Observations under the microscope revealed that the particles in the size range 10-20 μm were predominant. A small quantity of very fine powder was separated from a suspension of the powder in water and the observed efficiency with this powder was about 8% and the size range was 1-6 μm. From this data, it is concluded that the coincidence efficiency varies inversely as the square root of the particle size and for 1 μm particles, the efficiency could be as high as 15%.

Efforts are, therefore, being made to prepare substantial quantities of the powder in the size range 1-10 μm. Prolonged pounding of the plastic scintillator material at liquid nitrogen temperature has given encouraging results. An electrically operated pounding machine has been developed for this purpose. A detector, packed with 9 μm particles shall record a tritium activity level in water, as low as 50 μμc/cm^3. The advantages of this type of detector are its long life, relatively low cost and ease of fabrication. It is ideal for continuous monitoring purposes and highly suitable for use in a tritium-in-urine analyser. Future power reactors planned in this country will use natural uranium fuel and heavy water as moderator and coolant. Airborne tritium activity in these reactors is expected to be high. Continuous tritium monitors using this detector shall find an important application for these reactors.

4.2 Plastic Scintillator Film Detectors for Certain Specific Applications in Continuous Air Monitoring

A.N. Singh, M.G. Kadwani, P.K. Chugh, N.B. Nair and M.V. Ramana Murthy

Conventional detectors normally employed for continous alpha air monitoring are found unsuitable in certain situations. Thus ZnS (Ag) phosphor employed for gross alpha air monitoring, works satisfactorily as long as it does not get dirty or contaminated. In highly dusty atmosphere or in areas where contamination potential is very high, these detectors need frequent replacement. G.M. Counters normally employed for beta gamma air monitoring, apart from having relatively low life, have significant

gamma response. In areas where gamma background is variable and very high, use of a G.M. Counter for beta monitoring is not desirable.

Characteristics of thin plastic scintillator films were studied. The film could be readily prepared by spraying a solution of the plastic scintillator in benzene directly over the photomultiplier cathode, or, better still, on a perpex disc that could be mounted on the tube. The film is stable and could be wiped clean or decontaminated with water, acid or other decontaminating agents. A film of 2.5 - 3.5 mg/cm^2 thickness is adequate for gross alpha measurement. Alpha to beta efficiency ratio for this film is more than 200. The alpha efficiency is better than what could be obtained with ZnS(Ag).

Preliminary investigations have shown that for beta measurement, a film of 20 - 25 mg/cm^2 shall be adequate. Since the constituents of the plastic scintillator are the light elements hydrogen and carbon, gamma response for thin films is very poor. At a beta efficiency of 10% with a 6292 photomultiplier tube, the gamma efficiency is negligible. This type of detector is considered good for use in areas like RCB(CIRUS), where even with a 76 mm thick lead shielding, gamma background could not be brought down appreciably.

4.3 High Resolution Pulse Spectrometer for X and Gamma Ray Analysis

S. Ragupathy and S.D. Bedekar

A high resolution X and gamma ray pulse spectrometer is being developed for the Low Level Counting Laboratory. This system consists of a high resolution semiconductor detector (Si(Li) for X-ray and Ge(Li) for gamma rays), low noise linear signal processing electronics, an AD converter, a core memory system, input/output electronics and peripheral units. Major portion of core memory system, teleprinter electronics and CRT display unit have been assembled and tested. Other units of the system are being assembled and tested. Modern microelectronic components and circuits have been used in this project. Modular plug-in electronic concept has been incorporated. It is also proposed to use an instrumentation minicomputer for data analysis and presentation of results.