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Competencies Matrix for the CINCH-II VET courses

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1.0	24/05/16	A.Brown, P.Scully, E. Ansoborlo	Issue to Participants for Comment and Discussion at M36 Meeting, Prague
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Relevance

This deliverable contributes to the following Work-Packages and Tasks:

☐ ALL

WP 1
☐ Task 1.1 ☐ Task 1.2 ☐ Task 1.3 ☐ Task 1.4

WP 2
☒ Task 2.1 ☐ Task 2.2 ☐ Task 2.3 ☐ Task 2.4

WP 3
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WP 4
☐ Task 4.1 ☐ Task 4.2 ☐ Task 4.3 ☐ Task 4.4

WP 5
☐ Task 5.1 ☐ Task 5.2 ☐ Task 5.3 ☐ Task 5.4

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CONTENT

INTRODUCTION

Coordination in education and training In Nuclear CHemistry (CINCH-II) is a consortium of partners across Europe which aims at bringing together the capabilities of the different partners in order to implement new courses and to find a way of meeting the nuclear chemistry postgraduate education training needs of the European Union.

As part of CINCH, a pan-European set of vocational and education training (VET) courses for participation by nuclear industry and research professionals are being prepared. These VET courses have been developed for the specific needs of non-academic end-users, for example employers, regulators etc. These needs were identified in a comprehensive review undertaken by the CINCH consortium. The VET courses referenced in the sections below have been developed and delivered by the following partners:

- Loughborough University (LU) - United Kingdom,
- Norwegian University of Life Sciences (NMBU) - Norway,
- The Atomic Energy and Alternative Energies Commission (CEA) - France,
- Chalmers University of Technology (Chalmers) - Sweden,
- Czech Technical University (CTU) - Czech Republic.

This report produced examples of how key competencies from the proposed VET course curricula could translate to generic roles within Nuclear and RadioChemistry (NRC). This is to acknowledge the greater emphasis to competency based curricula and their application to end-user requirements.

TRANSLATING KEY COURSE COMPETENCIES TO GENERIC ROLES WITHIN NRC

As part of the task to translate key course competencies to generic roles within Nuclear and RadioChemistry (NRC), three roles were taken from the Nuclear Job Taxonomy developed by the Joint Research Center within the European Commission (EC) [1]. These generic roles were Chemistry Manager, Chemistry Supervisor and Chemistry Technician. In addition to this, as part of this task, a fourth role was created from scratch: Chemistry Researcher (see appendix). The reason for the fourth role was that it was felt that the three roles in the Nuclear Job Taxonomy did not cover all of the chemistry roles that would be expected to benefit from the VET courses.

From exploring the competencies required for these roles, the following keywords/ phrases were identified:

- Decisiveness
- Creativity
- Transversality
- Synthesis spirit
- Management of people
- Leadership
- Communication
- Problem solving
- Accountability
- Analytical thinking
- Impact and influence
- Organisation, planning and evaluation
- Discretion and confidentiality
- Team working
- Accuracy
- Good attitude to safety
- Punctuality
- Attention to detail
- Manual dexterity
- Knowledge

These keywords/ phrases were explored within the syllabi deliverable produced for the CINCH II VET courses [2]. The next part of this deliverable thus goes through each course syllabus and extracts information which translates into one of the above keywords/ phrases.

Course title: **Environmental Radiobiology**

Keywords/ phrases related to this course: knowledge, creativity, good attitude to safety, accuracy, manual dexterity, attention to detail, organisation, planning and evaulation

Information from the syllabus for this course which translates into the keywords/ phases above:

- Student has an overview of radiobiology fundamentals and state-of-the art of knowledge on radiation effects in humans.
- Student is able to understand and estimate/evaluate effects and endpoints of radiation on both humans and non-human biota.

- Student has knowledge and understands the environmental radiobiology concepts as well challenging paradigms.
- Student has knowledge and understands radiobiology methods and biomarkers being applied in ecological research, factors influencing radiosensitivity in different organisms, and ecological risk assessment.
- Student is able to estimate and evaluate potential radiation effects in humans and biota.
- Student is competent to join a team working with investigating the radiobiological effects by using biomarker tools and endpoint assessments.
- Student is competent to use certain radiobiological methods and tools in ecological risk assessment.

Course title: **ERICA Modelling Risk Assessment**

Keywords/ phrases related to this course: knowledge, good attitude to safety, accuracy, communication, decisiveness, problem solving, analytical thinking.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Student has an overview of the basic risk assessment modelling for non-human biota.
- Student/trainee is able to use ERICA Tool in risk assessments of ionizing radiation in freshwater, terrestrial and marine ecosystems.
- Student is able to conduct risk assessment using all three available tiers depending on the results and assessments need.
- Student has knowledge and understands the ecosystem approach for the assessment of effects of ionizing radiation on non-human biota.
- Student has knowledge and understands elements related to environmental management, risk characterization and impact assessment.
- Student has knowledge and understands underlying principles of risk and impact assessment and characterization, including uncertainties.
- Student is IUR (International Union of Radioecology) certificated ERICA Tool user.
- Student is able to do risk and impact assessments using ERICA Tool in different cases at national and international scales.

Course title: **Experimental Radioecology**

Keywords/ phrases related to this course: knowledge, communication, synthesis spirit, manual dexterity, impact and influence, organisation, planning and evaluation, team working.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Have an overview of the field of radioecology.
- Is able to conduct radioecological studies using tracer techniques, radiochemical separation techniques and advanced measurement methods.
- Be able to take part in basic preparedness, countermeasures and risk assessment within the topic of radioactive contamination.
- Can prepare and deliver effective oral and written presentations of technical information and scientific results
- Understands and has knowledge on radioactive sources.
- Understands the transport and spreading of radioactive substances in various ecosystems.

- Understands the basis for environmental impact and risk assessments.
- Understands and can evaluate the possible countermeasures and clean-up strategies.
- Is able to communicate and cooperate with people working on other subjects.
- Has insight in ethics and risk connected to use of radioactive sources.
- Is able to contribute within national preparedness associated with radioactive contamination.

Course title: **Basics of Radioprotection**

Keywords/ phrases related to this course: knowledge, decisiveness, problem solving, analytical thinking, organisation, good attitude to safety, planning and evaluation.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Can describe the basics of radiation protection.
- Can describe the energy spectra of alpha, beta and gamma radiation.
- Is able to interpret alpha, beta and gamma decay schemes.
- Is able to describe the atomic structure of matter, as well as provide information on the sizes and proportions in the atom.
- Knows the different types of radioactive decays; can explain the formation process and the physical properties of ionizing radiation
- Understands the meaning of the quantity "activity".
- Understands the difference between a continuous and a discrete spectrum.
- Understands the different interaction mechanisms of ionizing radiation with matter and the implications for radiation protection.
- Understands the production and spectrum of X-rays.
- Understands the concepts of radiation dose, absorbed dose, ion dose, dose rate.
- Knows the biological effect of the different types of radiation.
- Has insight into the risks connected to the use of radioactive sources, and ways of diminishing radiation exposure.
- Can apply the theoretical knowledge to the field of practical radiation protection.

Course title: **Behaviour of Radionuclides in the Biosphere**

Keywords/ phrases related to this course: knowledge, decisiveness, communication, good attitude to safety, team working, organisation, planning and evaluation.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Have an overview of the field of RNs speciation including analysis, applied to toxicology and environment.
- Be able to better understanding or conduct any impact studies, and to deal with treatment of contamination (decorporation or remediation).
- Can prepare and deliver effective oral and written presentations of technical information and scientific results.
- Understands and has knowledge on chemistry and radiochemistry.
- Understands the basis for environmental impact and risk assessments, and guidance associated.
- Understands and can evaluate the possible countermeasures and clean-up strategies.
- Is able to communicate and cooperate with people working on other subjects.

- Has insight in ethics and risk connected to use of radionuclides.
- Is able to contribute within national preparedness associated with radionuclide contamination.

Course title: **Hands-on Training in Nuclear Chemistry**

Keywords/ phrases related to this course: knowledge, synthesis spirit, communication, impact and influence, good attitude to safety, manual dexterity, attention to detail, organisation, planning and evaluation.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Can work in a radiochemistry laboratory.
- Follow substantial work scheme "preparation – measurement – calculation" with respect to radiochemistry practice and radiometric detection
- Basic application of fundamental NRC principles.
- Work with open radioactive sources/materials.
- Knowledge of basic principles of nuclear chemistry.
- Understanding and knowledge of using and handling of radioactive materials.
- Basic insight of/knowledge about fundamental phenomena behind radiation protection and decontamination routines.
- Introductory knowledge and understanding of experiments with radioactivity and their setup.
- Is now trained to carry out, understand and plan basic radiochemical work and experiments.
- Is now able to understand and exchange knowledge in the NRC field; and hold a conversation on the basic NRC technical level.
- Is able to help in minor laboratory contamination issue or an accident.

Course title: **Practical Exercises in Radioanalytical Methods**

Keywords/ phrases related to this course: knowledge, manual dexterity, attention to detail, good attitude to safety, accuracy, communication, synethsis spirit, decisiveness, attention to detail.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Can work in an analytical radiochemistry laboratory.
- Follow the work scheme "sample collection – sample treatment / separation of analyzed radionuclides – measurement – calculation" with respect to radiochemistry practice and radiometric detection.
- Advanced application of combined NRC and separation principles.
- Work with open radioactive sources/materials at analytical level.
- Basic insight/knowledge of radioanalytical methods, using ionizing radiation in/for analytical purposes, and general methods of determination of the selected radionuclides.
- Knowledge and understanding of experimental setup and standard radioanalytical procedures.
- Is now trained to carry out and understand radioanalytical work and methods of determination of the selected radionuclides in various types of samples.
- Is now able to understand and communicate on the basic radioanalytical level having insight into radioanalytical laboratory practice.

Course title: **Nuclear Fuel Fabrication**

Keywords/ phrases related to this course: knowledge, manual dexterity, attention to detail, good attitude to safety, accuracy, communication, synethsis spirit, decisiveness, organisation, planning and evaluation.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Can work in an analytical radiochemistry laboratory
- Follow the work scheme outlined for the purpose. Analyze all the safety aspects of the experiment beforehand with mitigation methods.
- Advanced application of combined NRC and separation principles.
- Work with open radioactive sources/materials at analytical level.
- Work with high temperature oven(s), gases and glove-boxes.
- Basic insight/knowledge of radioanalytical methods, using ionizing radiation in/for analytical purposes, and general methods of determination of the selected radionuclides.
- Knowledge and understanding of experimental setup and standard radioanalytical procedures.
- Knowledge and understanding of surface characterization methods (XRD/SEM).
- Knowledge and operation capability of a high temperature oven under certain atmosphere.
- Is now trained to carry out and understand radioanalytical work and methods of fabrication of nuclear fuel via a novel method.
- Is now trained to carry out and understand the operation of a high temperature oven under certain atmosphere (gas).
- Is now able to understand and communicate on the basic radioanalytical level having insight into radioanalytical laboratory practice.

Course title: **Plutonium Chemistry**

Keywords/ phrases related to this course: knowledge, manual dexterity, attention to detail, good attitude to safety, accuracy, communication, synethsis spirit, decisiveness, organisation, planning and evaluation.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Can work in an analytical radiochemistry laboratory
- Follow the work scheme outlined for the purpose. Analyze all the safety aspects of the experiment beforehand with mitigation methods.
- Advanced application of combined NRC and separation principles.
- Work with open radioactive sources/materials at analytical level.
- Basic insight/knowledge of radioanalytical methods, using ionizing radiation in/for analytical purposes, and general methods of determination of the selected radionuclides (Pu and Am).
- Knowledge and understanding of experimental setup and standard radioanalytical procedures.
- Knowledge and understanding of characterization methods.
- Is now trained to carry out and understand radioanalytical work and methods of handling plutonium.
- Is now able to understand and communicate on the basic radioanalytical level having insight into radioanalytical laboratory practice.

Course title: **Fuel Coolant Interaction**

Keywords/ phrases related to this course: knowledge, manual dexterity, attention to detail, good attitude to safety, analytical thinking, accuracy, communication, synethsis spirit, decisiveness.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Can work in an analytical radiochemistry laboratory
- Follow the work scheme outlined for the purpose. Analyze all the safety aspects of the experiment beforehand with mitigation methods.
- Advanced application of combined NRC and separation principles.
- Work with open radioactive sources/materials at analytical level.
- Working with a high temperature oven as well as handling gases.
- Basic insight/knowledge of radioanalytical methods, using ionizing radiation in/for analytical purposes, and general methods of determination of the selected radionuclides.
- Knowledge and understanding of experimental setup and standard radioanalytical procedures.
- Knowledge and understanding of characterization methods.
- Is now trained to carry out and understand radioanalytical work and methods of handling nuclear fuel.
- Is now able to understand and communicate on the basic radioanalytical level having insight into radioanalytical laboratory practice.

Course title: **Liquid Scintillation Counting**

Keywords/ phrases related to this course: knowledge, communication, analytical thinking, problem solving, accountability, team working, decisiveness.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Prepare and deliver effective written laboratory reports including technical information and scientific discussion.
- Take responsibility for individual work.
- Understands and has knowledge on chemistry and radiochemistry
- Understands the basis for alternative analytical measurements
- Able to communicate effectively using correct scientific knowledge.
- Be able to work effectively and efficiently with other students.
- Able to contribute to practical experiments and interpret scientific data.

Course title: **Field Work**

Keywords/ phrases related to this course: knowledge, attention to detail, analytical thinking, communication, manual dexterity, descisiveness, organisation, planning and evaluation.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Analyse and evaluate independently, a range of research-informed literature and synthesise research-informed examples from the literature into written work.
- Devise and sustain, with little guidance, a logical and reasoned argument with sound, convincing conclusions.
- Communicate effectively, arguments, evidence and conclusions using a variety of formats in a manner appropriate to the intended audience.

- Analyse and evaluate appropriate data and complete a range of research-like tasks with very limited guidance.
- Evaluate strengths and weaknesses in relation to graduate-level professional and practical skills, acting autonomously to develop new areas of skills as necessary.
- Understands the importance of correct storage of samples.
- Understands how to take representative samples.
- Understands the importance of effective and carefully planned sampling
- Is able to communicate and cooperate with colleagues.
- Understanding of ethics and risk connected with field work and radioactive samples.

Course title: **An Introduction to Radioisotope Techniques**

Keywords/ phrases related to this course: knowledge, analytical thinking, communication, manual dexterity, descisiveness, good attitude to safety, accountability.

Information from the syllabus for this course which translates into the keywords/ phases above:

- Work safely and efficiently in the laboratory, be confident using the techniques above and be able to interpret scientific data produced from the techniques.
- Prepare and deliver written documents of technical information and scientific results.
- Understands and has knowledge in chemistry and radiochemistry
- Understands the need and use of the techniques involved, including its uses in other sectors such as medicine, organic chemistry and biology.
- Able to communicate effectively and appropriately with colleagues on the subject matter.
- Understands the risks and benefits of using radionuclides.

REFERENCES

[1] Nuclear Job Taxonomy, May 2015, Joint Research Center, Institute for Energy and Transport, European Commission

[2] Syllabi for the CINCH-II VET Courses, May 2016, P. Scully, A. Brown, CINCH-II (project number: 605173)

APPENDIX

Job Title
Chemistry Reseacher

Role/ functions
Responsible for the aspects of a chemistry program that the individual is researching. The role encompasses doing experimental and/ or computational work, following procedures, meeting deliverables, communicating with other professionals, organising their own work, writing proposals and reports.

Job Requirements
Knowledge:

- Chemistry
- Data processing and IT tools
- Nuclear energy
- Radiological protection
- Research methods
- Grammar, punctuation and spelling
- Word processing

Skills:

- Write research proposals/ task specifications
- Plan and organize their work
- Perform laboratory work and/ or perform computational chemistry research
- Write reports where the work that has been done is clearly explained
- Deliver a presentation on research
- Network and communicate with other professionals
- Analyse and interpret data

Competencies:

- Creativity
- Transversality
- Synthesis spirit
- Communication
- Problem solving
- Accountability
- Analytical thinking
- Impact and influence
- Organisation, planning and evaluation
- Good attitude to safety
- Attention to detail
- Manual dexterity (if laboratory based)
- Knowledge