Ring of Five

The European Trace Survey Stations Network for Monitoring Airborne Radioactivity

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SHORT PRESENTATION OF THE RING OF FIVE NETWORK

- The Ring of Five (Ro5) is both a regional (European) and a topical (Atmosphere) network dedicated to airborne radionuclide at trace levels in the atmosphere on the European scale,

- It runs as an informal club based on rapid information between partners about detection of something abnormal somewhere in Europe,

- It matches the IUR policy of independence with regard to governmental or international authorities; non-political & non-profit community,

- It started at the beginning of the 80s with five countries (the Ring of Five was born !), namely Sweden, Germany, Finland, Norway and later Denmark. Currently, it gathers together 20 countries across Europe and about 90 members,

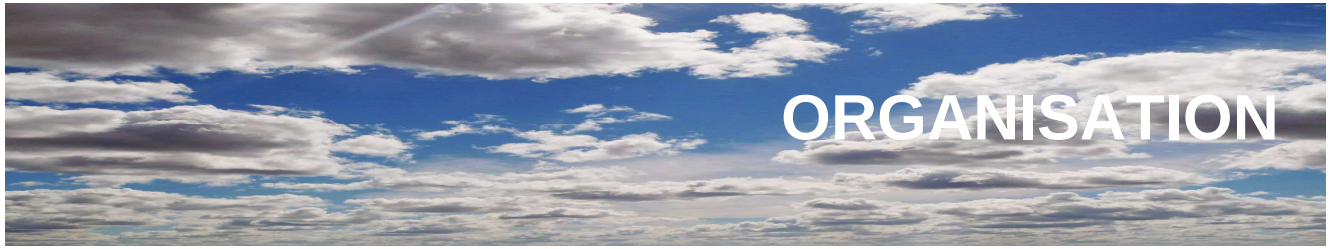
HISTORY OF THE RING OF FIVE NETWORK

- The last atmospheric nuclear explosion took place in China in October 1980 and in the few years to follow the background of bomb debris was reduced to levels where other emissions could be more easily detected. In 1983 and the following two years man-made radionuclides, both fission and activation products occurred occasionally in Northern Europe and a co-operation started between Sweden and the Federal Republic of Germany in trying to pin down the sources of these emissions. Finland, Norway and later also Denmark were soon drawn into these efforts. Sometimes the events caught the interest of the Press and it got more and more clear that we needed an "early warning" system.

- It was then decided that as soon as something interesting was seen in one country the others should be informed through telephone calls to people at the laboratories in the other countries. A list was kept current with business as well as home telephone numbers. "The Ring of Five" was born. "Ring" because we called each other in a circle and "Five" because we were initially five countries. It was a totally informal arrangement without any authorities involved.

- Especially after Chernobyl and a couple of meetings on low-level radiation measurements in Poland, the club expanded to some 20 members. But we keep the name, as we cannot change it all the time. And after all it sounds a little bit mysterious, which we think is only good.

- Ring of Five was fairly dormant most of the time. But when something special happened like in May 1998 when a smelter in southern Spain emitted ^{137}Cs or more recently when ^{131}I was detected on several occasions across Europe (2011-2012), this network moved on quickly.
- After the Fukushima accident most of the airborne data on the European scale were reported from laboratories participating in the Ro5. Ring of Five laboratories were actually the first to detect the plume in Europe.
- As an example of Ro5 cooperation, most information about airborne radionuclides in Europe after the FDNPP accident came from a comprehensive study gathering more than 80 co-authors and secondarily the most cited paper related to the Fukushima that is good for the visibility of our network.



- **COUNTRIES REPRESENTED**: Austria, Belgium, Bulgaria, Czech Rep., Denmark, Finland, France, Germany, Hungary, Iceland, Italia, Luxembourg, Netherlands, Norway, Poland, United Kingdom, Slovakia, Spain, Sweden, Switzerland, + Canada, US and Japan members.

- **LEGAL STATUS**: None, only informal community of scientists + IAEA

- **EXECUTIVE BOARD**:
  - Herbert Wershofen, PTB, Germany;
  - Catharina Söderström, FOI, Sweden;
  - Olivier Masson, IRSN, France.

- **TOOLS**:
  - Rapid data exchange via E-mail sending through the Ro5@foi.se address
  - As communications techniques developed we went through a fax phase and now we are in an e-mail phase. Next could be a www-phase. The ancient techniques of phone and fax will, however, always stay as a backup.
  - Task group WebPages hosted through the IUR website at http://www.iur-uir.org/en/task-groups/id-22--ring-of-five-task-group

- **MEETING**: 1st meeting 7 September, Barcelona, as a related event of the next ICRER Conference.

GOALS AND OBJECTIVES

- **UNTIL RECENTLY**:
  - Rapid and informal data exchange (via a mailing list) on occasional concentrations of man-made radionuclides in the atmosphere,
  - Explain origin, source location and possible routes to sampling locations.

- **CURRENTLY**, this network evolves towards a task group with the objectives to:
  - Promote research and expertise related to the evolution of radionuclides and interactions / transfer processes with other compartments of the biosphere,
  - Identify topics of common interest and draw up priorities in order to drive an efficient research,
  - Share equipment, platform, methods and experience for harmonization purpose,
  - Lower detection limits and improve measurements representativeness,
  - Make this community more visible and more structured,
  - Open it to new members. It is empowered to growth in the forthcoming years with increasing participation of countries from eastern Europe.

ON-GOING R&D ACTIVITIES OF RELEVANCE

- RN Captation and RN Deposition by rain, fog or snow events,
- Explanation of transfer processes and interactions with other compartments of the biosphere
- Airborne RN :
  - Aerosols: Plutonium, Strontium, Cesium, Radium, Uranium and cosmogenics, both as contaminants and tracers of processes
  - Gas: Kr, Xe, Iodine isotopes (sampling and measurements).
- Plutonium sources in the air and isotopic or mass ratios of concern,
- Improvement of detection limits and fast response metrological techniques (radiochemistry, alpha spectrometry)
- Size distribution of airborne RNs for modeling purpose (deposition velocity),
- Retrospective radionuclide size distribution from archived filters.

PERSPECTIVES AND ORIENTATIONS FOR THE FUTURE

- Resuspension characterization,
- Wet/Dry deposition sampling procedures and determinations,
- Aerosol electrical properties and their deposition
- Gas/Particle conversion or interactions,
- Chemical speciation of iodine compounds,
- Reference levels of ^{210}Po and uranium / thorium decay products,
- Improve measurement techniques: ICP-MS, coincidence / anti-coincidences,...
- Indoor exposure (i.e. infiltration),
- Monitoring of artificial RNs in the vicinity of NPP, at trace levels,
- Ion exchange efficiency for wet deposition
- Residual airborne levels at high altitude sampling locations and vertical distribution in relation to below-cloud and in-cloud scavenging,
- Focus on special events related to climate change (or not):
  - Biomass burnings (domestics or wildfires)
  - Wind erosion,
  - Extreme climatic events
  - Volcanic eruptions (U, Th, Po)
  - Sea sprays during marine storms,…

ON-GOING EFFORTS OF PRIORITISATION IN RESEARCH AND EXPERTISE

- **Regarding accident situations**: The FDNPP accident highlighted several points that remain to be solved and implemented in dispersion/deposition models or long-term behavior of RN:
  - Surface dependent dry deposition
  - RN resuspension regarding at short- and long-time scales,
  - Fog / cloud / snow deposition,
  - Gas-to-particle iodine kinetic and possible iodine desorption; iodine deposition
  - Emergency preparedness

- **Regarding routine conditions**: improvements and harmonization are needed
  - Sampling :
    - ^{131}I (lower detection limits, cope with humidity)
    - Dry deposition (film of water to avoid particle losses due to their wind driven suspension after their initial deposition)
  - Monitoring:
    - noble gas, tritium, ^{14}C
    - Online filter activity monitoring
  - Metrology:
    - Actinide chemistry: Faster and widespread !
    - Novel detectors

ON-GOING EFFORTS OF PRIORITISATION IN RESEARCH AND EXPERTISE

- Regarding technical aspects and methodologies: exchange all relevant information about technological novelties and upgraded methodologies that would allow to trap airborne radionuclides in a more efficient and representative way and to measure them using the best available measuring equipment.
- Collaborative approach to solve current questions related to numerous fairly unknown processes involved in atmospheric transfers and leading to deposition and residual airborne levels. Regarding the radioecological aspects, airborne radionuclide levels depend on meteorological conditions, and their persistence in the atmosphere is related both to the previous deposition level and to the initial stock or released amount. Washout, rainout and dry deposition processes, wind-driven re-suspension and re-emission of radionuclides by biomass burning, gas to particle transfers, size distribution of airborne radionuclides, residual airborne level in the high altitude, are some examples of the current topics of interest.