VERY LOW ENERGY β MEASURMENTS IN TRITIUM CONTAMINATED PARTS

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ABSTRACT

Possibility of utilizing a gas proportional counter for routine beta activity contamination checkup in a Neutron Generator lab is explored. The sensitivityof thegas flow counter has been improved and suitable modifications made to record beta energy spectrum. Samples from all over the laboratory were collected to monitor accidental spread of tritium.

INTRODUCTION

There is a renewed interest in fast neutron generators for their use in studying radiation damage on structural materials as well as its medical application in radiation therapy of cancer cells. High flux generators usually use solid targets with Tr. adsorbed in a matrix. Intense deuterium beam desorbs the tritium, thereby, contaminating several parts of the generator. Inspite of usual precautions it leaks to unexpected areas causing a possible health hazard if internally taken [1,2]. Since tritium is a very low energy pure β emitter, it escapes detection by conventional radiation detectors employed in a routine checkup. Therefore, windowless gas flow detectors are specially useful for the measurement of soft β. They have high efficiency, large solid angle and a convenient size. The counter can be successfully employed for low energy β emitters such as H^3, Ni^{63} and C^{14}.

RESULTS AND DISCUSSION

For tritium detection a conventional 4π windowless gas counter has been developed and improved by us [1,3]. The lower limit on the electron energy was determined by sensitivity of associated amplifiers, stability of the high voltage power supply and the characteristic of the counter gas. Its sensitivity for low energy electron has been enhanced from 300 keV to less than 5 keV. The

upper limit on the electron energy producing a full spectrum due to the chamber size and gas pressure in our case was < 50 keV [4]. Other factors affecting are the absorption of electrons in the source backing and backscattering from foils. Fig.1 shows spectrum of pure H^3 and C^{14} sources measured from the modified counter. For C^{14} β only partial energy is spent in the anode chamber. The laboratory faced at several occasions contaminations of which the causes could not be ascertained. As a result more than 100 samples from all over the lab. and working rooms were collected on a Watman filter paper. Table I & II summarises the measurements of β activity of these samples. Fig.2 presents the spectrum measurement of an oil sample of ruffing pump . The pump was in operation for more than 8 years and required maintenance work. The oil was found highly active with tritium.

CONCLUSION

The use of D-T based sources exposes personnel to hazards of radiation of neutron induced activities as well as of the tritium in the targets [5]. Tritium contamination are found in unexpected areas due to the easy migration of specs which might fall down while changing of the target or during some maintenance of the beam line. Such a spread can be controlled by regular measurements of swap samples using the modified gas flow counter. Strict rules of safety should be followed during changing of tritium targets. Use of a face mask is strongly recomended. The used targets should be placed in an air tight container and stored in separate housing immediately.

REFERENCES

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TABLE I : The beta actvity routine measurements between March 1987 to May 1987.

Place of Sampling	Activity (sample)	Counts/S (BackGrnd)	Comments
Control Room			
Desk	*3*	*2*	*clear*
Floor	*3*	*2*	*clear*
Window Pane	*500*	*2*	*Cont.*
Neutron Gnerator Room			
Wall	*2100*	*2*	*High Cont*
Vaccum Valve	*10*	*2*	*Clear*
Ground Surf.	*80*	*2*	*clear*
Accelerator Room			
Wall	*40*	*2*	*Clear*
Vaccum Valve	*100*	*2*	*Clear*
Non Radiation Zone			
Head Physics office	*2*	*2*	*Clear*
Corridor	*9*	*2*	*Clear*

TABLE II : The beta activity routine measurements between Dec. 1989 and January 1990.

Place of Sampling	Activity (Sample)	Counts/S (Backgnd)	Comments
Control Room			
Window Frame	*30*	*1*	*Clear*
Desk	*2560*	*1*	*High Cont.*
Floor	*120*	*1*	*Cont.*
Accelerator Room			
Tool Box	*2300*	*1*	*High Cont.*
Ion Pump Valve	*1800*	*1*	*High Cont.*
Non Radiation Zone			
Head Physics office	*5*	*1*	*Clear*
Corridor	*10*	*1*	*Clear*

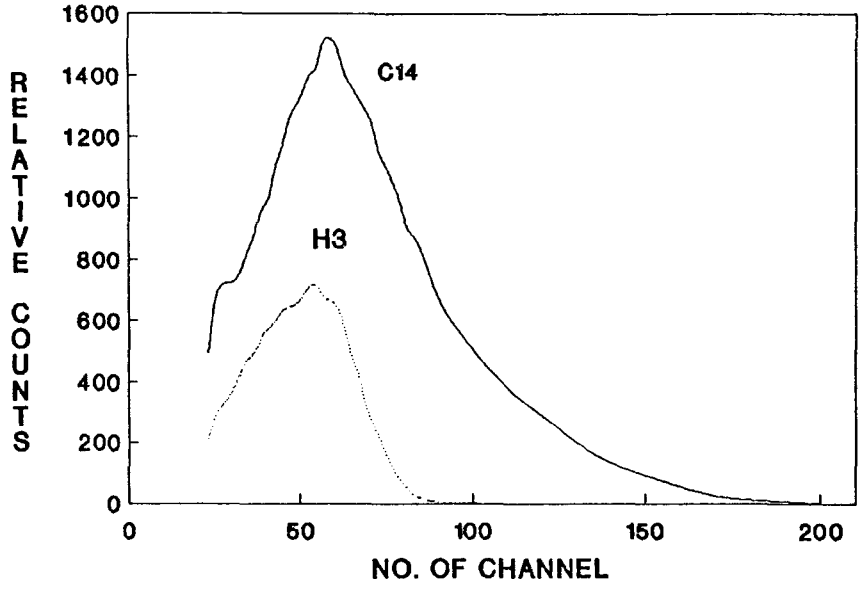

Fig.1: Beta spectrum of C14 and H3 using P-10 gas in the modified gas counter.

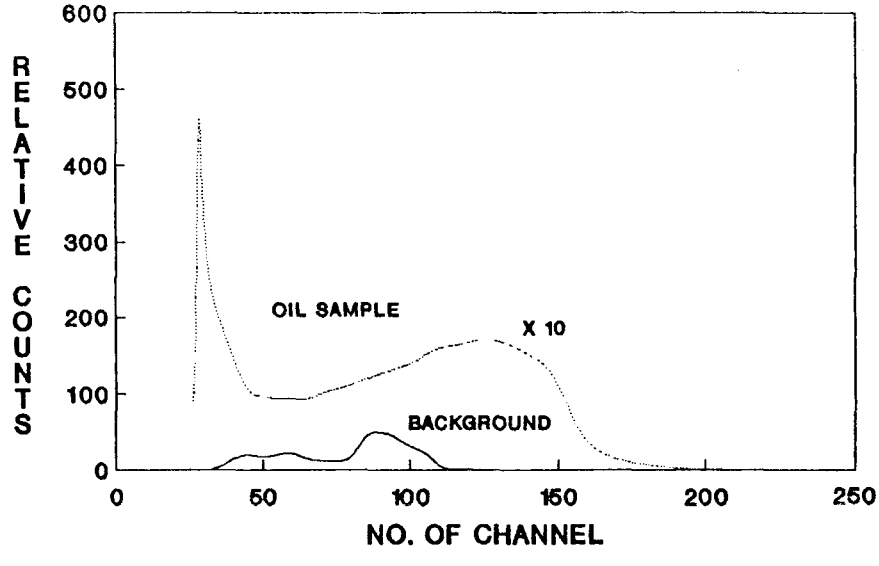

Fig.2: Beta spectrum of oil from ruffing pump of N.G.lab. It also shows backgroud activity for identical conditions.