# THE CURRENT STATUS OF NATIONAL RADIATION METROLOGY LABORATORY IN TAIWAN

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## INTRODUCTION

The Institute of Nuclear Energy Research (INER) has been entrusted by the National Bureau of Standards (NBS) , Taiwan to establish the national radiation metrology laboratory (1-4) since 1991. Three major radiation fields such as photons and betas, neutrons and radioactivity measurement, have been studied by the INER. The established standards and techniques are applied in personnel dosimetry proficiency test in addition to instrument calibration. Whenever possible INER also actively takes part in international intercomparison programs to ensure the uniformity of the established standards and techniques with the international community.

## PHOTONS(1)AND BETAS(2)

High energy photons are produced by radionuclides $^{60}Co$ and $^{137}Cs$ with average mono-energies 1.25 MeV and 0.662MeV, respectively. Since there have no radionuclide emitting photon energy below 300 keV with suitable half-life, X-ray machines are used to generate photons with energies from 10keV to 300 keV. Self-made graphite ionization chambers are used to measure the exposure from high energy photons. For low energy photons free-air ionization chambers are used. Transfer ionization chambers are used for intercomparison with Electrotechnical Laboratory (ETL, Japan) and National Institute of Standards and Technology (NIST, USA). The results show about 1-2% deviation. For beta fields, three sets of radionuclides $^{90}Sr+^{90}Y$, $^{204}Tl$, and $^{147}Pm$ are used to create beta irradiation fields which are determined directly by an extrapolation ionization chamber. The results of intercomparison with PTB (Germany) show about 3% deviation.

## NEUTRONS(3)

A room with dimension 5×6×9m is used for neutron irradiation. The four walls and the ceiling are made of aluminum in order to minimize neutron backscattering. Neutron sources can be hanged about 5m above the ground which is made of concrete. The neutron scattering effect is studied thoroughly. Radionuclide neutron sources such as $^{252}Cf$ situated at the center of a $D_2O$ sphere with radius of 0.15m is used to simulate the neutron field outside the containment of a nuclear power plant. Neutron detectors are calibrated with bare and $D_2O$ moderated $^{252}Cf$ respectively. The neutron emission rate of a radionuclide neutron source is determined directly by a manganese sulfate bath system.

Mono-energetic neutron fields produced by accelerating protons with a 7MV van de Graaff accelerator hitting lithium target are measured by various suitable techniques such as associated particles, proton recoil telescope and proportional counter.

Neutron spectrums are determined by bubble detectors, activation foils, Bonner spheres and NE-213 detector whenever is appropriated. Various computational techniques are applied to calculate the neutron spectrum of a $D_2O$ moderated $^{252}Cf$. The results are in good agreement with that of experiment.

## RADIOACTIVITY MEASUREMENT(4)

The activity of radionuclide is determined directly by conventional $4\pi\beta-\gamma$ coincidence method which is good for simply decaying radionuclides such as $^{60}Co$. For complex decaying radionuclide such as $^{133}Ba$, $4\pi\beta-\gamma$ coincidence method coupled with two dimensional extrapolation method is used. Radionuclides distributed by ETL are used for intercomparison. Good agreement shows about 1% deviation but, in some cases, 7% deviation can be achieved which need some more careful studies. A system of $4\pi\gamma$ ionization chamber is used as the secondary standard to determine the activity of a radionuclide because of its long term stability and easy calibration. Other secondary standards for radioactivity measurement are high purity germanium system and $2\pi\alpha-\beta$ system.

## PERSONNEL DOSIMETRY PROFICIENCY TEST(5)

INER is also entrusted by the Chinese National Laboratory Accreditation (CNLA) as the testing laboratory to carry out the proficiency test of personnel dosimetry service. Six personnel dosimetry service laboratories participated the performance tests in 1991 and 1993. In these two tests only gamma and X-ray were carried out. All of the laboratories passed the tests. Recently a full span of the test including beta and neutron dosimetry in addition to photon dosimetry was carried out. About nine personnel dosimetry service laboratories took part in the test.

## SUMMARY

INER has paid much effort to establish the primary radiation standard in this country since 1991. The radiation fields include photons, betas and neutrons. In addition to instrument calibration, these fields are also applied to the personnel dosimetry proficiency test.

## REFERENCES


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