
NAA
SERVICE at UTN

What can we offer to you?

With the commissioning of TRIGA MARK II Research Reactor, the Nuclear Energy Unit (UTN) under the Prime Minister's Department has therefore to play a major role in the development and enhancement of nuclear science and technology in the country. Using this reactor, various projects have been carried out and in order to realise its full utilization, the analytical service group was set up to carry out research in related field as well as to provide services to other departments and agencies. Now, we are capable to offer an analytical service using a nuclear technique known Neutron Activation Analysis (NAA).

What is NAA?

Neutron activation analysis (NAA) is accomplished in three steps:

Neutron bombardment of the sample
Recording of the energy spectrum of the gamma rays produced by the mildly activated sample.
Analysis of the significance of the features of the gamma spectrum

In a manner analogous to optical spectroscopy, the energies of the spectral peaks identify the elements present; the area of the peaks defines the quantity of each element. Most elements can be detected and measured by using the NAA technique.

Why we choose NAA technique?

Safe, Economical and Modern NAA systems present a practical answer to many industrial process control and quality assurance analysis requirements.

NAA is sensitive, accurate, fast, economical and non-destructive to the sample.

Reactor facility at UTN

The PUSPATI Research Reactor TRIGA MK II (PTR) at UTN achieved its first criticality on 28th June 1982. Some other relevant information are as follows:

Max. power	:	1 MW at steady state 1200 KW at pulse
Fuel	:	U - ZrH
Enrichment	:	19.9%
Reflector element	:	Graphite
Fuel's max. temp.	:	500°C
Critical mass (cold, clean)	:	2.5 kg ^{235}U
Loaded mass	:	3.3 kg ^{235}U
Excess reactivity	:	4.75%
Max. neutron flux	:	5 x 10^{13} ncm^{-2} S^{-1}
Coolant	:	Close circuit, demineralised water.
pH	:	6.5 – 7.0
Conductivity	:	Less than 2 microhm cm^{-1}
Max. temp. of primary coolant	:	49°C

PTR provides three major irradiation facilities namely:

1. Pneumatic transfer system – for short irradiation of samples, ranging from 1 to 5 minutes.
2. Lazy Susan (rotary racks) – for long irradiation of samples.
3. Central thimble – for high flux irradiation of samples.

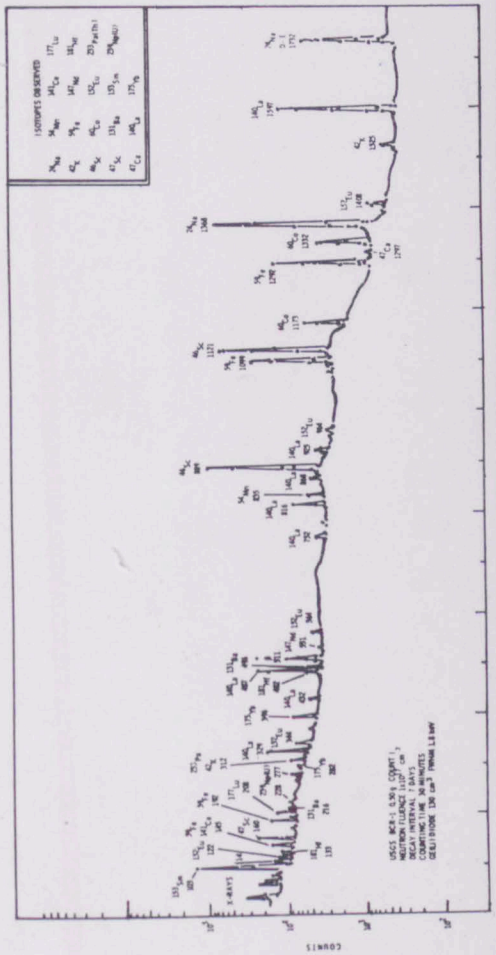
Gamma Spectrometry (counting facilities)

The counting facilities consist of Hyperpure germanium detectors and computerised MCA. The softwares that are readily available for NAA work in this systems are as follows:

1. Programme PEAK – to calculate the peak area of the photopeak by fitting to the Gaussian distribution function.
2. Programme EFF, SPLIN and SPLIST – EFF is used to calibrate the detector efficiency; SPLIN is used for detector efficiency calculation at various energies while SPLIST is used to obtain print out for the energy vs efficiency values in tabular and graphical form.
3. Programme ENERGY is used for the calibration of MCA from channel to energy.
4. NAA package consist of many subroutine programme for calculating the elemental contents of the sample by comparison method, taking into account all correction factors to be made (e.g. decay, counting dead time etc.).

What should you do?

The answer is simple. Send us your samples together with service request form indicating the elements of interest. We will send you the result.



Address

Director General,
Nuclear Energy Unit,
Prime Minister's Department,
Kompleks PUSPATI, Bangi,
43000 KAJANG.

(Attn. : Customer Service Unit)
Tel. : 8250510/511.

Element	Product Nuclide	Gamma Energy keV	Half Life	Decay Interval
	Short irradiation			
Mg	^{27}Mg	1014	9.46 minutes	20 minutes
Al	^{28}Al	1779	2.32 minutes	
Cl	^{38}Cl	2168	37.32 minutes	
Ca	^{49}Ca	3084	8.80 minutes	
Ti	^{51}Ti	320	5.79 minutes	
V	^{52}V	1434	3.75 minutes	
Mn	^{56}Mn	847	2.58 hrs.	
Ba	^{139}Ba	166	82.9 minutes	
Na	^{24}Na	1369	15 hrs.	24 hours
K	^{42}K	1525	12.4 hrs.	
Eu	^{152m}Eu	122	9.2 hrs.	
	Long irradiation			
As	^{76}As	559	26.4 hrs.	5.7 days
Sb	^{122}Sb	564	2.7 days	
La	^{140}La	1596	40.2 hrs.	
Sm	^{153}Sm	103	46.8 hrs.	
Lu	^{177}Lu	208	6.7 days	
W	^{187}W	686	24 hrs.	
Au	^{198}Au	412	2.7 days	
U	^{239}Np	228,277	56.3 hrs.	
Fe	^{59}Fe	1099,1292	45.6 days	
Co	^{60}Co	1173,1332	5.26 yrs.	5.7 days
Zn	^{65}Zn	1116	245 days	20 - 30 days
Rb	^{86}Rb	1079	18.7 days	
Zr	^{95}Zr	757	65.5 days	
Ba	^{131}Ba	496	12.1 days	
Eu	^{152}Eu	122,1408	12.7 days	
Yb	^{169}Yb	177	32 days	
Hf	^{181}Hf	482	42.5 days	
Ta	^{182}Ta	1221	115 days	
Th	^{233}Pa	312	27.4 days	