

CHAPTER 64

Low-Level Liquid Scintillation Counting Workshop

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Two workshop type discussion groups met during and after the International Conference on New Trends in Liquid Scintillation Counter and Organic Scintillators, 1989. Researchers discussed problems of common interest relating to low-level counting technology. The well attended discussions, attesting to the significance of the subject, were lead by Henry Polach. Selected for discussion were topics considered timely and pertinent:

Performance of the New Packard Vial Guard

It was resolved that the performance of the Packard Vial Guard, using vials made of different materials and various cocktails, should be tested in any LS spectrometer fitted with pulse shape analyses. Ed Robertson, Vice President Engineering, Packard, Downers Grove, IL 60515, U.S. would like to receive reprints of published research relating to this subject.

Background and Resolution of Low Count Rate Signals

It was recognized that there is a lack of publications addressing themselves to the: (1) significance of low background in applied research (2) definition of the theoretically attainable detection limit, and (3) testing of the practical resolution limits of weak signals close to background. Many radiocarbon daters, for example, observed contamination with ^{14}C during conversion of infinite age (no ^{14}C) sample carbon to synthetic benzene. Research in these areas is needed.

Low-Level Counting Quality Control and Assurance

It was generally recognized that low level counting, however it is defined and irrespective of type and origin of counters used, is both an art and science. Practitioners agreed that quality control within the laboratories is the only means of giving quality assurance outside of the laboratories. Exchange of

information relating to equipment stability and long term reproducibility of very low count rates, participation in international calibrations and cross-checks, were seen as essential precursors to global validity of radiometric results in all branches of applied sciences.

Application of LS Low-Level Spectrometers to Environmental Studies, Food Quality, and Health Research

The initial usage of the LS technique was confined largely to biological and medical studies using beta particle emitters such as ^3H , ^{14}C , and ^{32}P ; it was extended, only at a later stage, to environmental, chronological or isotope origin, abundance, and cycle type studies. Instrumental development included evolution from fixed window counters to multichannel, often multi-parameter spectrometry, pulse shape analysis, alpha and beta particle resolution, low-level spectrometers, software assisted DPM, spectral analyses, and quench corrections. One of the next most significant advances was the development of scintillation cocktails holding water and subsequently, gel scintillants. Applications of the method are now steadily growing with the development of detection techniques for ^{36}Cl , ^{90}Sr , ^{85}Kr , Th, Ra, and Rn isotopes. There is now much interest in the measurement of alpha particle emitting radionuclides, and it is envisaged that LS spectrometry will compete with Geiger-Muller and Gas Proportional counting techniques due to (1) simplified preparation procedures, (2) low inherent background, (3) counting efficiencies approaching 100% and (4) available selective extractants/ scintillants for actinide series elements. However, surface barrier counting techniques are unlikely to be superseded due to their high resolution.

The consensus was that liquid scintillation technology (instrumentation) is now generally ahead of application technology and know-how. Thus increased emphasis needs to be placed on research leading to improved sample separation and usage of modern cocktails leading to wider applications.

User Education

It was recognized by all that manufacturers and experienced researchers need to participate in "user education". The conclusions were as follows:

- Advances in instrumentation, techniques of sample preparation, and development of new applications have reached such a momentum that three years between LS conferences is far too long. Manufacturer supported workshops, lead by experienced researchers, were suggested to fill the gap and would fulfill the educational needs, especially if the workshop proceedings were to be published without the restrictions imposed by larger conferences and research journals.
- Many developments are too well protected by patents and we are now in a situation where the LS technique is rapidly becoming "black-box" technology. The manufacturer will have to accept much more responsibility for presenting information to help their customers.

- It was reported that sales backup leaves much to be desired. The policy of switching the equipment on and presenting the customer with an operations manual is now no longer sufficient.
- There are literature references that the “user friendly hardware and software” did not perform to specifications and/or did produce errors. Yet, in the hands of many (majority ?) these items perform well. “User friendliness” clearly is not a substitute for user experience. It was suggested that peer assistance, rather than sales assistance, would serve better to resolve the problems often caused by misunderstanding of functions and/or design aims.
- The expert customer (user) will need to assist the manufacturer in the production of application oriented manuals. In the past there has been a degree of apathy from the users (eg., Wallac publishes a Quantulus User Club newsletter for which no significant feedback from the user has been received). It is understood that Packard has taken positive steps in having an all embracing low-level manual produced. This is, from the user’s point of view, a very encouraging move.
- Ideally the sales force should receive or have more scientific training. Instrumentation is now so complex (or so new), that during this conference for example, the sales engineers and senior personnel could not demonstrate, explain, or document all the features of the LS counters on their stands. Perhaps some expert users could have made themselves available for consultations, thus contributing to dissemination of knowledge and application of advanced technologies.

CONCLUSIONS

Research literature is, by definition of purpose, very restrictive in documenting “know-how”. The liquid scintillation counting and spectrometry technique and technology covers a vast range of topics, all technically very complex until they are mastered. Increased interaction, communication and exchange of technical and procedural information between researchers is seen as the major key to success; rediscovering the wheel is an unnecessary process! We recommend and will support the organization of workshops (eg., low-level counting) of the kind that lead, through researcher/manufacturer interaction, to user education and production of detailed application oriented manuals.

Comment Made by Henry Polach as Chairman of the Waste Disposal Session.

I was fascinated to hear that as LS users we not only solve problems but also create them. The magnitude of the waste disposal problem that we have created is staggering. The diversity of regulations governing the disposal of the waste is unbelievable.

So, it seems to me that we are both: the scientist and the public, affected by our own activities.

The question that now must be asked, indeed the question that now goes begging is:

“How can we as scientists, as well as members of the concerned public, assist those who seek to assist us?”

I invite Jeane Kreiger from Du Pont to respond.