# I am not the same as when I began

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This talk will describe the journey I made from rural Britain to rural Norway, via the bright lights of London and the heat of the south of France. Over the years I have worked at a number of different employers doing a range of different things, like most people.

I started off with no connection to the world of radiochemistry and radiochemical analysis, and spent my formative years studying chemistry, while working (1977 to 1983) at the Laboratory of the Government Chemist (LGC) in central London on analyses of road fuel, North Sea oil, dental materials and water. At the end of my time there, I was transferred to the Radiochemistry section, and I have never looked back!

Having decided that radiochemical analysis was what I wanted to do, I moved to the Central Electricity Generating Board's (CEGB) Central Radiochemistry Laboratory, situated in Gravesend, and worked there until early 1987. The laboratory was responsible for the radiochemical analysis of all effluents from the thirteen English and Welsh (but not Scottish) nuclear power stations, covering $^{3}$H, $^{35}$S, $^{55}$Fe, $^{90}$Sr, $^{147}$Pm, uranium, plutonium, americium and curium. I think I was particularly lucky to work there, partly due to a group of good colleagues, and partly due to the range and scope of the work that was carried out at the CEGB, which allowed me to hone my laboratory skills.

From the CEGB I moved to the Atomic Weapons Establishment (AWE) at Aldermaston until 1989, where I worked on analysis of material associated with the testing of nuclear weapons.

Then, in 1989, I transferred to the Radionuclide Metrology Group of the National Physical Laboratory (NPL) in Teddington, where I spent the next 30 years. The NPL is the direct counterpart of the National Institute for Standards and Technology in Gaithersburg, although with some differences in the scope and range of the work carried out.

Whilst at NPL, I was again fortunate to work with a great team, from whom I learned so much. As the NPL is, as the name suggests, a physics establishment, part of the fun of working there was that one needed to acquire a new set of skills in order to be effective. At NPL, I was involved in many things, much of which continues to this day at NPL:

- Setting up a national proficiency test scheme for environmental radioactivity measurements,
- Initiating and expanding the provision of low-level actinide tracers,
- Generating reference materials for radioactivity measurement,
- From 2000 onwards, participation in threat reduction work, with colleagues from the USA,
- Generation and calibration of radionuclides…I will talk about the search for $^{236g}$Np
- Leading the NPL effort in EU funded projects concerned with (i) decommissioning, and (ii) NORM/TENORM

In 2018, I took a secondment to the Bureau International des Poids et Mesures (BIPM) at Sèvres, Paris, to work on the international reference system for pure β-particle emitting radionuclides and in early 2019, I moved to the IAEA Laboratories to work on their proficiency testing schemes for the measurement of radioactivity in the marine environment and to re-assess the reference values for some of the range of IAEA reference materials.

At the end of my time at the IAEA, I was fortunate enough to be offered a job in Norway at the Isotoplaboratoriet of the Norges miljø- og biovitenskapelige universitet (NMBU), starting at the beginning of 2020. It was my plan to move to Norway at the end of my time at NPL, and so this was again a lucky coincidence. At NMBU I have spent the past 2½ years working on actinide analysis of water, sediment and biota samples from the sunken Soviet Union submarine, the Komsomolets, determining the $^{236}$U, $^{239}$Pu, $^{240}$Pu and other nuclides at these levels:

| | **Range (pg kg$^{-1}$)** | **Range (atoms kg$^{-1}$)** | **Range (Bq kg$^{-1}$)** |
|---|---|---|---|
| **$^{236}$U** | $6{,}0\times10^{-2}$ – $2{,}5\times10^{2}$ | $1{,}7\times10^{8}$ – $6{,}4\times10^{11}$ | $1{,}6\times10^{-7}$ – $6{,}0\times10^{-4}$ |
| **$^{239}$Pu** | $7{,}0\times10^{-4}$ – $6{,}0\times10^{3}$ | $1{,}8\times10^{6}$ – $1{,}5\times10^{13}$ | $1{,}6\times10^{-6}$ – $1{,}4\times10^{1}$ |
| **$^{240}$Pu** | $1{,}6\times10^{-4}$ – $7{,}6\times10^{2}$ | $3{,}9\times10^{5}$ – $1{,}9\times10^{12}$ | $1{,}3\times10^{-6}$ – $6{,}4\times10^{0}$ |

The presentation will cover most of the above as well as additional comments on metrology of radionuclides and characteristic limits.