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October 1, 1979



Secretary of the Commission  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

ATTENTION: Docketing and Service Branch

Dear Sir:

I read, with interest, the recent draft regulatory guide entitled "Audible Alarm Dosimeters." Though I can see that there may be difficulties associated with these devices in the industrial environment, I would not like to see the Nuclear Regulatory Commission discourage the use of these devices in the medical field. We have had excellent experience with these in diagnostic radiology and I am sure that they would be just as valuable in nuclear medicine departments. I am enclosing a copy of a paper which will be published in the near future in the American Journal of Roentgenology concerning our experience.

Again, I would urge NRC not to discourage the use of such devices when used as secondary monitoring devices in diagnostic radiology and nuclear medicine.

Sincerely,

*Joel E. Gray*  
Joel E. Gray, Ph.D.  
Department of Diagnostic  
Radiology  
Mayo Clinic  
Rochester, MN 55901

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Enclosure

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17 Department of Diagnostic Radiology, Mayo Clinic and Mayo Foundation, Rochester, MN 55901.

## Radiation Awareness and Exposure Reduction with Audible Monitors

Joel E. Gray

The monitoring of radiation exposure to individuals working in diagnostic radiology is usually carried out with film badges or thermoluminescent dosimeters. Though these cumulative exposure readings provide useful information, it is retrospective and of little value in educating staff in avoiding or reducing hazards.

Small (about the size of a pack of cigarettes), inexpensive (about \$125) radiation monitors that emit an audible "chirp" on exposure to a predetermined amount of radiation are available from several firms. Most of these devices use a Geiger-Mueller tube as the radiation detector and, consequently, are not suitable for quantitative measurements in the diagnostic range. However, due to their extreme sensitivity they are ideal for use in a radiation awareness program in diagnostic radiology. At the same time this extremely high sensitivity may cause the users to become apprehensive about an apparent lack of protection unless adequate education is also provided, with the sensitivity of the monitor being demonstrated and put into perspective.

### Characteristics

Audible monitors whose sensitivity, according to the manufacturer, results in one chirp for each 0.25  $\mu$ R (as measured at 662 keV) are ideal for use by technologists, nurses, and residents (who are not doing fluoroscopic examinations). For radiologists and residents doing fluoroscopic procedures, a lower sensitivity (one chirp for each 10  $\mu$ R) is desirable.

When first attempting to use the audible monitors here, it was found that the high volume of the chirping was distracting. In one model "chirpie" evaluated, the manufacturer supplied information that allowed insertion of a variable resistor in series with the speaker to reduce the volume. Since similar information was not available from the other manufacturer, it was discovered that removing the speaker, which is glued directly to the plastic case, and remounting it with silicon rubber sealant reduced the volume to an acceptable level. This manufacturer has since provided a prototype unit with a volume control which should be for sale in the near future. The lowest volume setting is almost inaudible to everyone in the room except the wearer.

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in CM

9/26/79

OK as revised  
Joel Gray

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Applications

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Each new resident in the department was given one of the audible monitors for the first 3 months of their training after an initial introduction to radiation safety, and a demonstration and discussion of the use of the monitors. Their film badge readings were compared to those of residents in the previous year who had not used audible monitors. There was a 65% reduction in radiation exposure during the first month of training when most were observing fluoroscopy daily. A 30% reduction was noted during the second month

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71 of residency for the group using the audible monitors. Since  
72 the number of participants was small (7 residents without  
73 monitors and 10 with monitors) and since the assignments  
74 for the two groups may not have been identical during their  
75 first 2 months, this can only be considered a pilot study.

76 Taking the overall average for the 2 month period there is  
77 a 47% reduction in exposure for the group with the audible  
78 monitors. It is believed that these reductions are significant  
79 and that the audible monitors have provided the residents  
80 with an immediate awareness of radiation safety in the  
81 clinical environment.

82 Radiologists and cardiologists here periodically use the  
83 audible monitors with general interest and acceptance. Sev-  
84 eral radiologists, including some of the more senior staff,  
85 have stated that they have changed the way they do fluor-  
86 oscopy (primarily where they stand) since they are now able  
87 to immediately determine the higher radiation areas around  
88 the table. Likewise, the cardiologists have stated that they  
89 have changed their techniques somewhat in order to reduce  
90 their exposure as a result of using the audible monitors.

91 If one of the female staff advises her supervisor that she  
92 is pregnant, she is immediately provided with weekly moni-  
93 toring by the institution's radiation safety office. In addition,  
94 she is provided with an audible monitor, after her work and  
95 exposure history are reviewed and aspects of radiation  
96 protection are discussed with her. (It is important to stress  
97 that these monitors are extremely sensitive to radiation and  
98 are not quantitative. Only the weekly and monthly film badge  
99 reports should be used for quantitative purposes.)

100 Quality control technologists and radiologic physicists  
101 carry the monitors with them at all times. This has resulted  
102 in locating several potential radiation safety problems. For  
103 example, a poorly designed Bucky slot cover was discov-  
104 ered on a new fluoroscopic table during acceptance testing  
105 as a result of the increased chirping rate of the audible  
106 monitor.

107 In addition to some personnel using the monitors on an  
108 ongoing basis, audible monitors are provided to individuals  
109 receiving exposures in excess of normal levels as deter-  
110 mined from their film badge reports. (These normal levels  
111 are chosen as 200 mrem/month for technologists and 500  
112 mrem/month for residents, radiologists, and cardiologists.)  
113 Each individual is asked, after wearing the audible monitor  
114 for 1 month, if they can indicate why they believe that they  
115 may be receiving exposures higher than normal. Such in-  
116 formation can then be used to determine if the work habits  
117 of the individual should be modified, or if additional shielding  
118 is required on a particular piece of equipment. (This resulted  
119 in locating a fluoroscopic unit in a special procedures room  
120 that was operating at three times its normal exposure level,  
121 and an old fluoroscopic table with no Bucky slot protection.)  
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#### 123 Discussion

124 Audible radiation monitors provide an immediate non-  
125 quantitative feedback concerning levels of ionizing radiation  
126 in the clinical setting. Their use and early radiation safety  
127 training has resulted in an exposure reduction to residents  
128 during their first 3 months of training. In addition, several  
129 potential radiation safety problems have been discovered as  
130 a result of the use of personal audible radiation monitors by  
131 other members of the department. Audible radiation moni-  
132 tors can provide a significant benefit in a radiation aware-  
133 ness and exposure reduction program.

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