

Contribution of RN-52 Generated Data in the Establishment of Radioactivity Data Base in the Philippines

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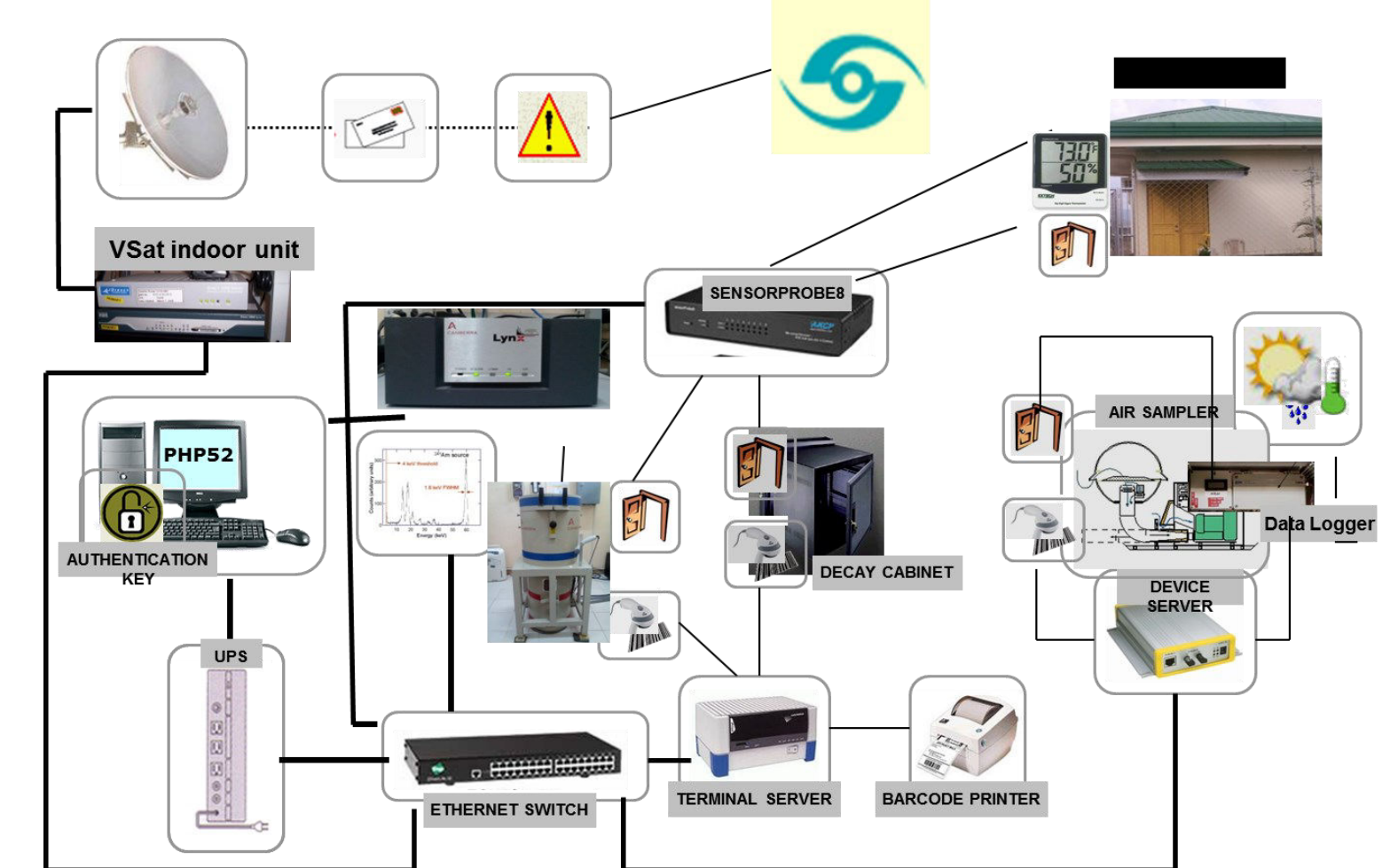
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ABSTRACT One of the modalities of CTBTO verification systems is the operation of radionuclide monitoring station for air particulates. The Philippines through the Philippine Nuclear Research Institute has been operating and maintaining the RN-52 since 2005. This station is co-located at the Weather and Radar Station of the Philippine Atmospheric, Geophysical and Astronomical Services Administration in Tanay, Rizal, Philippines. It is a manual station, whose function is to provide continuous monitoring of radioactivity levels in the air. This involves collection of particulate materials on a filter; performance of gamma spectroscopy to identify radionuclides in the air filter and transmittal of raw spectral data using the Global Communications Infrastructure (GCI) to the International Data Centre (IDC). The designated operator manually change the filter and complete the daily routine. The radionuclide data from the years of RN-52 operation, thru the NDC-137 were retrieved, collated and analyzed. The poster presentation will discuss the analysis made on the radionuclide data as to the levels/ types of radioactivity, abundance, half lives, seasonal variation, and other relevant characteristics. These data will be inputted to the radionuclide baseline data being established in the Philippines. This baseline data will be useful for information, research and impact assessments in case of nuclear incidents.

RN-52 PROFILE and BASIC COMPONENTS



National Data Center (NDC) Products & Data Processes

66 peaks found in spectrum by automated peak search.
61 peaks associated with nuclides by automated processing.
5 peaks not associated with nuclides by automated processing.
92 percent of peaks were associated with nuclides.

Energy (keV)	Centroid	Width	FWHM	EFF (%)	Net Area	Blkgnd (%)	RelErr (%)	Radionuclide
28.32	83.00	3	1.12	0.03	646.27	N/A	11.84	1
46.55	135.94	3	1.13	2.79	532.58	N/A	15.45	Pb-210
63.29	184.59	3	1.14	9.42	994.10	N/A	15.72	Th-234
67.23	196.03	3	1.15	10.79	12054.53	N/A	10.99	Pb-212P
70.95	206.83	3	1.15	12.03	937.73	N/A	3.59	Pb-212P
72.79	212.19	3	1.15	12.94	2099.23	N/A	0.63	Pb-212P
74.87	218.24	3	1.15	13.48	3071.85	N/A	0.49	Pb-212P
77.15	224.85	3	1.15	13.48	46575.53	N/A	0.49	Pb-212P
84.99	247.63	3	1.16	14.95	1216.02	N/A	6.43	Pb-212P
87.25	254.20	3	1.16	15.30	17805.75	N/A	0.85	Co-109
87.25	254.20	3	1.16	15.30	17805.75	N/A	0.85	Pb-212P
89.92	261.96	3	1.16	15.72	5620.14	N/A	1.85	Pb-212P
92.67	269.93	3	1.16	15.99	1243.94	N/A	6.37	Th-234
115.20	335.40	3	1.18	17.10	1787.07	N/A	4.60	Pb-212P
176.90	514.66	4	1.22	15.17	206.04	N/A	31.28	Pb-212P
185.70	540.22	4	1.23	14.73	943.47	N/A	7.39	U-235
233.14	678.04	4	1.26	12.49	313.01	N/A	20.47	Pb-212P
252.54	734.41	4	1.28	11.75	439.35	N/A	12.64	Pb-212P
277.29	806.31	4	1.29	10.86	4400.90	N/A	1.86	Pb-212P
288.06	837.59	4	1.30	10.51	874.87	N/A	6.47	Pb-212P
295.25	858.49	4	1.30	10.30	210.23	N/A	24.30	Pb-214
300.07	872.50	4	1.31	10.16	5841.92	N/A	1.53	Pb-212P
328.03	953.72	4	1.33	9.42	332.03	N/A	15.24	Pb-212P
338.01	982.70	4	1.33	9.18	196.02	N/A	24.27	Ac-228
351.93	1023.16	4	1.34	8.88	460.39	N/A	11.01	Pb-214
364.18	1058.76	4	1.35	8.62	152.72	N/A	31.16	I-131
374.68	1089.26	4	1.36	8.42	343.90	N/A	14.15	Pb-212P
376.97	1095.90	4	1.36	8.38	358.55	N/A	13.94	Pb-212P
386.71	1124.21	4	1.36	8.20	167.64	N/A	28.61	Pb-212P
415.18	1206.91	4	1.38	7.72	273.94	N/A	15.63	Pb-212P
452.87	1316.41	4	1.41	7.17	599.47	N/A	7.41	Pb-212P
473.61	1376.68	4	1.42	6.91	121.85	N/A	30.32	Pb-212P
477.61	1388.30	4	1.42	6.86	4852.72	N/A	1.60	Be-7
510.76	1484.59	4	1.44	6.47	10133.62	N/A	1.05	Pb-212P
583.19	1695.02	4	1.49	5.78	3366.12	N/A	0.55	Pb-212P
609.29	1770.86	4	1.50	5.58	447.27	N/A	7.91	Bi-214
656.34	1907.54	4	1.53	5.27	70.88	N/A	41.33	Pb-212P
658.08	1912.58	4	1.53	5.26	127.22	N/A	23.49	Pb-212P
721.91	2098.02	5	1.57	4.87	80.25	N/A	32.64	Pb-212P
727.34	2113.80	5	1.57	4.84	7363.15	N/A	1.20	Pb-212P
763.31	2218.31	5	1.59	4.66	542.26	N/A	6.04	Pb-212P
785.54	2282.87	5	1.61	4.55	1000.24	N/A	3.89	Pb-212P

YEAR	Be-7	Bi-214	K-40	PA-234M	Pb-210	Pb-212F	Th-234
2009	2058.0	10.9	138.8	523.2	300.4	10152.4	142.3
2010	1680.9	10.8	142.1	335.4	474.4	19322.5	231.5
2011	1859.5	19.4	227.5	597.8	340.2	14952.2	252.5
2012	3258.6	33.4	198.7	294.9	501.3	20591.3	295.8
2013	2228.8	13.6	143.0	219.4	476.1	14390.5	172.6
2014	2270.4	16.8	147.3	214.9	621.5	15172.0	186.0
2015	2414.6	12.2	140.9	204.6	1646.8	17683.0	156.2

RN	Mode of Formation	Half Life	Energy (keV)
Be-7	Cosmogenic	53.1 days	477
Bi-214	decay product (U-238 series)	20 minutes	609
K-40	Primordial	1.25 x 10 ¹⁰ years	1460
PA-234M	decay chain trace (U-238 series)	27 days	767,1001
Pb-210	Primordial	22 years	47
Pb-212F	decay product (U-238 series)	10.64 hours	352
Th-234	decay product (U-238 series)	24.1 days	237

RN	Activity Concentration μBq/m ³	ICRP Conversion (Sv/Bq)	Dose Rate (μSv/y)
K-40	143.7	2.1 E-09	2.64 E-03
Th-234	171.5	7.7 E-09	1.16 E-02
Pb-210	347.7	1.1 E-06	3.35 +00
Pb-212	14586.5	1.8 E-08	2.3 +00
Be-7	2204.7	5.0 E-11	9.31 E-04
ESTIMATED TOTAL DOSE RATE (μSv/y)			5.67

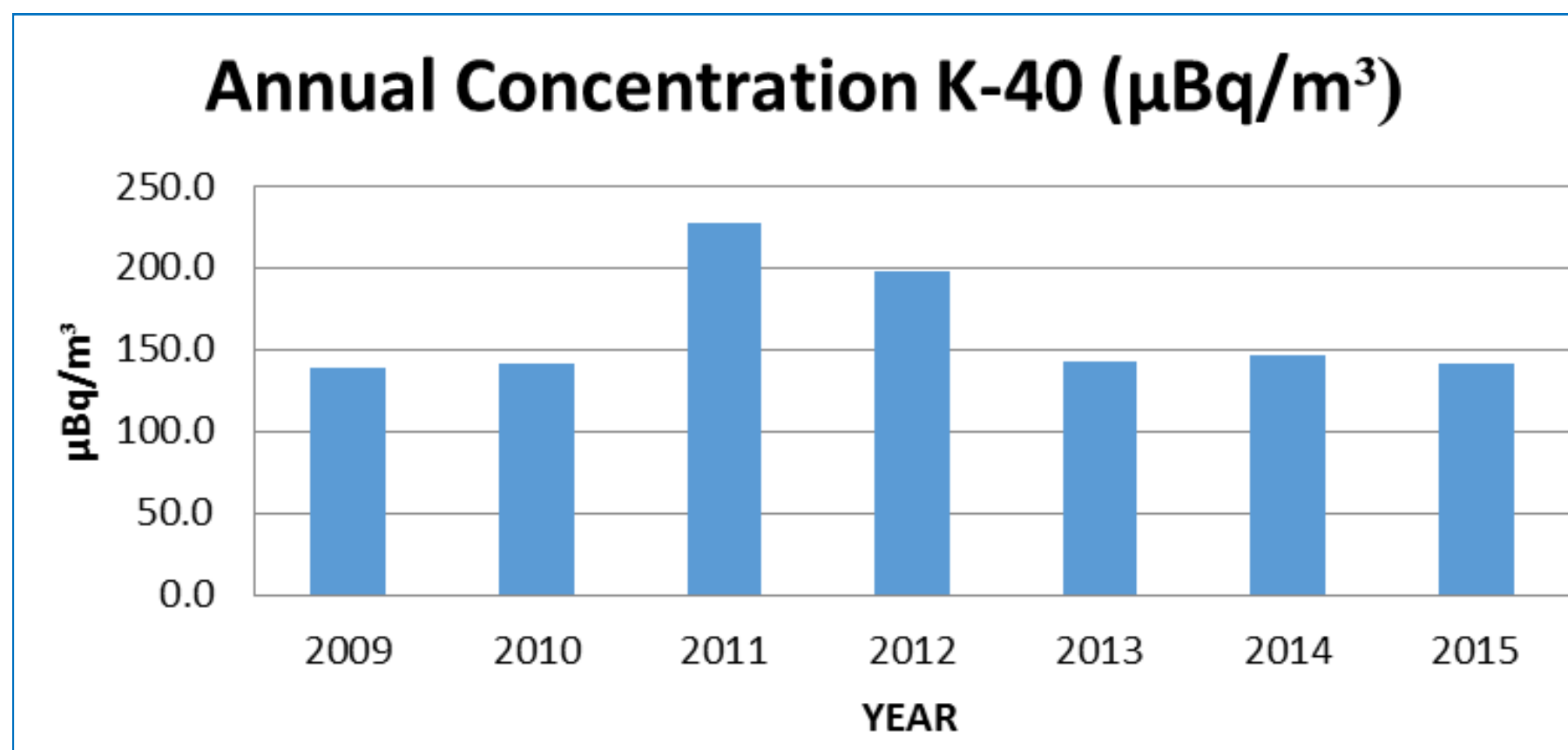
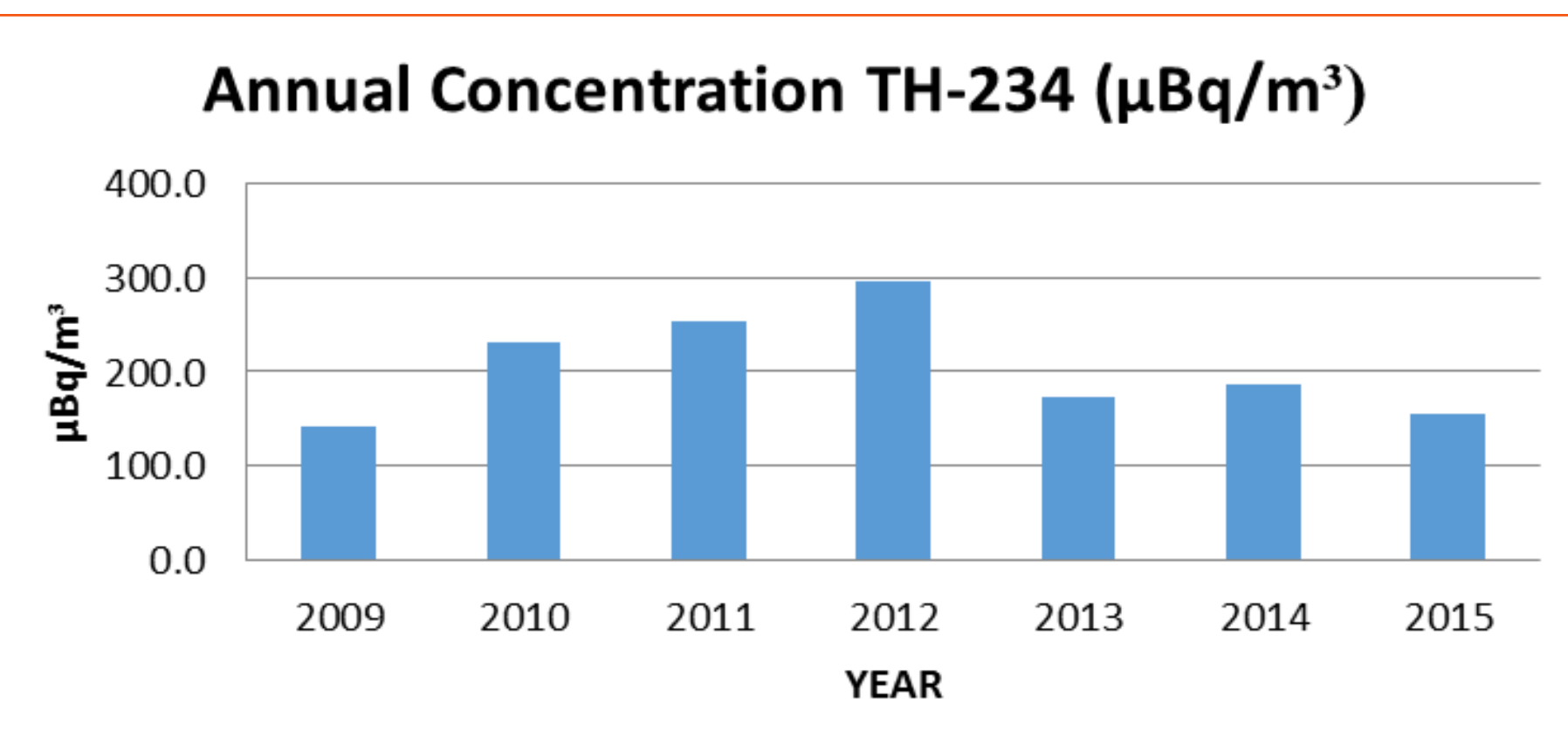
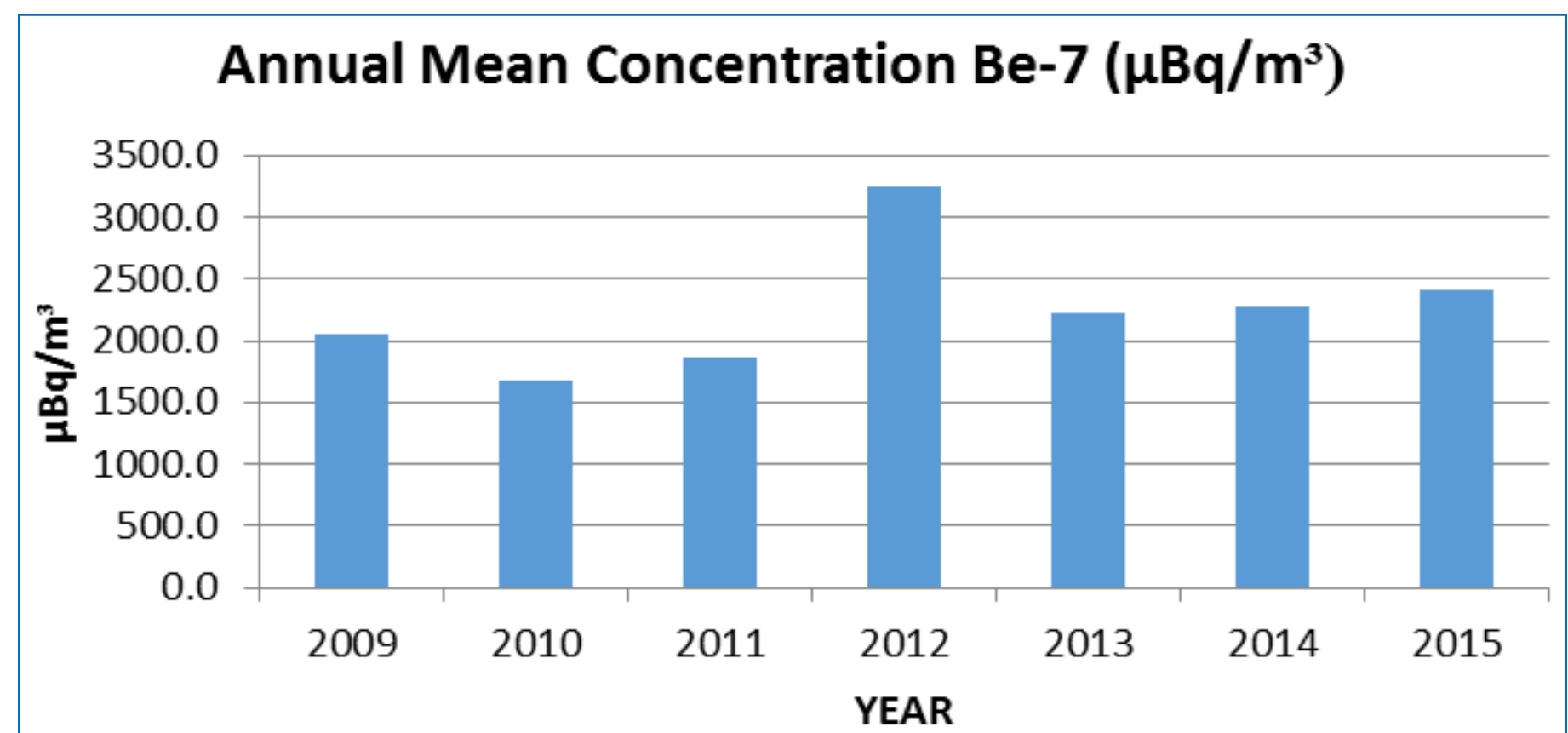
History: Infrastructure, installation and testing (Dec 2004 - Oct 2005); Final turn-over to station operator on Sept 2006 (PNRI)
Location: Northern part of the Philippines approx. 50-60 km from Manila (640 masl); Co-situated with DOST/PAGASA Department of Science and Technology/ Philippine Atmospheric Geophysical Astronomical Service Administration)

Type of Verification Regime: Radionuclide Monitoring Station
Station Installer: Scientific Solutions Inc.
Start of operation: 2005
Operation: 24/7
Operator: Health Physics Research Section, Atomic Research Division

DAILY ROUTINE OPERATION

- Collection of air particulates
- Decay Process (24hrs)
- Gamma spectrometry (24hrs)
- Message System and Reporting
 - Data/emails sent to IDC
 - Acknowledgement sent to PNRI
 - Emails sent from IMSOPS to PNRI
 - Emails sent to IMSOPS: spectral, supplementary, support, and regular
 - Station data emails sent to IDC
 - Station of Health (SOH)
 - MET
 - QCPhD
 - SAMPLEPHD

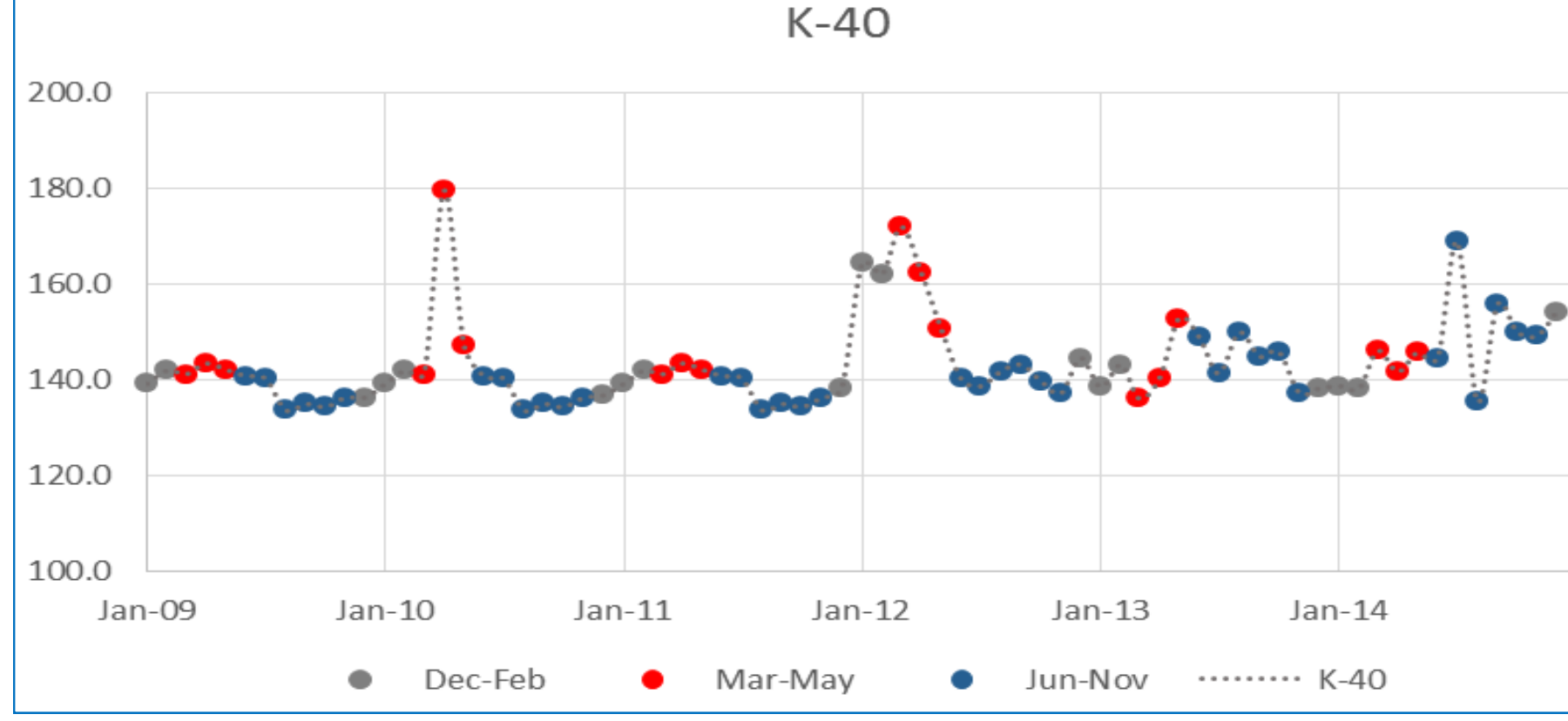
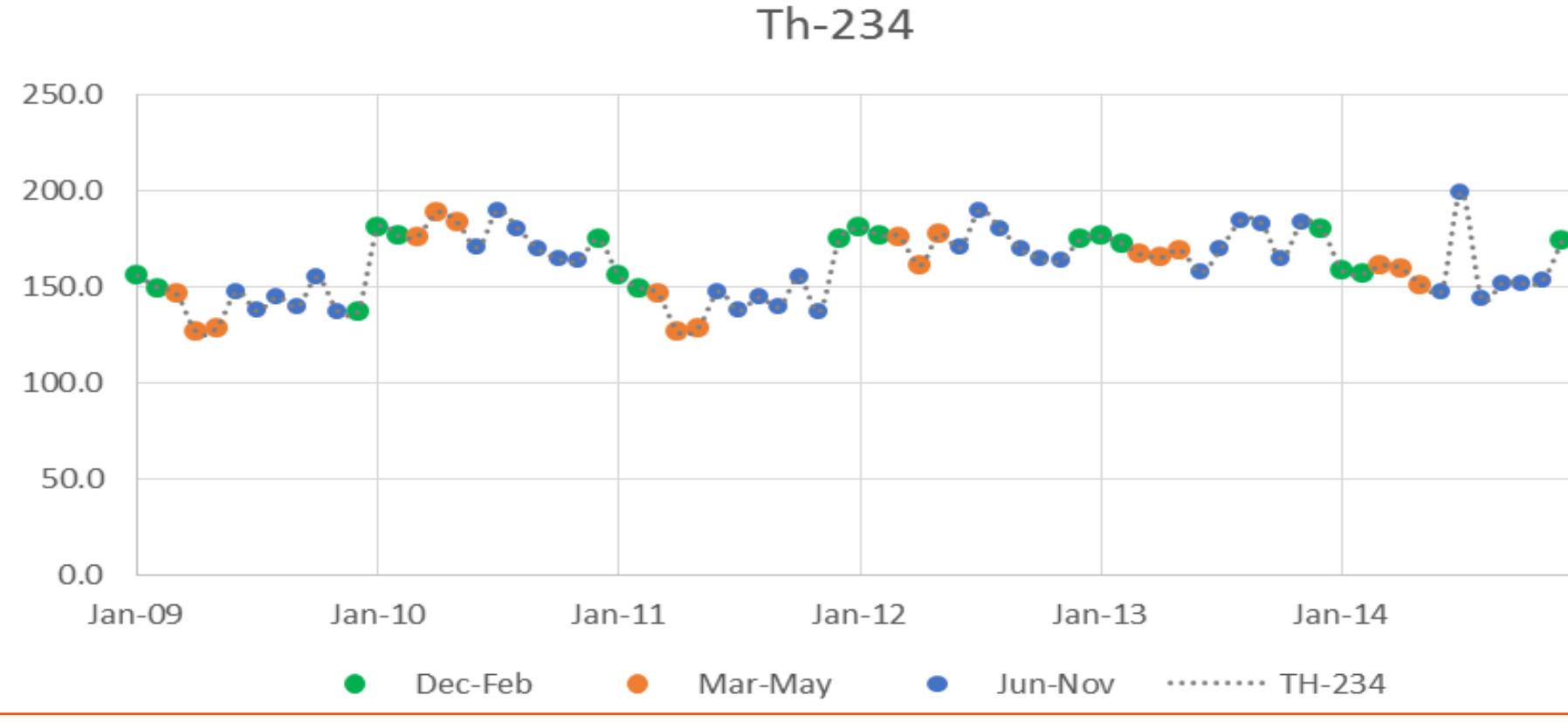
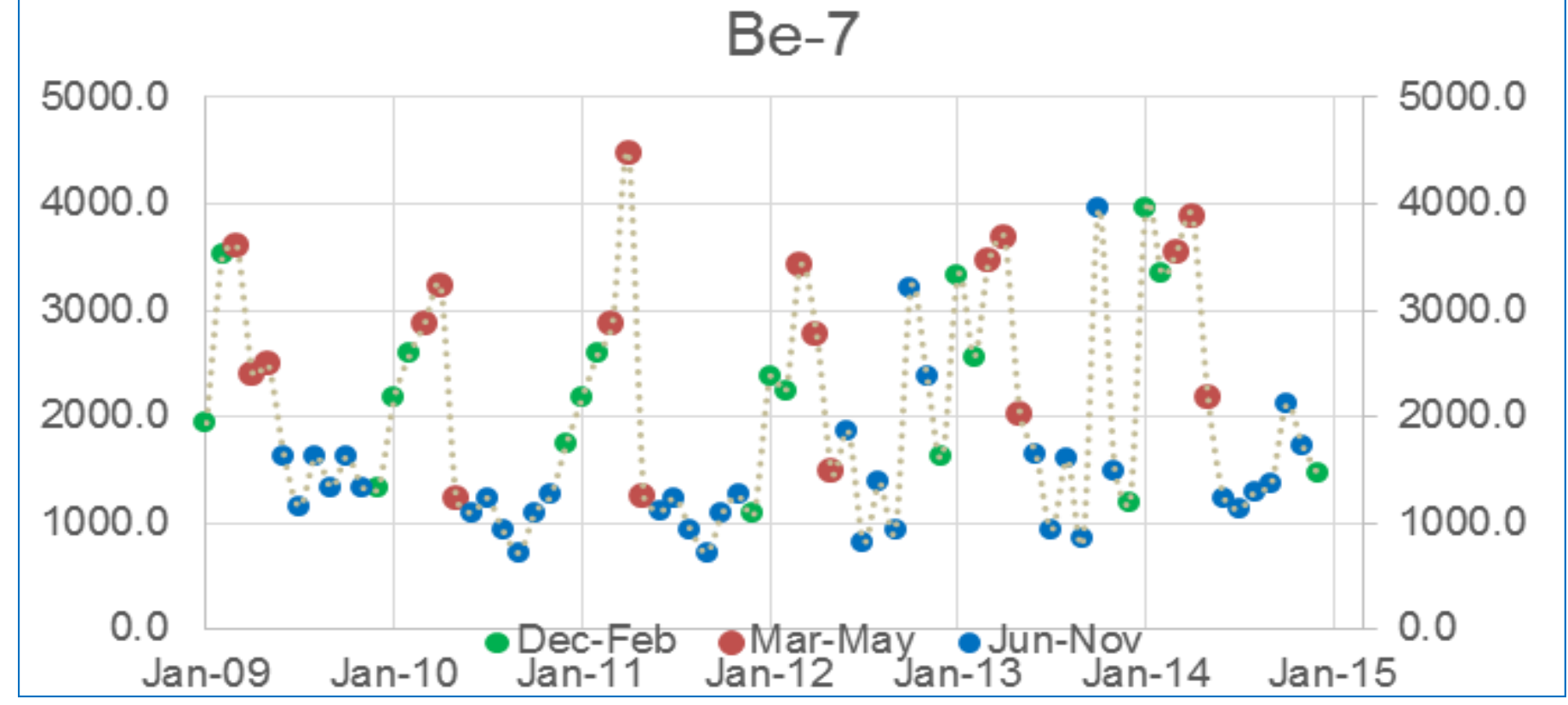
The IMS station software is a central component of the radionuclide monitoring station that provides complete control of the system. It collects formats and delivers the data. It also receives commands and e-mails and provides graphical user interface. The IMS allow the operator to graphically display the state-of-health (SOH) and metrological (MET) data, to read/send emails, to have a complete control of the filter management and to control the LYNX multi-channel analyzer of the spectrometer system. The software is capable of detecting and recording functional and operational errors, and to inform the operator of them via graphical alerts.



Higher concentration: Hot-Dry Season
 - due to increase in Be-7 concentration due to increased vertical mixing of surface air with air in upper troposphere and stratosphere, where the nuclide is produced mainly
Lower concentration: rainy season
 - removal of particulates in air by precipitation, results to decrease of Be-7 in air

- Dec -Feb - dry cool season
- Mar - May - dry hot season
- June - Nov - rainy season

Higher concentration: during dry season
 - increased resuspension of soil particles carried by wind during dry season result to increase in K-40 concentration
Lower concentration: during wet season
 - reverse effect of precipitation - removal of air particulates and decrease in resuspension due of wet soil



Data Analysis Results from Different Data Sets

CONCLUDING REMARKS Analysis and processing of data generated by the air particulate monitoring station (RN-52) thru the National Data Center (NDC-137) reveals that the station is very important not only in detection of nuclear testing & events/nuclear related activities or incidents and radioactive emissions from radioisotope production, but also highlighted prospective contributions of the data collated in scientific applications. The data can be most useful in the establishment of the over-all dose assessment to man, natural radioactivity base line, historical data base for documentation of other significant events such as El Niño, La Niña and other weather phenomenon. Further in-depth analysis and interpretation is recommended to be able to infer sound scientific findings and correlation studies.

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