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Acceptance Testing of Gamma Cameras

TO THE EDITOR: The recent article by Murphy provides an excellent summary of the performance parameters that should be measured after an Anger scintillation camera is installed and the quality control procedures that should be utilized to evaluate daily performance (*1*). Although the set of standardized procedures provided by the National Electrical Manufacturers Association (NEMA) (*2*) cannot be performed in its entirety because of computer limitations in most state-of-the-art nuclear medicine systems, the major elements of camera performance can and should be tested. In the last 4 years, I have tested 30 cameras representing all major manufacturers. Only one camera met specifications and that only because it was manufactured before performance specifications were published. My experience is essentially the same as that of Finney et al. (*3*). While the failure of most scintillation cameras to pass acceptance tests may be partly attributed to the high degree of complexity of state-of-the-art instruments, most of the blame must be attributed to inadequate testing by the vendors at the time of installation. This statement is substantiated by the fact that all but a few of the cameras eventually met specifications and passed the acceptance tests. A satisfactory installation should mean more than the simple ability of a camera to provide an image.

Users who wish to perform acceptance tests will need some special equipment such as the NEMA resolution test pattern (*1,2*). In certain instruments they will also need special equipment such as field-of-view masks that are available only from the vendor. In addition, special software may be required to quantitate such parameters as uniformity, spatial resolution, multiple window spatial registration, etc. Some calculations can be performed by hand from data obtained with standard keyboard commands. For example, FWHM and FWTM values can be calculated from listings of numerical values provided by "Profile" or "Slice" commands.

Individuals performing acceptance tests need the complete assistance of the vendor's representatives. For example, in many cameras it is necessary to know the proper combination of correction circuits turned off/on for an instrument to reach the specified maximum count rate according to the NEMA specifications. Similar assistance is needed for measuring other performance parameters.

As Dr. Murphy pointed out, components not detailed in the NEMA protocols must also be tested. These include collimators, whole body scanning mechanisms, electronic formatters, magnifier/rotator circuits, etc. In my experience, vendors are usually willing to correct problems even if they are not subject to detailed specifications.

The article by Dr. Murphy comes at an appropriate time. The recent improvements in Anger camera technology will only bring added benefit to the patient when these instruments are operating to the full extent of their capability.

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Early Description of "Bull's-Eye" Plot for Emission Cardiac Tomography

TO THE EDITOR: We are pleased to note the growing acceptance of the "bull's-eye" plot for displaying tomographic thallium-201 data, as exemplified in L. Holman's keynote address at the 1987 Annual Meeting of the Society of Nuclear Medicine. We are also pleased that Caldwell et al. at the University of Washington and Garcia et al. at Cedars-Sinai were acknowledged by Dr. Holman for their early recognition of the merits of the bull's-eye approach to data presentation (*1,2*). However, we feel it is important to point out that the bull's-eye method was actually developed earlier by Johnson, Kirch, Hasegawa, Sklar, Hendee and Steel at the University of Colorado and Denver Veterans Administration Hospital. This technique was described at the 1981 Western Section meeting of the Society of Nuclear Medicine, the 1981 Annual Meeting of the Society of Nuclear Medicine, and the 21st Annual Meeting of the American Association of Physicists in Medicine (*3,4*). A paper describing the bull's-eye method, submitted in 1981 to *The Journal of Nuclear Medicine*, was rejected for publication. We did not, unfortunately, pursue publication further, which may explain why this early presentation of the method is now obscure.

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Cost-Effectiveness of Reducing Radon in Homes

TO THE EDITOR: In the article on Indoor Radon in the Newsline Section of your July 1987 issue (*1*), there is a call for a cost-benefit analysis of radon activities. Let me offer one here: At least one out of ten houses has a radon level above 4 pCi/L, and the average level in these houses is ~8 pCi/l. Finding this one high radon house would require ten tests costing ~$120; confirming and discarding false-positives would raise this cost to ~$200. Reducing the radon level by 4 pCi/L (say from 8–4 pCi/L) costs an average of ~$1,200, bringing the total cost to $1,400.

Reducing radon levels in a house by 4 pCi/l reduces the mortality risk for each inhabitant by at least 1% (*1*); if we assume six inhabitants per house, there is a 6% probability that this $1,400 will save a life, which gives a cost of $1,400/0.06 equaling $23,000 per life saved.

Typical costs (*2,3*) for cancer screening and highway safety programs are ~$100,000 per life saved. Protecting the public from radiation in other contexts is much less cost effective—the "$1,000/man-rem" rule on routine emissions corresponds to $8 million per life saved, removing natural radium from drinking water according to EPA requirements costs $5 million per life saved, and radioactive waste management and nuclear power plant safety are costing billions of dollars per life saved (*2,3*).

With this perspective, it is difficult to see how one can question the cost-effectiveness of the $23,000 per life saved being spent on the problem of indoor radon in homes.

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REPLY: Dr. Cohen's figures are most interesting and his point is well made. Unfortunately, there is some resistance in the public sector to programs of radon detection and remediation. One of the major causes is the fear among home owners that something expensive will be found. The calculations clearly illustrate a societal benefit to such a systematic approach, but are of much less comfort to the individual home owner potentially faced with having to pay $1,400 to reduce the levels of radon in his basement to levels considered acceptable by EPA.

The figure of $1,400 is an average. Radon can never be completely eliminated, but the point should be made that, in many homes, major reductions can be achieved with little inconvenience and far less expense. Cohen (*1*) himself has calculated the multiplicative effects of insulation, etc., on radon levels. It is possible to use his concept in reverse. Concentration of radon depends on rates of ventilation and replenishment. By doubling the rate of air exchange, say by a small exhaust fan, one could reduce levels by 50%. Further, by retarding ingress of radon by 3.8 days (the physical half-life of radon-222), a similar halving should occur. This can often be accomplished by very simple means such as covering holes or sealing porous foundations with a heavy latex paint, repairs easily and inexpensively performable by the home owner himself.

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Thyroid Cancers in Atomic Bomb Survivors Exposed in Youth: 30-Year Follow-up Study

TO THE EDITOR I read with interest the article (*1*) by Morimoto et al., and would like to know the clinical courses of the well-differentiated thyroid cancers detected in the eight females of Nagasaki and Hiroshima, because we know from a previous study that despite the high prevalence of occult thyroid cancer the Japanese have a very low incidence and death rate of thyroid cancer (*2*). Further, they quoted the carcinogenic radiation dose range as 6.5–1,000 rad, whereas recent reports of thyroid cancers follow high dose radiation, e.g., Kaplan (*3*) treated two patients of thyroid cancer, one of which occurred six years after cervical irradiation of 5,000 rad for upper mediastinal Hodgkin's disease and the second, 20 years after neck irradiation of 6,000 rad for a parotid tumor.

We are also interested to know whether the reported differences in the serum thyroglobulin levels (higher in Nagasaki than in Hiroshima) could be explained by dietary factors e.g., iodine nutrition, as it is known that iodide excess may predispose to papillary thyroid cancer (*4*).

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