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Microwave Dosimeter: A Concept

The problem:

To design a device that will detect and measure the time-integrated radiation dosage to which an individual is exposed. The device should be so designed that the wearer would receive an exposure measurement representing an average of the dose over the entire body.

The solution:

A microwave dosimeter for determining time-integrated radiation dosage. Variation in a dc electric current produces a shift in the pH of an acid solution, causing a color change in an indicator cell. The integration is measured chemically in proportion to radiation detected by microwave electronics components.

How it's done:

The proposed microwave dosimeter would be similar in performance to the well-known pocket-carried nuclear radiation gage. The device (Figure 1) consists of an omnidirectional antenna unit, an electronics module, an integrator detector, and a battery for the electronics.

The antenna is designed to capture sufficient radiation energy to drive the electronics signal conditioner. A dipole antenna (short relative to the radiation wavelength) has a toroidal-shaped power pattern, where the dipole axis is normal to the equatorial plane of the toroid. Four dipoles, arranged as shown in Figure 2, provide an omnidirectional pattern for circularly polarized radiation. Since the radiation wavelengths to be detected are in the 1-to-10 centimeter range, the dipole antennas which are short in comparison to those wavelengths will be physically unobtrusive and conveniently packaged.

In the electronics module, energy intercepted by the antenna is fed through a diplexer to a full-wave rectifier. A signal conditioning section sufficiently amplifies the rectified signal to operate the integrator detector.

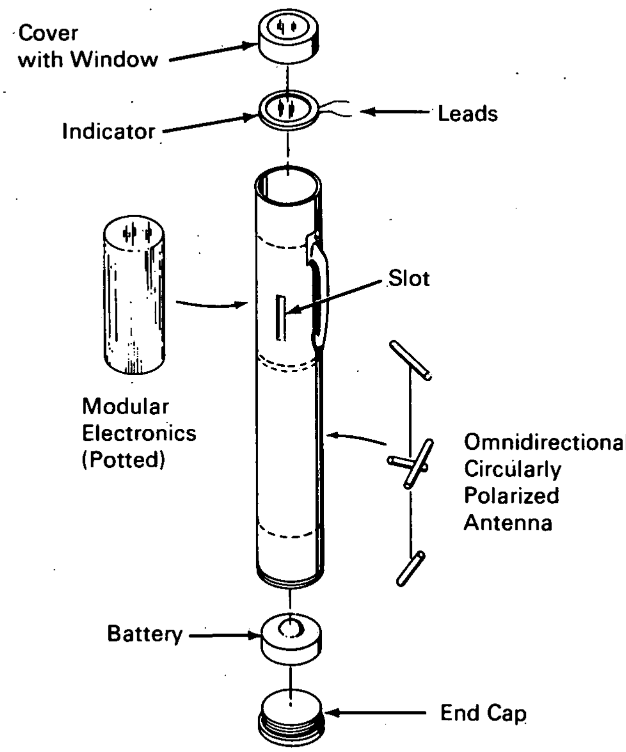

Figure 1. Microwave Dosimeter

The integrator detector takes into consideration the duration of exposure as well as the radiation flux density. Figure 3 is a schematic showing the dye marker chemical integrator which gives a visual indication of radiation dosage by a color change in the indicator under the viewing window. As radia-

(continued overleaf)

tion impinges on the indicator, the change in the dc current produces a change in the pH of the acid solution with which the indicator pad is saturated. This change is linearly reflected in an indicator pad

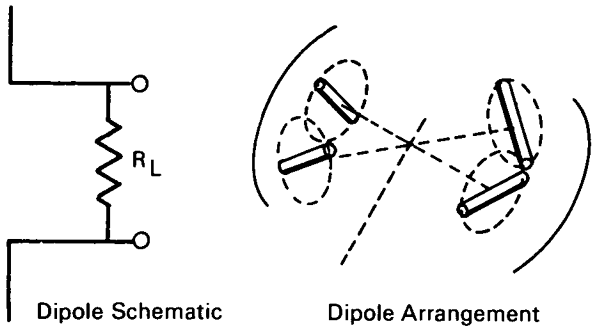

Figure 2. Dipole Schematic and Arrangement

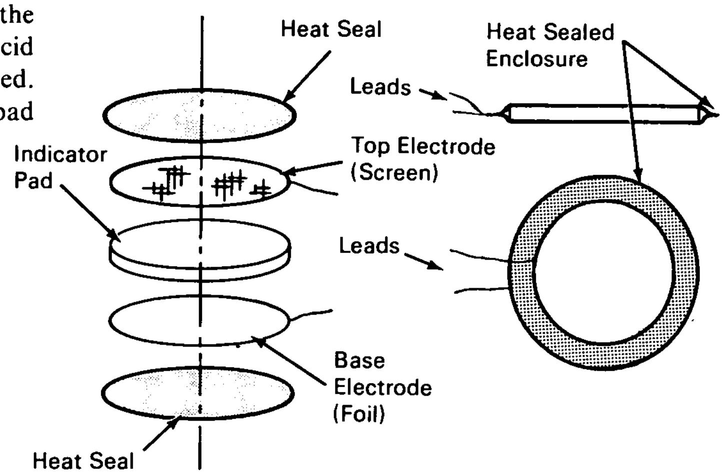

Figure 3. Chemical Current Detector- Integrator

color change, which is proportional to the product of current and time during exposure.

Notes:

1. This development is in conceptual stage only, and, as of the date of publication of this Tech Brief, neither a model nor prototype has been constructed.
2. No further documentation is available.

Patent status:

No patent action is contemplated by NASA.

Source: Frederick Bird and Robert Bartlett of Allied Research Associates, Inc. under contract to NASA Headquarters (HQN-10407)