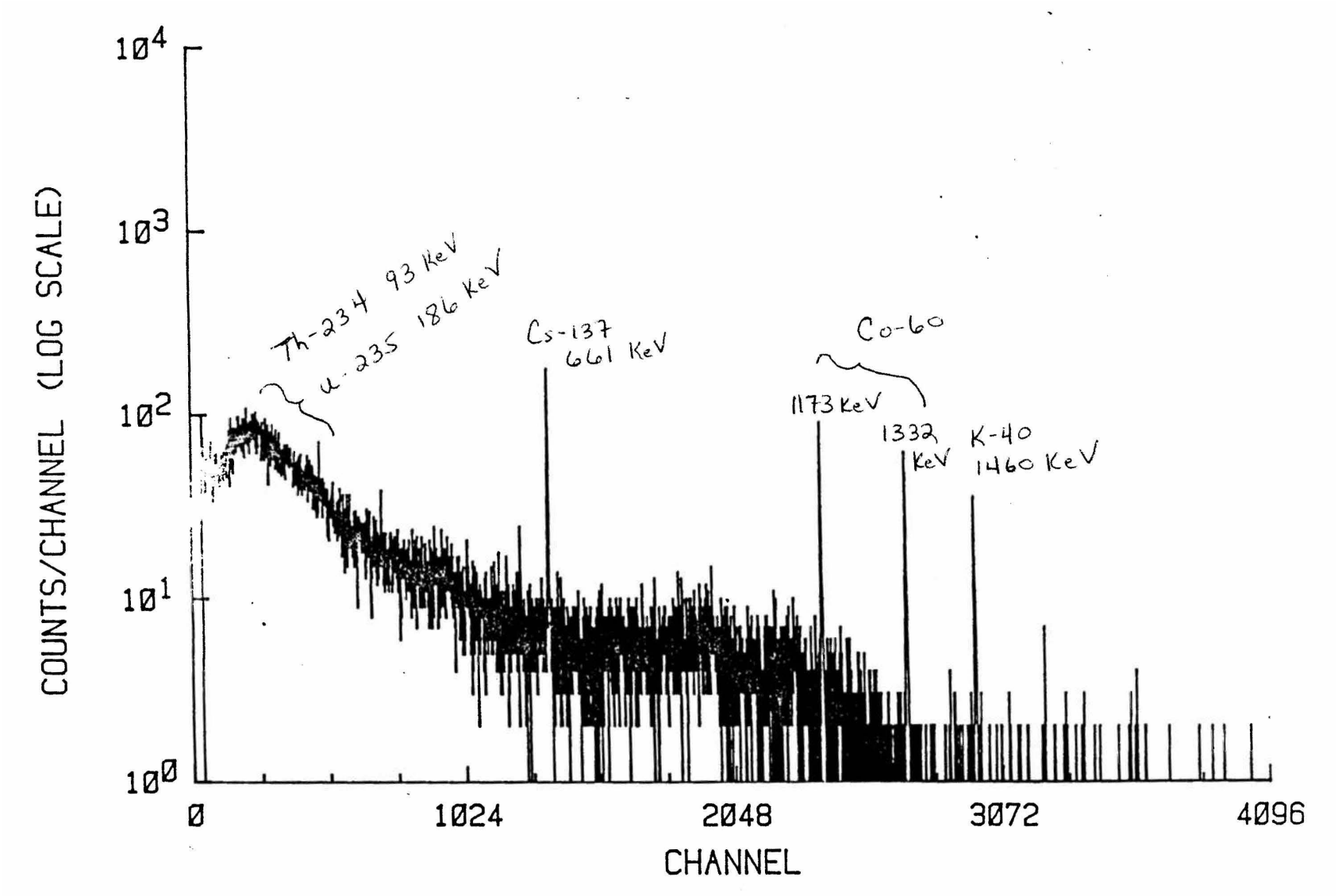
Applying the Gross Alpha Drinking Water Standard Limit to Gamma Spectroscopy Results (such as Am-241):

The gross alpha drinking water standard limit of 15 picoCuries/Liter (pCi/L) cannot be compared against a gamma spectroscopy MDA such as the noted 17 pCi/L Am-241 activity. The gamma spectroscopy result for Am-241 is used for gross screening and it is not intended for use as an analytical tool for the same reason as described in the previous discussion of uranium alpha isotopic versus gamma spectroscopy. Am-241 emits a low energy gamma ray at 60 keV which is located in the Compton Scattering region. Alpha isotopic separation and counting techniques are performed for accurate measurement of Am-241 content in the sample. The USEPA method for analysis of gross alpha in water bases the gross alpha limit of 15 pCi/L on the summation of the contributions from multiple alpha-emitting isotopes, including, but not limited to Am-241, plutonium isotopes, etc. There fore, comparing Am-241 gamma spectroscopy MDA to gross alpha drinking water concentration limit is not only contextually inappropriate, but is extremely non-conservative because it fails to acknowledge that Am-241 is only one of many contributions to the overall limit.

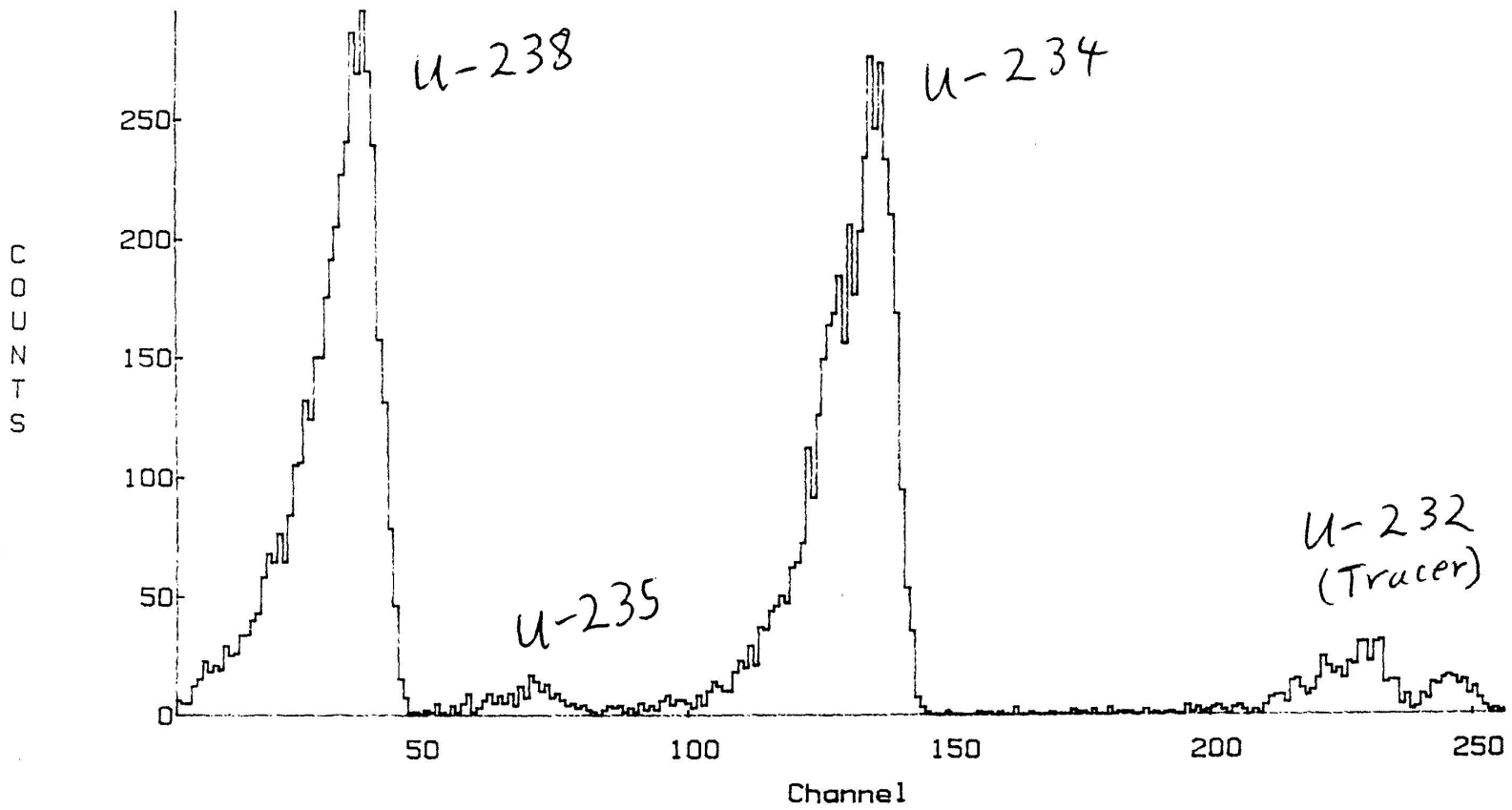

Natural Uranium
(U238 + U235 With Daughters)
65 cm3 Coaxial Ge (Li)
4-17-73
Source Dist. -10 cm
Absorber-None
Annihilation Radiation
Counts / Channel
Channel Number


7.1x10⁸ - Yr U²³⁵
55 cm² Coaxial Ge(Li)
5 - 20 - 72
Source Dist.- 2 cm
Energies followed by * are for Th²³¹ Daughter
Counts / Channel
Channel Number
Annihilation Radiation

Example of Multiple Radioisotopes Screened Using Gamma Spectroscopy



Example of Natural Uranium Isotopic Analysis Using Alpha Spectroscopy



Start Time:	29-JAN-93 15:32	Sample Time:	29-JAN-93 00:00	FWHM Parameters:	
Real Time:	0 16:40:01.00	Sample ID:	10	Offset:	-7.00E+00
Live Time:	0 16:40:01.00	Sample Type:		Slope:	2.00E+00