

It is also worthy to note that any radioactive noble gas may be adsorbed on media of this type. As other noble gases find use in nuclear medicine studies, an activated charcoal gas trap will serve to contain their release.

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A REPLY

I appreciate Mr. Panetta's interest in my letter on xenon traps and must apologize for one error in the letter, that is, the use of the word "absorb" instead of "adsorb." Being a chemist by education, this is an unforgivable error but I must confess that I never could get it right, even in college. *Webster's New Collegiate Dictionary* also led me astray since it gives "charcoal-gas" as an example of absorption.

With regard to the other errors he alludes to, I must take exception and suggest that he reread my letter more carefully because some of the "errors" attributed to me were neither stated nor implied. In order to clarify the situation, I will discuss them in the order in which he presents them.

The type of charcoal used by various manufacturers. My letter does not state that all manufacturers use type G210. It very clearly says, "the activated charcoal used in most units is type G210..." Further, his statement concerning proprietary grades manufactured for them is misleading. Nuclear Associates has used the following types of charcoal in their traps (in chronological sequence); G210 from North American Carbon; AK from Barnebey Cheney; 727 from Barnebey Cheney; and 617 from North American Carbon.

None is a proprietary product and all are available commercially from the companies indicated. It is commendable that they use a charcoal with a K_d of approximately 1200 cc/g, although without giving the rest of the specification, this number has little significance. Assuming that the K_d was determined at the same temperature, concentration, and velocity as G210, their charcoal would adsorb 1.35 billion Ci/kg as opposed to 856 million Ci/kg for G210 of Xe-133. Since we both use multiple kg cartridge packs, both numbers are ridiculous and that was part of the purpose in writing my letter—to demonstrate that Xe-133 adsorption capacity has little or no bearing on the life of the trap. It is impossible to saturate either trap with Xe-133; however, it is inevitable that all traps will saturate so that they can no longer adsorb Xe-133.

The principle of entrapment. My letter does not disagree with Mr. Panetta's on the principle of entrapment. I clearly state "It is important to note that

this activated charcoal will not only adsorb radioactive xenon, but also a tremendous amount of airborne contaminants." Further, "It has no capacity to selectively adsorb xenon in the presence of contaminants..." In this sense, other inert gases would be considered contaminants since the sole purpose of the xenon trap we both supply is to adsorb radioactive xenon.

I must take exception with his statement that other inert gases "poison" the charcoal. Even the novice environmentalist will tell you that the amount of air pollution (hydrocarbons from auto emissions, etc.) far exceeds in g/l the amount of inert gases in the atmosphere. Charcoal traps will be "poisoned" by these pollutants and moisture long before they saturate with inert gases.

An incorrect value for "minute respiratory volume" (MRV) and the need for "expandable interfaces" on gas traps. Classic pulmonary function textbooks list normal minute respiratory volume as approximately 5.9–7.8 l (1); however, these normal values were determined on water spirometers which were in common usage at the time the textbooks were written. A water spirometer for measuring tidal volumes (TV) has the same effect as measuring cardiac output with a highly dampened rate meter. Modern-day spirometers have demonstrated minute respiratory volumes closer to 9 l (2). It should be stressed that all of these normal values are determined at rest. Normal walking can increase this to over 12 l/min.

There are several other aspects that require consideration. The classic textbooks on lung function state that the MRV increases with age, size, and also during illness. During respiratory illness, MRV can exceed 20–25 l/min (3). Since many of the patients subject to this procedure have respiratory illness, what happens to the additional 15–20 l/min if an expandable interface is not used? A third consideration is the momentary volume differences between the patient and the trap. A normal expiration takes approximately 2 sec, and at a TV of 0.5 l the expiration rate is 0.25 l/sec. A pump moving air through a trap at 5 l/min (the specification on the Nuclear Associates Nonex Trap) is moving it at a rate of 0.08 l/sec. Thus, for 2-sec intervals the patient is attempting to put three times as much air through the trap as the trap is capable of receiving. Resistance would rise appreciably unless an expandable interface is used. That Mr. Panetta has overlooked sick people and momentary volume differences is quite significant.

I do apologize for the statement "People normally breathe at a rate of 15 l/min..." It is in error; however, it would be safe to say that people undergoing a lung ventilation study with suspected disease breathe at a rate in excess of 15 l/min, on the average, and that therefore an expandable interface is required. Mr. Panetta's statement that no expandable interface is required indicates a lack of understanding of what lung ventilation is all about.

The regeneration and reuse of a charcoal charge. I do agree, at least in part, with Mr. Panetta on the reuse of charcoal packs and this was clearly stated in my article.

They may not be reused after decay if leakage is caused by saturation with contaminants. However, they may be reused if leakage is caused by excessive air flow.

It is common knowledge that the binding of Xe-133 is a rather loose arrangement. Migration without air flow has been demonstrated by others. We have demonstrated on our trap, the Nuclear Associates trap, and the Atomic Development trap, the chromatographic-like phenomena seen when air is washed continuously over the Xe-133 trapped on the charcoal bed. Subsequent decay of all three cartridges and later reuse revealed no indication of saturation. One can conclude that the leakage which developed had nothing to do with saturation or "poisoning." Statement 6 of the discussion section of my letter stands as written.

I am totally confused by Mr. Panetta's statement that "a monitor on the output of a xenon trap, although good in principle, is an after the fact confirmation of a leakage situation." He then proceeds to describe a procedure where they collect exhaust from the output of a xenon trap and monitor the collected exhaust for radioactivity. I cannot find any difference between these techniques with regard to after-the-factness.

I would like to point out that my statement on this subject (No. 7 in the discussion) was very clear and general in nature, and made no reference to the method of monitoring the traps. The statement was that "the exhaust port of xenon traps should be monitored continuously or at least daily for Xe-133." From Mr. Panetta's statements, I must conclude that he agrees with the "continuous" portion of this statement and I would join with him in urging all users of traps not having a built-in monitoring system to collect *all* the trap effluent in 50 l bags and quantitatively analyze the contents of each bag for Xe-133.

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References

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DOSE CALIBRATOR PERFORMANCE AND QUALITY CONTROL

We would like to comment and provide further information regarding the performance of dose calibrators as reported by Kowalsky, Johnston, and Chan in the *Journal of Nuclear Medicine Technology* of March 1977 (1). Of particular interest is the failure of a CRC-6A dose calibrator (Manufactured for E.R. Squibb

TABLE 1. Calibrator Information

Calibrator	Model	Serial No.	Chamber No.
1	CRC-6A	62326	R-2135
2	CRC-6A	62617	T-836
3	CRC-4	41646	T-900
4	CRC-6A	62617	T-4626
5	CRC-6A	62617	R-2089

& Sons, Inc. by Capintec, Inc.) to remain linear over a wide range of activity.

Our firm has used Capintec calibrators for some time and feels that they are the most reliable and convenient calibrator available. We did, however, experience a situation similar to that of Kowalsky et al. (1), in that a new CRC-6A gave extremely low readings when performing whole vial assays from large Mo-99/Tc-99m generators. During a period of three months we accumulated data on five ionization chambers, which were placed into three dose calibrators. The technical information regarding the calibrator type, serial number, and most importantly, the ionization chamber number is presented on Table 1.

Our primary calibrator (Table 1, No. 1) has proved over a period of a year and a half to provide a linear response up to 1.8 Ci of activity. Since the other calibrators exhibited variation, a comparison of whole-vial generator eluates was undertaken between calibrator No. 1 and each of the other calibrators. The percent difference for each is graphically illustrated in Fig. 1. In all cases the readings were lower than for calibrator No. 1.

It is interesting to note that ionization chambers with Capintec lot designation "T" all exhibited marked nonlinearity, especially in the high-activity range. The two "R"-lot chambers remained linear throughout a wide range of activity showing less than 3% variation. We brought this information to the attention of personnel at

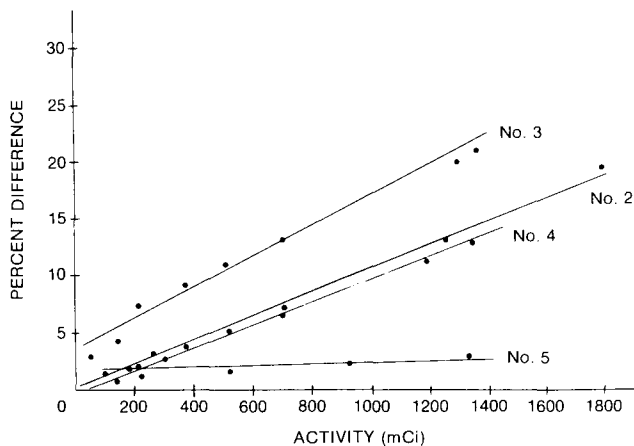


FIG. 1. Comparative calibrator assay of whole-vial generator eluate.