



Title: “UAE National Strategy for Education and Training in Radiation Protection”

Document prepared by: the ““UAE National Strategy for Education and Training in Radiation Protection” Working Group”, a subgroup of the UAE Radiation Protection Committee

0. EXECUTIVE SUMMARY

As part of a high-level national commitment towards Safety, each IAEA Member State should develop a “*National Strategy for Education and Training in Radiation Protection*”, in order to streamline and foster all initiatives aiming at building a sustainable and competent Radiation Protection workforce in the Country.

To this purpose, UAE representatives of relevant Stakeholders from the Radiation Protection Committee in the State, gathered in the “*UAE National Strategy for Education and Training in Radiation Protection Working Group*”, developed this document, for the Radiation Protection Committee’s approval and endorsement.

It is expected that the implementation of the actions outlined in this strategic document will help to shape and consolidate the various Radiation Protection professions in the UAE, in the next years.



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2. UAE National Strategy for education and training in Radiation Protection: introduction and background

Ionizing radiation sources (radioactive materials and radiation generators) are extensively used in the UAE in several applications, belonging to the industrial, medical, veterinary, educational, security, oil&gas and electronuclear sectors, among others.

Currently, the UAE is building four nuclear power plants, which are expected to be fully operational in the next years.

An impressive number of medical facilities already exist in the country, and a significant increase in the number and complexity of such facilities is expected in the next years.

Radiation sources are daily used in the construction and in the oil&gas industries, with many applications in other industrial activities.

The number of UAE Licensees (Legal subjects authorised to import, store and/or use radiation sources) has reached almost 3000, in 2018.

Given the intrinsic radiological risks in the use of radiation sources, and the significant step of embarking a nuclear programme, the UAE expressed since their Nuclear Policy, in 2007 [1], their commitment to make use of the highest standards of radiological safety, and to fully conform to the International Atomic Energy Agency safety standards. The Nuclear Policy already stresses the importance of developing Education and Training programmes as a cornerstone of Safety.

This commitment has been subsequently confirmed in the “Nuclear Law” [2], establishing the *Federal Authority for Nuclear Regulation* with a mandate to implement, among others, Radiation Protection obligations under any relevant convention or agreement entered by the UAE.

The Federal Authority for Nuclear Regulation has issued UAE Regulations and UAE Regulatory Guides (including, among others, [3], [4], [5]), conforming to the highest international standards of radiological safety, and has submitted its licensing and inspection programmes to extensive reviews by the International Atomic Energy Agency (including, among others, the IRRS, ORPAS, EduTA missions).

The UAE Legal Framework in radiological protection conforms to the International Atomic Energy Agency Safety Standards, and therefore contains provisions for the roles and responsibilities of the “Qualified Expert”, the “Radiation Protection Officer” [3] and the “Medical Physicist”, among other “Radiation Protection Professionals”¹.

¹ Professional involved in this field include: Personnel with specific responsibilities or functions in Radiation Protection (**Qualified Experts, Radiation Protection Officers**); Staff of the UAE **Regulatory Body**, FANR; **Health**



The UAE Legislation, in line with international practice, assigns primary responsibility to the Licensee for the provision of training in Radiation Protection to the QE, the RPO and other subjects ([3], [4], [5]). Provisions for re-training are also included in the Regulation.

However, the detailed implementation of the QE/RPO *regime* in the practice is not fully developed yet, for example due to the lack of education and training requirements and of the qualification and recognition criteria for Radiation Protection Professionals.

According to the IAEA proposed approach (for example: [6], [7], [8]), each Member State should develop a comprehensive National Strategy for Education and Training in Radiation Protection, ensuring that all Professionals involved in activities characterised by radiological risks possess solid education foundations, have received appropriate training and will continuously receive appropriate regular re-training on the various aspects of radiological protection which may be present in their work.

A large and comprehensive body of knowledge, experience and good practices has been developed by the “European Network on Education and Training in Radiological Protection” (ENETRAP, [9]), an initiative of the European Commission which regrouped several competent Partners and was started more than ten years ago; and by the EUTERP foundation [10], among others.

The Federal Authority for Nuclear Regulation has issued –in its website- a preliminary framework, based on the IAEA literature, for Education and Training requirements of Radiation Protection Professionals.

The further definition of other important implementation details (including E&T requirements, learning objectives, recognition process, implementation of the requirements, etc.) is the scope of the present document, which contains the UAE “**National Strategy for Education and Training in Radiation Protection**”.

This document, given its collegial nature, and the involvement of the several UAE Stakeholders, should be considered as a direct implementation of the UAE Policy [1].

Professionals (such as: Medical Physicists, Radiological medical practitioners, Medical Radiation Technologists (e.g. nuclear medicine technicians, diagnostics technicians), Radiopharmacists, Referring Medical Practitioners, Approved Medical Practitioners, etc.); **Exposed Workers** (including those ones who have the responsibility for the day-to-day use of radiation sources, such as qualified operators); **Non-Exposed Workers**, who may be involved or associated with activities involving radiation but not considered to be directly working with radiation; and other personnel who may occasionally be involved or associated with activities involving radiation exposure (e.g. **Emergency preparedness and Emergency response personnel**).



3. Acronyms

The following acronyms are used in the text:

- EmW** Workers Professionally Exposed to the risks of ionizing radiation during a nuclear or radiological emergency (**Em**ergency **W**orkers)
- E&T** Education and **T**raining
- EW** Workers Professionally Exposed to the risks of ionizing radiation (**E**xposed **W**orkers)
- IAEA** **I**nternational **A**tomic **E**nergy **A**gency
- NQA** **N**ational **Q**ualifications **A**uthority
- NS** UAE National Strategy in Education and Training in Radiation Protection (**N**ational **S**trategy), the present document
- QE** **Q**ualified **E**xpert (as defined in [3])
- Q+NOSS** National **Q**ualifications based on **N**ational **O**ccupational **S**kills **S**tandards
- RNDC** Recognised National Development Committee
- RP** **R**adiation **P**rotection
- RPC** **R**adiation **P**rotection **C**ommittee in the State (as defined in [2])
- RPO** **R**adiation **P**rotection **O**fficer (as defined in [3])
- RTP** **R**egistered **T**raining **P**rovider
- TP** **T**raining **P**rovider
- VETAC** **V**ocational **E**ducation and **T**raining **A**wards **C**ouncil
- WG** Working Group on the “UAE National Strategy in Education and Training in Radiation Protection” (**W**orking **G**roup)



4. Commitments and Obligations

In its Nuclear Policy [1], the UAE expressed the intention, among other commitments, to adopt, in its nuclear programme's development, the highest standards of safety, while at the same time ensuring "development and funding of human resource capabilities". The importance of Education and Training is recognised as being an integral part of the development of a nuclear programme, including ensuring the availability of the appropriate resources all along plants' commissioning, operation and decommissioning ("*continued education and training constitute a cornerstone of the critical infrastructure necessary to sustain a nuclear power program*"). Similar considerations apply to other non-nuclear activities related to the use of radiation sources (radioactive materials and radiation generators) in various fields.

Sustainability, and more specifically Emiratisation, is an important part of any long-term Strategy, as it ensures that human resources are properly developed, with the specific objective of maintaining a national qualified workforce which is able to continuously improve its competence with time.

Ideally, as a result of the National Strategy's implementation, it is envisaged that, eventually:

1. The professions of "Qualified Expert", "Radiation Protection Officer" and "Medical Physicist" (among other RP Professionals, here also discussed) are available² in the UAE
2. Mechanisms for the UAE qualification and recognition of "Qualified Experts" are in place, specifying competence (educational, experience, training) requirements, the national process for formal recognition, and the characteristics (duration, validity, cancellation, etc.) of the qualification
3. Mechanisms for the UAE qualification and recognition of "Radiation Protection Officers" are in place, specifying competence (educational, experience, training) requirements, the national process for formal recognition, and the characteristics (duration, validity, cancellation, etc.) of the qualification
4. Mechanisms for the UAE qualification and recognition of "Medical Physicists" are in place, specifying competence (educational, experience, training) requirements, the national process for formal recognition, and the characteristics (duration, validity, cancellation, etc.) of the qualification
5. Mechanisms for the UAE qualification and recognition of other Professionals are in place, specifying competence (educational, experience, training) requirements, the national process for formal recognition, and the characteristics (duration, validity, cancellation, etc.) of the qualifications
6. Comprehensive Training and re-training programmes are in place in the UAE, leading to the creation of a competent and sustainable workforce (policy and sustainability, continuous

² "Available" is intended as: "accessible to Candidates, with clear and established Education and Training requirements, and a unique and UAE-recognized National Qualification scheme".



capacity building). This would include the development of an adequate E&T framework in the UAE.

It is envisaged that competence requirements for RP Professionals in the UAE are defined in a way to reflect the best international standards in the RP field, and will take account of the various developments that, in the last 20 years, have been made, specifically within European collaboration initiatives (e.g.: [9], [10]) and at the international level (e.g.: [11], [6]).

It is also envisaged that corresponding education curricula and vocational training courses available in the UAE will consequently reflect the highest levels of specialisation outlined in RP Professionals' competence requirements.

The implementation of the Strategy will involve various Governmental entities (as discussed in §6), some of which will have a more direct role, while others will proactively cooperate in the proper implementation of some of the intended developments.

Those Entities, acknowledging the works of the Working Group by directly taking part in them; and by finding consensus and sharing the final draft of this document with the "Radiation Protection Committee" for its endorsement, therefore share the responsibility to enact the actions that are outlined in this document.



5. Scope and purpose of the “National Strategy for Education and Training in Radiation Protection”

The UAE National Strategy (NS) is a cornerstone for building and sustaining competency in Radiological Protection for all UAE workers who are exposed to radiation risks and the UAE general public.

The NS aims at supporting several developments needed in the UAE in the field of radiological protection, by streamlining actions at various levels, both among Governmental Entities and in the private sector.

This document, hence, covers many different areas, including:

- a. Creation of the Professions: Defining roles and responsibilities for Qualified Experts, Radiation Protection Officers, Medical Physicists, etc., and their respective tasks, i.e., defining Job Profiles for those Professionals, at various levels and in various sectors
- b. National Qualification: Defining the mechanisms for the UAE national qualification for Qualified Experts, Radiation Protection Officers, Medical Physicists, and other Professionals
- c. Education: Defining a strategic direction for (lower/higher) education in radiological protection for Qualified Experts, Radiation Protection Officers, Medical Physicists and other RP Professionals
- d. Training: Defining training, residency and apprenticeship (competence) requirements for Qualified Experts, Radiation Protection Officers, Medical Physicists, etc.
- e. Training Courses: Defining learning objectives for training courses addressing the competence requirements for Qualified Experts, Radiation Protection Officers, Medical Physicists, etc.
- f. Training Providers' Accreditation: Defining accreditation mechanisms for training service providers, offering training courses for Qualified Experts, Radiation Protection Officers, Medical Physicists and other RP Professionals.

According to the IAEA framework [8], the National Strategy should comprise four phases, namely the statement of the needs, the definition of the National E&T Programme, the implementation of the Programme, and the systematic review of the effectiveness of the Programme, including its amendment and modifications, after its initial implementation.

To this purpose, an analysis of the current E&T status and needs has been performed by the Working Group, and is reported in §7.

The actions needed to develop and sustain competence building in Radiation Protection (the core of the National Strategy) are reported in §§10-18.



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Monitoring effectiveness and adjusting the Strategy based on its implementation is dealt with in §20. The feedback cycle, as suggested by the IAEA, should initially range between three and five years, and could be adapted following the needs of the Country. The Strategy implementation strategy could be adapted, if needed, after a one-cycle experience, and collection of feedback.



6. Relevant Stakeholders

The present NS has been developed by a corresponding WG, a subset of the “Radiation Protection Committee in the State” [2], which ensured large consensus among Stakeholders in all areas of application of radiation and nuclear technology in the UAE.

Various Stakeholders are also involved in the direct implementation of the NS.

Representatives from the following Entities belong to the WG, and contributed to the preparation, review and discussion of the present NS document:

- Abu Dhabi Department of Education and Knowledge (ADEK)
- Abu Dhabi Polytechnic
- Cleveland Clinic Abu Dhabi (CCAD)
- Department of Health (DoH)
- Dubai Health Authority (DHA)
- ENEC and Nawah
- Environment Agency – Abu Dhabi (EAD)
- Federal Authority for Human Resources (FAHR)
- Federal Authority for Nuclear Regulation (FANR)
- General Authority for Ports, Borders and Free Zones Security (MANAFTH)
- GHQ Armed Forces (AF)
- Higher Colleges of Technology (HCT)
- Khalifa University (KU)
- Ministry of Climate Change and Environment (MOCCAEE)
- Ministry of Health and Prevention (MOHAP)
- Ministry of Human Resources and Emiratization (MOHRE)
- National Emergency and Crisis and Disasters Management Authority (NCEMA)
- National Qualification Authority (NQA)
- UAE University (UAEU)
- University of Sharjah (UOS)
- Commercial Training Providers³

While consensus on the NS structure is important to secure its endorsement by the Radiation Protection Committee, the work on ensuring continuity and sustainability in E&T in RP just starts with the submission of the document to the RPC.

³ Although private Training Providers have not been nominated in the WG, which is composed of Governmental Entities, they have been involved in the preparation of the National Qualifications (the parallel work of the RNDC at the NQA). Moreover, public comments on the NS and its detailed implementation have been collected during public workshops and gatherings. It must be noted that some Governmental Entities belonging to the WG also provide training courses in the UAE, at various levels (DHA, UOS, KU, ENEC, etc.)



The creation of a proper E&T environment will need efforts and coordination from different UAE Entities.

It is envisaged that a specific active role will be played during the Strategy's implementation by the following UAE Entities:

- Abu Dhabi Department of Education and Knowledge (ADEK)
- Abu Dhabi Polytechnic: Abu Dhabi Polytechnic established in partnership with ENEC and Nawah in 2011 a technician education and training program. This program includes the implementation of the NQA-endorsed "Diploma of Nuclear Power Plant Technology (Radiation Protection)" qualification awarded by Nawah and the Higher Diploma in Nuclear Technology academic degree conferred by Abu Dhabi Polytechnic.
- Dubai Health Authority (DHA): all Medical Entities are expected to collaborate in the preparation of the requirements for E&T of Medical Professionals, and to support the definition of their roles and responsibilities with respect to the QEs and RPOs. More specifically, the Q+NOSS for Medical Physicists needs to be developed, and a better definition of requirements for other Professionals (including technologists, radiologists, radiopharmacists, medical practitioners, occupational medical practitioners, etc.) is also needed.
- ENEC and NAWAH: it is expected that ENEC and NAWAH, having a direct stake in the development of Qualifications and National Occupational Standards for the nuclear sector, will contribute to the definition of their characteristics. Moreover, NAWAH is the Registered Training Provider endorsed by the NQA to award the "Diploma of Nuclear Power Plant Technology (Radiation Protection)" qualification
- Environment Agency – Abu Dhabi (EAD)
- Federal Authority for Human Resources (FAHR): the structure of the National Qualifications and Occupational Standards developed for the private Sector should also be available to UAE Government Employees, hence the need of FAHR support, to ensure that the same requirements exist and are also reflected in the Public Sector
- Federal Authority for Nuclear Regulation (FANR): it is expected that FANR, as the sole UAE Regulator for the Nuclear and Radiological practices, will support and oversee all developments in the field, and will issue, among others, requirements for E&T competences of Radiation Professionals, and clarification on the roles and responsibilities of the QE, the RPO and other Professionals in the workplace.
- Department of Health (DoH): all Medical Entities are expected to collaborate in the preparation of the requirements for E&T of Medical Professionals, and to support the definition of their roles and responsibilities with respect to the QEs and RPOs. More specifically, the Q+NOSS for Medical Physicists needs to be developed, and a better definition of requirements for other Professionals (including technologists, radiologists, radiopharmacists, medical practitioners, occupational medical practitioners, etc.) is also needed.



- Higher Colleges of Technology (HCT): all Higher Education Institutions are expected to collaborate in the preparation and execution of Programmes aiming at offering Education and Training opportunities for QEs and RPOs (BSc and MSc in RP)
- Khalifa University (KU): all Higher Education Institutions are expected to collaborate in the preparation and execution of Programmes aiming at offering Education and Training opportunities for QEs and RPOs (BSc and MSc in RP)
- Ministry of Health and Prevention (MOHAP): all Medical Entities are expected to collaborate in the preparation of the requirements for E&T of Medical Professionals, and to support the definition of their roles and responsibilities with respect to the QEs and RPOs. More specifically, the Q+NOSS for Medical Physicists needs to be developed, and a better definition of requirements for other Professionals (including technologists, radiologists, radiopharmacists, medical practitioners, occupational medical practitioners, etc.) is also needed.
- Ministry of Human Resources and Emiratization (MOHRE): in the creation of the “new” UAE Professions (QE, RPO, EW, EmW, MP), support from MOHRE will be needed to ensure compliance with the existing regulations, and that appropriate “Work Permit” are issued to right candidate after confirming his competency by FANR & NQA. MOHRE will support the monitoring of implementation through collaboration of site inspection with FANR.
- National Emergency and Crisis and Disasters Management Authority (NCEMA): while the definition of E&T requirements for Personnel operating during nuclear and radiological emergency is a responsibility of each single Governmental Entity; it is envisaged that NCEMA, in its role as a coordinating Entity, will help to harmonize them
- National Qualification Authority (NQA): as the Federal Authority in charge for defining UAE Qualifications, NQA support in the definition and creation of the RP Professions is invaluable. Continuous support in the implementation phase, by accreditation of Training Providers and by coordinating QE’s National Qualification Examinations with the support of several other Entities, will also be needed in the future years.
- UAE University (UAEU): all Higher Education Institutions are expected to collaborate in the preparation and execution of Programmes aiming at offering Education and Training opportunities for QEs and RPOs (BSc and MSc in RP)
- University of Sharjah (UOS): all Higher Education Institutions are expected to collaborate in the preparation and execution of Programmes aiming at offering Education and Training opportunities for QEs and RPOs (BSc and MSc in RP)
- Training Providers: various Training Providers in the UAE, both belonging to the public and private sectors, are expected to develop and administer training courses, at various levels and specialisation, in the UAE, in the next years. All UAE Training Providers will need to be properly registered by the National Qualifications Authority (NQA), in order to deliver the appropriate UAE qualifications (see also §17)



7. Analysis of the present status and needs of E&T in Radiation Protection in the UAE

The IAEA proposed process for the qualitative and quantitative definition of a NS is a straightforward process: given an *analysis* of the present situation and a specific set of *needs/expectations*, the NS will help the Member State to reach the national target, and will be *monitored* during its implementation.

This process, while clear and consequential in theory, may be easily applied in a “static” condition, in which a Member State either possesses a clear definition of its intended developments for the future, or has already reached maturity, hence can easily identify its status and needs.

The highly dynamic situation of an embarking Member State makes it more challenging both to define the current status and to guess future national needs. For example, in the last 10 years, the UAE experienced a tremendous and previously unseen rate of development in all its radiological sectors. Numbers of medical and industrial facilities surged, nuclear power plants have been built, and a large population of workers is now dealing with ionizing radiation.

At the beginning of the works of the WG’s activities, no UAE Entity represented in the WG possessed a clear picture of what the future developments in the UAE in the radiological field will look like. All WG Members provided estimates of the needs in the mid-term, based on their direct experience and understanding of the future developments. Those assessments have been discussed during various meetings and revisions of the document, and are certainly neither perfect nor final: this analysis should be repeated regularly and its outcome should be adjusted.

The analysis of the UAE needs which is presented here has been performed on the basis of various assumptions, and may contain significant uncertainties and omissions: more details on the process which has been followed are presented in Annex 01 (§21).



The following table contains an analysis of the current number of existing facilities (2018) and their projected numbers in five years.

Facilities have been regrouped by using “categories” corresponding to the “levels” indicated in §8, 9 and 10.

Table 1, Approximate number of existing (2018) and projected (in 5 years' time) Facilities in the UAE

Type of facility	Current total number of facilities	Projected total number of facilities (in 5 years)
Security applications (Security equipment (e.g. baggage x-ray, container inspection, etc.)) - Cat. I	~100	~150
Industrial activities (industrial radiography, industrial and research irradiator facilities, gauges and well logging, etc.) - Cat. II	~300	~400
Fuel Cycle (including Nuclear Power Plants, Waste management facility, enrichment, fuel fabrication and reprocessing facilities, Uranium mines, Mineral extraction and processing companies (NORM)) - Cat. III	-	~10
Diagnostic medical facilities (Dental radiology, Veterinary radiology) - Cat. I	~520	~730
Nuclear Medicine and Diagnostic and interventional radiology Facilities - Cat. II	~420	~630
Radiotherapy Facilities - Cat. III	~5	~10



The following table indicates the approximate number of existing and projected QEs, RPOs and EWs for the same categories.

Table 2, Approximate current numbers of QEs, RPOs and EWs

Type of facility	Current number of QEs	Current number of RPOs	Current number of EWs
Security applications (Security equipment (e.g. baggage x-ray, container inspection, etc.)) - Cat. I	-	100	100
Industrial activities (industrial radiography, industrial and research irradiator facilities, gauges and well logging, etc.) - Cat. II	-	230	1730
Fuel Cycle (including Nuclear Power Plants, Waste management facility, enrichment, fuel fabrication and reprocessing facilities, Uranium mines, Mineral extraction and processing companies (NORM)) - Cat. III	-	5	3010
Diagnostic medical facilities (Dental radiology, Veterinary radiology) - Cat. I	-	520	540
Nuclear Medicine and Diagnostic and interventional radiology Facilities - Cat. II	-	420	440
Radiotherapy Facilities - Cat. III	-	10	10
Regulator's Staff	~3	5	70
	TOTALS:	1290	5900



The following table indicates the approximate number of existing and projected QEs, and projected re-training requirements.

Table 3, Approximate number of existing and projected QEs, and projected re-training requirements

Type of facility	Current number of QEs	Projected number of QEs (5 y)	QEs requiring retraining (persons/year)
Security applications (Security equipment (e.g. baggage x-ray, container inspection, etc.)) - Cat. I	-	15	10
Industrial activities (industrial radiography, industrial and research irradiator facilities, gauges and well logging, etc.) - Cat. II	-	40	20
Fuel Cycle (including Nuclear Power Plants, Waste management facility, enrichment, fuel fabrication and reprocessing facilities, Uranium mines, Mineral extraction and processing companies (NORM)) - Cat. III	-	15	10
Diagnostic medical facilities (Dental radiology, Veterinary radiology) - Cat. I	-	70	40
Nuclear Medicine and Diagnostic and interventional radiology Facilities - Cat. II	-	60	30
Radiotherapy Facilities - Cat. III	-	10	10
Regulator's Staff	~3	5	5
TOTALS:		215	125



The following table indicates the approximate number of existing and projected RPOs, and projected re-training requirements.

Table 4, Approximate number of existing and projected RPOs, and projected re-training requirements

Type of facility	Current number of RPOs	Projected number of RPOs (5 y)	RPOs requiring retraining (persons/year)
Security applications (Security equipment (e.g. baggage x-ray, container inspection, etc.)) - Cat. I	100	150	80
Industrial activities (industrial radiography, industrial and research irradiator facilities, gauges and well logging, etc.) - Cat. II	230	515	260
Fuel Cycle (including Nuclear Power Plants, Waste management facility, enrichment, fuel fabrication and reprocessing facilities, Uranium mines, Mineral extraction and processing companies (NORM)) - Cat. III	5	100	50
Diagnostic medical facilities (Dental radiology, Veterinary radiology) - Cat. I	520	730	370
Nuclear Medicine and Diagnostic and interventional radiology Facilities - Cat. II	420	630	320
Radiotherapy Facilities - Cat. III	10	20	10
Regulator's Staff	5	10	5
TOTALS:	1290	2155	1095



The following table indicates the approximate number of existing and projected EWs, and projected re-training requirements.

Table 5, Approximate number of existing and projected EWs, and projected re-training requirements

Type of facility	Current number of Ews	Projected number of EWs (5 y)	EWs requiring retraining (persons/year)
Security applications (Security equipment (e.g. baggage x-ray, container inspection, etc.)) - Cat. I	100	150	80
Industrial activities (industrial radiography, industrial and research irradiator facilities, gauges and well logging, etc.) - Cat. II	1730	2455	1230
Fuel Cycle (including Nuclear Power Plants, Waste management facility, enrichment, fuel fabrication and reprocessing facilities, Uranium mines, Mineral extraction and processing companies (NORM)) - Cat. III	3010	3040	1520
Diagnostic medical facilities (Dental radiology, Veterinary radiology) - Cat. I	540	760	380
Nuclear Medicine and Diagnostic and interventional radiology Facilities - Cat. II	440	660	330
Radiotherapy Facilities - Cat. III	10	20	10
Regulator's Staff	70	100	50
TOTALS:	5900	7185	3600



Table 6, Analysis of UAE present and projected RP needs

Type of facility	Current total number of facilities	Projected total number of facilities (in 5 years)	Current number of QEs	Projected number of QEs (5 y)	QEs requiring retraining (persons/year)	Current number of RPOs	Projected number of RPOs (5 y)	RPOs requiring retraining (persons/year)	Current number of Ews	Projected number of Ews (5 y)	Ews requiring retraining (persons/year)
Security applications (Security equipment (e.g. baggage x-ray, container inspection, etc.)) - Cat. I	~100	~150	-	15	10	100	150	80	100	150	80
Industrial activities (industrial radiography, industrial and research irradiator facilities, gauges and well logging, etc.) - Cat. II	~300	~400	-	40	20	230	515	260	1730	2455	1230
Fuel Cycle (including Nuclear Power Plants, Waste management facility, enrichment, fuel fabrication and reprocessing facilities, Uranium mines, Mineral extraction and processing companies (NORM)) - Cat. III	-	~10	-	15	10	5	100	50	3010	3040	1520
Diagnostic medical facilities (Dental radiology, Veterinary radiology) - Cat. I	~520	~730	-	70	40	520	730	370	540	760	380



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Type of facility	Current total number of facilities	Projected total number of facilities (in 5 years)	Current number of QEs	Projected number of QEs (5 y)	QEs requiring retraining (persons/year)	Current number of RPOs	Projected number of RPOs (5 y)	RPOs requiring retraining (persons/year)	Current number of Ews	Projected number of EWs (5 y)	EWs requiring retraining (persons/year)
Nuclear Medicine and Diagnostic and interventional radiology Facilities - Cat. II	~420	~630	-	60	30	420	630	320	440	660	330
Radiotherapy Facilities - Cat. III	~5	~10		10	10	10	20	10	10	20	10
Regulator's Staff	-	-	~3	5	5	5	10	5	70	100	50
TOTALS:				215	125	1290	2155	1095	5900	7185	3600



8. Strategy for the Qualification of the “Qualified Expert” in the UAE

The Qualified Expert [3] is a (nationally) recognised RP Professional able to provide authoritative advice to employers on matters relating to compliance with applicable legal requirements and technical standards, in respect of occupational and public exposure to radiation.

The QE usually [11] has education and/or experience equivalent to a master’s degree from an accredited college or university, in radiation protection, radiation safety, biology, chemistry, engineering, physics or a closely related physical or biological science; and has acquired vast competence in radiation protection, by virtue of special studies, training and practical experience.

The title of “Qualified Expert” should be recognised as a Profession by the UAE Government (via the National Qualification Authority processes), and a recognition process/scheme should be available in the UAE, in compliance to the BSS requirements [12], and as indicated in the UAE Legislation.

A number of around 100 QEs should be needed in the UAE in the medium term, according to the analysis of the WG.

Public lists of QEs should be made publicly available in the UAE, and criteria for re-training, validity of the title and cancellation from the lists should also be published.

According to the discussions during the national workshops on this topic, it seems appropriate that three levels of QEs be available in the UAE, which will be matched by a similar structure in the RPO and in EW classifications (see §9 and §10):

1. QE Level 1 (QE-1): required in facilities characterised by lowest radiological risks, in all sectors (industrial, research, medical, etc.)
2. QE Level 2: required in facilities characterised by higher radiological risks, with a further specialisation as (QE-2A), for the Medical sector and (QE-2B), for all the other Sectors
3. QE Level 3: required in facilities characterised by highest radiological risks, with a further specialisation as (QE-3A) for the Medical sector, (QE-3B) for the nuclear power sector, and (QE-3C) for all the remaining Sectors

Table 7, QEs levels and sectors

QE-3A (medical sector)	QE-3B (nuclear sector)	QE-3C (all other sectors)
QE-2A (medical sector)		QE-2B (all other sectors)
QE-1 (all sectors)		



In order to ensure proper recognition to this Professional, some actions are needed, and they have been collected in the next table: basically the role and responsibilities of the QE –including relationship with other RP Professionals (RPOs, MPs, EWs, etc.) must be clarified and properly inscribed in the legal framework; the internal classification in “levels” and “sectors” should also be clearly defined, associating one type of radiological facility with one QE level/sector; requirements for QEs’ Education should be defined; requirement for QEs’ competency and skills (training and apprenticeship/OJT) should be defined; mechanisms for a candidate to be certified as a QE by the UAE Government should be developed; interim criteria, valid in the meantime, including temporary recognition of foreign QE titles, should also be developed; public lists of QEs in the UAE should be created; mechanisms for duration of the certification validity and for its renewal process should be developed.

It is suggested that FANR specifies how “levels” and “sectors” will be defined, and how cases in which multiple sources or sectors are simultaneously present should be classified.

It is also suggested that FANR specifies requirements for QEs’ qualifications’ renewal, expiry, termination, and also integrates Continuous Professional Development schemes in re-training and renewal of qualifications (ref. §19, related to the UAE RP Society, an Entity which could potentially organise those CPD events).

Table 8, NS tasks related to the QE recognition process

n.	Task	Comments	UAE Entities directly involved
1	Definition of QEs’ classification/categorization	Define radiological boundaries for internal QEs’ classifications (QE-1, QE-2A, QE-2B, QE-3A, QE-3B, QE-3C)	FANR
2	Definition of QE’s education requirements	Generally, minimum required education for a QE is MSc [11], although it may be possible to accept BSc for QE-1. Equivalence for lower education levels should also be detailed.	FANR, NQA and all Entities in the RNDC, via the NOSs’ definition
3	Definition of QE’s specific experience/apprenticeship requirements	Generally, a minimum required experience in RP of some years [11], apprenticeship or similar training on the job is needed to acquire the technical and professionals skills.	FANR, NQA and all Entities in the RNDC, via the NOSs’ definition
4	Definition of QE’s training requirements	Specific training may be requested for those Candidates who do not possess a previous nuclear/radiological experience. Re-training and CPD requirements should also be fixed.	FANR, NQA and all Entities in the RNDC, via the NOSs’ definition



n.	Task	Comments	UAE Entities directly involved
5	Definition of the process for the formal Qualification of the QE in the UAE	A process, usually comprised of administrative steps and a written/oral examination, is usually [11] required for the QE' formal recognition. The examination would be coordinated by NQA and jointly administered by the UAE Entities involved. Provisions for Qualification's expiry, termination, and re-qualification should also be given.	FANR, NQA and all Entities in the RNDC, via the NOSs' definition
6	Definition of interim criteria (including the recognition of equivalent titles) for the temporary recognition of QEs in the UAE	Interim criteria are needed in the UAE while the formal national recognition mechanisms are being developed	NS WG and FANR
7	Definition of an official public list of QEs in the UAE	Public UAE lists of recognised UAE QEs should eventually be made available to the Employers	NQA and FANR
8	Definition of the roles and responsibilities of the QE in the UAE, also with regard to the RPO and other medical Professionals	FANR should issue a more detailed description of the role and responsibilities of QEs, integrating it in a revision of the relevant Regulation/Guidance. This work could be an outcome of the National Workshops, with the support of the IAEA.	FANR



9. Strategy for the Qualification of the “Radiation Protection Officer” in the UAE

The Radiation Protection Officer is a trained RP Professional who is technically competent in Radiation Protection matters to oversee, supervise or perform the implementation of the Radiation Protection arrangements [3] defined by the QE, in respect of occupational and public exposure to radiation. While the QE is the RP Professional who creates (and oversees) the overall RP system for an Employer, the RPO is the Professional who is implementing the RP system, on a daily basis. In this sense, while the QE’s role is advisory in nature, and could lead to a part-time occupation, the RPO has an operational role in the daily radiological activities and may be a full-time employee.

The RPO usually [11] has education and/or experience equivalent to a bachelor degree from an accredited college in science, and has acquired competence in radiation protection, by virtue of special studies, training and practical experience.

The title of “Radiation Protection Officer” should be recognised as a Profession by the UAE Government (via the National Qualification Authority), and an accreditation scheme will be available in the UAE for Training Providers, in compliance to the IAEA requirements [12], which specify that the recognition should not necessarily come directly from the Government, but from accredited training providers. Hence, individual RPOs will not be recognised by NQA itself (as will be the case for QEs), but by Registered Training Providers (which had previously been accredited by NQA).

Public lists of RPOs should be made publicly available in the UAE, and criteria for re-training, validity of the title, CPD and cancellation from the lists should be published.

Three levels of RPOs shall be available in the UAE, which will be matched by a similar structure in the QE and in EW classifications:

1. RPO Level 1 (RPO-1): required in activities characterised by lowest radiological risks, in all sectors (industrial, research, medical, etc.)
2. RPO Level 2: required in activities characterised by higher radiological risks, with a further specialisation as (RPO-2A) for the Medical sector and (RPO-2B) for all the other Sectors
3. RPO Level 3: required in activities characterised by highest radiological risks, with a further specialisation as (RPO-3A) for the Medical sector, (RPO-3B) for the nuclear power sector, and (RPO-3C) for all the remaining Sectors

In order to ensure proper recognition to these Professionals in the UAE, some actions are needed, and they have been collected in the next table: basically the role and responsibilities of the RPO –including relationship with other RP Professionals (QEs, MPs, EWs, etc.) must be clarified and properly inscribed in the legal framework; the internal classification in “levels” and “sectors” should also be clearly defined, associating one type of radiological facility with one RPO level/sector, and treating cases in which multiple sources or multiple sectors are simultaneously present; requirements for RPOs’



Education should be defined; requirement for RPOs' competency and skills (training and apprenticeship/OJT) should be defined; mechanisms for a candidate to be recognised as RPO by the UAE Government should be developed; public lists of RPOs in the UAE should be created; mechanisms for duration of the certification validity and for its renewal process should also be developed.

As in the case of the QE, it is also suggested that FANR specifies requirements for RPOs' qualifications' renewal, expiry, termination, and also integrates Continuous Professional Development schemes in re-training and renewal of qualifications (ref. §19, related to the UAE RP Society, an Entity which could potentially organise those CPD events).

Table 9, NS tasks related to the RPO recognition

n.	Task	Comments	UAE Entities involved
1	Definition of RPOs' classification/categorization	Define radiological boundaries for RPOs' classifications: RPO-1, RPO-2A, RPO-2B, RPO-3A, RPO-3B, RPO-3C	FANR
2	Definition of RPO's education requirements	Generally, minimum required education for RPOs is BSc or equivalent, although lower levels could be acceptable for RPO-1. Experience equivalence should also be defined for those not meeting education requirements.	FANR, NQA and all Entities in the RNDC, via the NOSs' definition
3	Definition of RPO's specific experience/apprenticeship requirements	Generally, a minimum required experience of some years in RP, or a similar training on the job is needed to acquire the technical and professional skills of RPO.	FANR, NQA and all Entities in the RNDC, via the NOSs' definition
4	Definition of RPO's training requirements	Generally, specific training may be needed for those Candidates who do not possess a nuclear/radiological background. Retraining requirements should also be specified.	FANR, NQA and all Entities in the RNDC, via the NOSs' definition
5	Definition of the process for the formal accreditation of RPO training Providers in the UAE	A process, usually comprised of administrative steps and verifications, is usually required for the formal accreditation of training providers delivering recognition of RPO. More details are needed for re-qualification, qualification expiry, and termination.	FANR, NQA and all Entities in the RNDC, via the NOSs' definition
6	Definition of criteria for the recognition in the UAE of RPO titles obtained abroad	Interim criteria are needed in the UAE, while the formal RPO recognition mechanisms are being developed.	NS WG



n.	Task	Comments	UAE Entities involved
7	Grace period from the current system to the final NQA-based Qualifications' system	A timeframe for the switch from the existing qualification scheme (all RPO qualifications are accepted by the Regulator) and the final scheme (only NQA Registered Training Providers will be able to provide the UAE qualifications) has to be set	FANR
8	Definition of an official public list of RPOs in the UAE	Public UAE lists of RPOs should be made available to Employers	NQA and FANR
9	Definition of the roles and responsibilities of the RPO in the UAE, also with regard to the QE and other medical Professionals	FANR should issue a more detailed description of the role and responsibilities of RPOs, integrating it in a revision of the relevant Regulation/Guidance. (This work could be an outcome of the National Workshops, with the support of the IAEA)	FANR



10. Strategy for the Qualification of the “Exposed Worker” in the UAE

Workers who are professionally exposed to the risk of ionizing radiation (“Exposed Workers”, EW) must have proper education and specific training in Radiation Protection [3]: the responsibility of the provision of RP training to Workers who are professionally Exposed rests with the Employer [3].

A wide variety of Exposed Workers operate in the UAE’s nuclear and radiological fields, with several specialisations: hence it appears wise to leave to the Employers the assessment on specific advanced training needed for specific occupational task.

However, it is also convenient to fix minimum UAE requirements for E&T criteria that must be satisfied for broad EW categories, in order to harmonise their implementation in the Country, and to ensure that a minimum level of E&T is consistent throughout all UAE work sectors.

Similarly to the QEs’ and to the RPOs’ structure, it has been considered convenient to classify EWs in “levels” and “activity sector” categories:

1. EW Level 1 (EW-1): involved in facilities characterised by lowest radiological risks, across all Sectors (industrial, research, medical, etc.)
2. EW Level 2: involved in activities characterised by higher radiological risks, with a further specialisation as (EW-2A), for the Medical Sector and (EW-2B), for all the other Sectors
3. EW Level 3: involved in activities characterised by highest radiological risks, with a further specialisation as (EW-3A) for the Medical Sector, (EW-3B) for the Nuclear Sector, and (EW-3C) for all the remaining Sectors

EWs operate in presence of radiation sources, they do not have direct responsibility for the setup or implementation of the RP System: their training is therefore intended to create awareness and understanding of radiation risks.

Level 1 EWs should be trained in general RP, and should have a basic, broad understanding of radiological risks. Workers in this category would be exposed to lower annual doses of external radiation only. Most EWs in the industrial, medical and security services sectors, including Customs Officers, radioactive materials’ transport companies, will fall into this category.

Level 2 EWs would potentially be exposed to higher annual doses, and may be also potentially subject to internal exposures. Typically, workers operating in a nuclear medicine department, or an isotope production facility, or operating unsealed radiation sources will fall into this category. Training in contamination control and on internal exposure prevention should be present in this category. CT scan, radioactive waste management, radiochemistry operators may fall into this category.

Level 3 EWs could be exposed to even higher annual doses, and would normally be exposed to higher radiological risks, including alpha contamination risk, neutron irradiation, criticality, and may work in



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nuclear fuel cycle facilities and high energy accelerators. Those workers will need a more advanced level of training, including neutron radiation, criticality, alpha contamination detection and prevention. They would be workers operating in a nuclear reactor, technicians operating high-activity sealed sources, radiotherapy installations operators.

It should be stressed that the level of knowledge, skills, competence and experience requested to an EW depends on the specific work activity and sector and is not going to be covered by this Qualification.

This National Qualification intends to build a basic common level of competence for all Exposed Workers in the UAE.

It should also be stressed that the Qualification will not generate a Profession (as in the case of the QE and of the RPO): the job description of, e.g., a Skilled Workshop Operator would still be defined by another Qualification, for which the additional Qualification of “Exposed Worker” would be required, if the “Skilled Workshop Operator” is performing his tasks in an environment which is subject to radiological risks. The proper “packaging” of the EW Qualification needs to be further developed among the several Entities in the WG and in the RNDC.

As a last observation, it must be observed that this Qualification would automatically be reached for all those professions requiring a higher level of competence in RP: as an example, a Radiologist is a qualified Professional with highest skills in the use of radiation, and her/his education and training and experience in RP would represent a more-than-sufficient competence to operate as an Exposed Worker (without obtaining such a qualification). Conversely, considering the case of an Electrician, previous competence requirements for the job may not have included any knowledge/awareness in RP, hence the EW Qualification would be needed.

Further guidance and regulations would be needed from the WG, the RNDC and FANR in this regard.

As in the case of previous Professions, it is also suggested that FANR specifies requirements for EWs’ qualifications’ renewal, expiry, termination, and also integrates Continuous Professional Development schemes in re-training and renewal of qualifications (ref. §19, related to the UAE RP Society, an Entity which could potentially organise those CPD events).



Table 10, NS tasks related to the EW recognition

n.	Task	Comments	UAE Entities involved
1	Definition of EWs' classification/categorization	Define radiological boundaries for EWs' classifications: EW-1, EW-2A, EW-2B, EW-3A, EW-3B, EW-3C	FANR
2	Definition of the nature of the EW Qualification	The EW Qualification being an additional Qualification with respect to a specific job, it is important to define how such a Qualification could be delivered	NQA and all Entities in the RNDC, via the NOSS' definition
3	Definition of cases for which the EW Qualification would not be needed	The EW Qualification being an additional Qualification with respect to a specific job, cases must be specified for which such a Qualification would not be needed	NQA and all Entities in the RNDC, via the NOSS' definition
4	Definition of EW's training requirements	Generally, specific training may be needed for those Candidates who do not possess a nuclear/radiological background. Retraining requirements should also be specified.	FANR, NQA and all Entities in the RNDC, via the NOSS' definition
5	Definition of the process for the formal accreditation of EW training Providers in the UAE	A process, usually comprised of administrative steps and verifications, is usually required for the formal accreditation of training providers delivering the Qualification of EW. More details are needed for re-qualification, qualification expiry, and termination.	FANR, NQA and all Entities in the RNDC, via the NOSS' definition
6	Grace period from the current system to the final NQA-based Qualifications' system	A timeframe for the switch from the existing situation and the final scheme (only NQA recognised training providers will be able to provide the UAE qualifications) has to be set	FANR



11. Strategy for the Qualification of the “Emergency Worker” in the UAE

Workers who are professionally exposed to the risk of ionizing radiation in the course of an emergency (“Emergency Workers”, EmW) must have proper education and specific training also in Radiation Protection [3]: the responsibility of the provision of RP training to EmW rests with the Employer [3].

A wide variety of EmWs operate during nuclear and radiological emergencies, with several specialisations and different roles: hence it is wise to leave to the Employers the assessment on the need of specific advanced training.

However, it is also convenient to fix minimum UAE requirements for E&T criteria that must be satisfied for broad EmW categories, in order to harmonise their implementation in the Country, and to ensure that a minimum level of E&T is consistent throughout all UAE work sectors.

Unlike other Professionals’, for which it has been possible to define a sector of activity and a “level” of radiological risk, this approach was not applicable to emergency exposure situations: it was found useful, taking into account the advice provided by the IAEA, to classify EmWs in two broad categories, depending on the main activities performed in the field:

1. EmW Level 1 (EmW-1): first responders directly involved in the initial activities on site, during the accident, across all sectors (industrial, nuclear, research, medical, etc.)
2. EmW Level 2 (EmW-2): involved in subsequent activities of assessment and decontamination

EmWs operate in presence of radiation sources, usually out of control, and do not have direct responsibility for the setup or implementation of the RP System: their training is therefore intended to create awareness and understanding of radiation risks, and complements other specific competences (fire fighters, policemen, soldiers, etc.).

Level 1 EmWs should be trained in general RP, and should have a basic, broad understanding of radiological risks, and in detection of radioactivity and radiation.

Level 2 EmWs would potentially be required to operate in subsequent accidental situation phases (when a fire is already extinguished, for example), and should be able to measure radiation and to take actions in case decontamination is needed: their training should include more complex elements of radiation detection and measurement.

It should be stressed that the level of knowledge, skills, competence and experience requested to an EmW depends on the specific work activity and sector and is not going to be entirely covered by this Qualification.



This National Qualification intends to build a basic common level of competence for all Emergency Workers in the UAE.

It should also be stressed that the Qualification will not generate a Profession *per se* (as in the case of the QE and of the RPO): the job description of, e.g., a Firefighter would still be defined by another Qualification, for which the additional Qualification of “Emergency Worker” would be required, if that firefighter would be performing his tasks in a radiological accident. The proper “packaging” of the EmW Qualification needs to be further developed among the several Entities in the WG and in the RNDC.

As a last observation, it must be noted that this Qualification would automatically be reached for all those professions requiring a higher level of competence in RP: as an example, a Nuclear Reactor Technician is a qualified Professional with highest skills in the use of radiation, and her/his education and training and experience in RP would represent a more-than-sufficient competence to operate as an “Emergency Worker” (without obtaining such a qualification), provided that she/he is given appropriate training. Conversely, considering the case of a Firefighter whose previous competence requirements for the job did not include any knowledge/awareness in RP, hence the EmW Qualification would be needed.

Further guidance and regulations would be needed from the WG, the RNDC and FANR in this regard.

As in the case of previous Professions, it is also suggested that FANR specifies requirements for EmWs’ qualifications’ renewal, expiry, termination, and also integrates Continuous Professional Development schemes in re-training and renewal of qualifications (ref. §19, related to the UAE RP Society, an Entity which could potentially organise those CPD events).

Table 11, NS tasks related to the EmW recognition

n.	Task	Comments	UAE Entities involved
1	Definition of EmWs’ classification/categorization	Define radiological boundaries for EmWs’ classifications: EmW-1, EmW-2	FANR
2	Definition of the nature of the EmW Qualification	The EmW Qualification being an additional Qualification with respect to a specific job, it is important to define how such a Qualification could be delivered	NQA and all Entities in the RNDC, via the NOSS’ definition
3	Definition of cases for which the EmW Qualification would not be needed	The EmW Qualification being an additional Qualification with respect to a specific job, cases must be specified for which such a Qualification would not be needed	NQA and all Entities in the RNDC, via the NOSS’ definition



n.	Task	Comments	UAE Entities involved
4	Definition of EmW's training requirements	<p>Generally, specific training may be needed for those Candidates who do not possess a nuclear/radiological background.</p> <p>Retraining requirements should also be specified.</p>	FANR, NQA and all Entities in the RNDC, via the NOSs' definition
5	Definition of the process for the formal accreditation of EmW training Providers in the UAE	<p>A process, usually comprised of administrative steps and verifications, is usually required for the formal accreditation of training providers delivering the Qualification of EmW.</p> <p>More details are needed for re-qualification, qualification expiry, and termination.</p>	FANR, NQA and all Entities in the RNDC, via the NOSs' definition
6	Grace period from the current system to the final NQA-based Qualifications' system	A timeframe for the switch from the existing situation and the final scheme (only NQA Registered Training Providers will be able to provide the UAE qualifications) has to be set	FANR



12. Strategy for the Qualification of other specific industrial professions in the UAE

There are also some **Specialised Workers** who, while being professionally exposed to the risk of ionizing radiation (hence for whom the qualification of “Exposed Workers” may apply) may need a well-defined level and specialisation of training in Radiation Protection. Those Workers may be directly involved in practices for which higher RP education and training is needed, but not at the level of the RPO or the QE.

As an example, such specialised Workers may be the Operators of High Activity Sealed Sources (for NDA-NDT), Transport Operators involved in the preparation or the execution of shipments of radioactive materials, skilled Technicians operating in radioactive waste management or NORMs activities, skilled Technicians in radioanalytical radiation measurements’ laboratories, calibration laboratories personnel, whole-body counter or radiotoxicology analyses operators, environmental radiation operators, etc.

Another important category of Workers for which a Qualification scheme, of simplified structure, may also be needed, is the category of what are indicated as “**Outside Workers**” [13], i.e. those Workers belonging to a Company (not necessarily operating in the UAE), who are temporarily called to intervene in another Company’s premises (under the UAE legislation). This situation is typical of nuclear reactor’s fuel outages, during which a large populations (of the order of the thousands workers) is called to intervene on the reactor’s refuelling. At present, the level of qualification and the technicalities of the qualification process in the UAE still need to be explored.

Similar situations may also happen in some specialised operations (decommissioning, decontamination, etc.), for which specific Companies may be contracted from abroad.

At this stage, no specific qualification scheme has been defined for those two broad categories of Exposed Workers, that we have here indicated as “Specialised Workers” and “Outside Workers”.

It would be very appropriate, when the qualification process for those Professionals is started, to make sure that appropriate RP E&T requirements and learning outcomes are also included, i.e. to introduce RP aspects in the UAE Qualification process.

⁴ It is worth to notice that vast experience in the definition and harmonisation of “Outside Workers” exists in the European Union [13], a vast international market in which free movements of workers from one Member Country to the others have been ensured. An analysis of how access to the transnational RP work market has been gradually opened in the EU, along the years, may provide an inspiration for future UAE policies.



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As a UAE qualification strategy is not available for those Professions yet, it has been deemed too early to assess and to fix a strategic direction now: a review of the status at the end of the first cycle of the implementation of the present NS is appropriate.



13. Strategy for the Qualification of the “Medical Physicist” in the UAE

Generally, healthcare professionals have a low awareness of radiation doses in radiological medical procedures along with the nature and magnitude of the related radiation risks.

Medical Physicists have a specific role in a medical organization: not only do they ensure proper levels of functioning of medical radiation sources, but they also contribute directly in improving the overall quality of medical procedures.

Unlike the QE and the RPO (who operate for the RP of workers, the environment and the general public), the role of the MP is related to RP of the patient. MPs are in charge –among other tasks- of setting best parameters for the operation of radiation sources on patients, defining treatment planning, and keeping patient doses under review. The MP may also act as QE if she/he possesses the corresponding UAE qualification.

E&T and qualification paths of Medical Physicists are substantially different than those of QEs, RPOs and other RP Professionals.

MPs education was indeed available in the UAE, until some years ago. Graduates MPs were entering the medical profession, finding employment in several UAE Entities, both in the private and public sectors. However, universities curricula leading to the specialisation in Medical Physics are currently not available in the UAE, and this adds reliance on other Countries’ educational systems.

Moreover, a UAE-wide Qualification as MP does not currently exist in the UAE, and the MP Profession relies on recognition of individual Emirates’ Medical Authorities. It must be noted, however, that an important harmonisation effort in licensing requirements of several medical professionals (including MPs) has been done with the so-called PQR, “Professional Qualification Requirements” [14], which are the result of a Joint effort between Ministry of Health, Department of Health and Dubai Health Authority.

As noted also by the International Organisation for Medical Physics (IOMP, [15]), there is an added value in national qualification, which promotes “*professional competency and high standard of practice*”: “*IOMP recommends that an appropriate means for professional certification of medical physicists be established by national member organizations, either by implementing their own national certification schemes or in collaboration with other established national or international certification bodies*”.

The MP usually [16] has education and/or experience equivalent to a master degree, majoring in medical physics or an appropriate science subject. The qualifying educational programme could be composed by two phases, the second of which is the completion of a postgraduate programme at a master’s degree level in medical physics (or equivalent degree).



Medical physicists who have clinical responsibilities should have received (additionally to their education, [16]) a clinical competency training, preferably in the form of a formal residency or an equivalent clinical training program, for a duration appropriate to their roles and responsibilities, which should be defined in the UAE (syllabi examples are provided by the IAEA [17], [18], [19]).

The title of “Medical Physicist” should be recognised as a Health Profession by the UAE Government (via the National Qualification Authority), hence, similarly to the QE, a MP who has fulfilled the education and training requirements as previously stated should sit for a formal professional certification assessment.

Upon passing the formal professional certification assessment the MP would become a UAE **Clinically Qualified MP (CQMP)**.

Public lists of CQMPs should be made publicly available in the UAE, and criteria for re-training, validity of the title, CPD and cancellation from the lists should be published.

Four categories of MPs shall be available in the UAE:

1. **MP-DR:** Medical Physicist for diagnostics applications, familiar with diagnostic radiation-generating equipment and experience in developing and performing oversight of quality assurance for diagnostic radiation-generating equipment
2. **MP-NM:** Medical Physicist for Nuclear Medicine, expert in developing and performing oversight of quality assurance for nuclear medicine equipment
3. **MP-RT:** Medical Physicist for Radiotherapy with training and work experience in clinical radiation facilities that provide high-energy external beam radiation therapy with photons and electrons
4. **MP-ASST:** Assistant Medical Physicist, freshly graduated and supporting MPs in any of the previous categories⁵

In order to ensure proper recognition to these Professionals in the UAE, some actions are needed, and they have been collected in the next table: basically the role and responsibilities of the MP –including relationship with other RP Professionals (QEs, RPOs, EWs, etc.) must be clarified and properly inscribed in the legal framework; the internal classification in “categories” should also be clearly defined, associating one type of radiological facility with one MP category, and treating cases in which multiple sources or multiple sectors are simultaneously present; requirements for MPs’ Education should be defined; requirement for MPs’ competency and skills (training and residency programmes) should be defined; mechanisms for a candidate to be recognised as MP by the UAE Government should be

⁵ It is worth noting that the MP-ASST category is related to a specific temporary situation in the UAE (current unavailability of residency programmes), therefore this category may not be anymore needed, once proper training programmes will be established and running in the UAE.



developed; public lists of MPs in the UAE should be created; mechanisms for duration of the qualification validity and for its renewal process should also be developed.

As in the case of the QE and RPO, it is also suggested that FANR and the UAE Medical Authorities, specify requirements for MPs' qualifications' renewal, expiry, termination, and also integrates Continuous Professional Development schemes in re-training and renewal of qualifications (the already existing Emirates Medical Physics Society could contribute and potentially co-organise those CPD events).

Table 12, NS tasks related to the MP recognition

n.	Task	Comments	UAE Entities involved
1	Definition of MPs' classification/categorization	Define radiological boundaries for MPs' categories: MP-DR, MP-NM, MP-RT, MP-ASST	FANR and Medical Authorities
2	Definition of MP's education requirements	Generally, minimum required education for MPs is MSc or equivalent. Experience equivalence should also be defined for those not meeting education requirements.	FANR, NQA and Medical Authorities; all the Entities in the RNDC, via the NOSS' definition
3	Definition of MP's specific experience/residency programmes requirements	Generally, a minimum required residency programme/clinical training and experience of some years in MP tasks, or a similar training on the job, is needed to acquire the technical and professionals skills of MP.	FANR, NQA and Medical Authorities; all the Entities in the RNDC, via the NOSS' definition
4	Definition of MP's training requirements	Generally, specific training may be needed for those Candidates who do not possess an appropriate clinical background. Continuous retraining requirements should also be specified.	FANR, NQA and Medical Authorities; all the Entities in the RNDC, via the NOSS' definition
5	Definition of the process for the formal qualification as MP in the UAE	A process, usually comprised of administrative steps and verifications and an exam, is usually [16] required for the formal national qualification. More details are needed for re-qualification, qualification expiry, and termination.	FANR, NQA and Medical Authorities; all the Entities in the RNDC, via the NOSS' definition
6	Definition of criteria for the recognition in the UAE of MP titles obtained abroad	Interim criteria are needed in the UAE, while the formal MP qualification mechanisms are being developed.	NS WG



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n.	Task	Comments	UAE Entities involved
7	Grace period from the current system to the final NQA-based Qualifications' system	A timeframe for the switch from the existing qualification scheme (all MP qualifications are accepted by the Regulator) and the final scheme (only NQA recognised qualifications are valid in the UAE) has to be set	FANR and Medical Authorities
8	Definition of an official public list of MPs in the UAE	Public UAE lists of MPs should be made available to Employers	FANR and Medical Authorities
9	Definition of the roles and responsibilities of the MP in the UAE, also with regard to the QE and other RP Professionals	A more detailed description of the role and responsibilities of MPs should be made available. (This work could be an outcome of the establishment of the appropriate NOSs, or of National Workshops)	FANR and Medical Authorities
10	Reactivation of MP University Programmes at Graduate and Post-Graduate level in the UAE	University degrees, and graduate and post-graduate levels, should be available again in the UAE.	FANR, Medical Authorities, UAE universities
11	Update of the corresponding MP PQR	The corresponding MP PQR should be updated, in order to ensure that MP Qualifications are recognised by all Medical Authorities throughout the UAE, and that licensing requirements are correspondingly harmonised	FANR, MoH, DHA, DoH



14. Strategy for the Qualification of other specific medical professions in the UAE

There are also some **Specialised Workers** who, while being professionally exposed to the risk of ionizing radiation in the medical field (hence for whom the qualification of “Exposed Workers” may apply) may need a well-defined level and specialisation of training in Radiation Protection. Those Workers may be directly involved in practices for which higher RP education and training is needed, but not at the level of the MP, or the RPO or the QE.

As an example, such specialised Workers may be Radio-pharmacists, Operators in a Nuclear Medicine Department, technicians in radioanalytical radiation measurements’ laboratories, calibration laboratories personnel, whole-body counter or radiotoxicology analyses operators, Medical Physicists involved in Research and Education, etc.

Another important category of Workers for which a Qualification scheme may also be needed, while they are not necessarily being Exposed Workers, are some specialised Doctors, for example, the “**Approved Medical Practitioner**”, i.e. a Medical Doctor competent in occupational medicine, whose competence in Radiation Protection matters has been recognised.

Those Occupational Doctors are directly involved in the approval process of Exposed Workers (health aptitude of EWs), and usually define their Health Surveillance scheme, and perform regular visits and health reviews. An Approved Medical Practitioner is also normally involved in the health assessment of EWs, following contaminations and accidents. This profession needs to be defined and properly authorised also in the UAE.

At this stage, no specific qualification scheme has been defined for the above mentioned Professionals (and potentially for others): it would be very appropriate, when the qualification process for those Professionals will be started, to make sure that appropriate RP E&T requirements and learning outcomes are also included, i.e. to introduce RP aspects in the UAE Qualification process.

As a UAE qualification strategy is not available for those Professions yet, it has been deemed too early to assess and to fix a strategic direction now: a review of the status at the end of the first cycle of the implementation of the present NS is appropriate.



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15. Strategy for Education in Radiation Protection in the UAE

Several educational opportunities exist in the UAE [20]: short courses, BSc, MSc and even PhD in fields of study which relate to radiological and nuclear techniques, both in the medical and industrial sectors, and for which specific courses in RP are foreseen for students at various educational levels. Together with three main providers of academic education in the nuclear field (Khalifa University, Abu Dhabi Polytechnic, University of Sharjah), at least three other Universities offer courses in radiological applications (mainly medical), hence offering RP content.

No specific degree exists in the UAE in Radiological Protection or in Medical Physics, giving access to the professions of Qualified Expert and Medical Physicist.

The WG considers that it is urgent to develop educational degrees in the UAE allowing access to highly qualified professions as QE and MP: corresponding requirements on education in RP will be inserted in the UAE Qualification Framework, and Candidates should have the possibility to fulfil them in the UAE.

The Strategy for RP Education must therefore include:

- The development and establishment of MSc and BSc curricula in the UAE with a comprehensive Radiation Protection content, which will be considered fulfilling the potential education requirements for QEs' and RPOs' qualification
- The development and establishment of post-graduate educational specialization in Medical Physics, which will be considered fulfilling the potential education requirements for MPs' qualification

Within the scope of the UAE Strategy on Education and Training in Radiation Protection, this section addresses the educational requirements to meet the needs of Exposed Workers and Radiation Protection Officers (RPOs), Qualified Experts (QEs), Medical Physicists (MP), and Emergency Workers in all sectors within the UAE where Radiation Protection is a requirement.

In context with the ISCO-08 classification of the Radiation Protection Expert (RPE, equivalent to the Qualified Expert) the International Radiation Protection Association's (IRPA) Executive Council ([11]) elaborated the following definition:

"An RPE is a person having education and/or experience equivalent to a graduate or master's degree from an accredited college or university in radiation protection, radiation safety, biology, chemistry, engineering, physics or a closely related physical or biological science; and who has acquired competence in radiation protection, by virtue of special studies, training and practical experience. Such special studies and training must have been sufficient in the above sciences to provide the understanding, ability and competency to:



- *anticipate and recognize the interactions of radiation with matter and to understand the effects of radiation on people, animals and the environment;*
- *evaluate, on the basis of training and experience and with the aid of quantitative measurement techniques, the magnitude of radiological factors in terms of their ability to impair human health and well-being and damage to the environment;*
- *develop and implement, on the basis of training and experience, methods to prevent, eliminate, control, or reduce radiation exposure to workers, patients, the public and the environment.”*

The education requirements should meet the relevant IAEA safety standards as well as complying with the requirements of the National Qualifications Authority (NQA), Vocational Technical Awards Council (VETAC) for newly developed applied National Qualifications and the Ministry of Higher Education and Scientific Research for current academic programmes accredited in the UAE.

The competence of Qualified Experts will be recognized by FANR and other competent authorities in order for these professionals to be eligible to undertake certain defined radiation protection responsibilities. The process of recognition will involve formal certification and registration. It is worth noting that across all sectors, the education requirements will range from the radiation protection basics to advanced level. The proposed education strategy will follow a levelled approach similar to that shown in the “Skills Pyramid” below taken from, Eurosafe Tribune #014, p22; Also NSAN UK 2017.

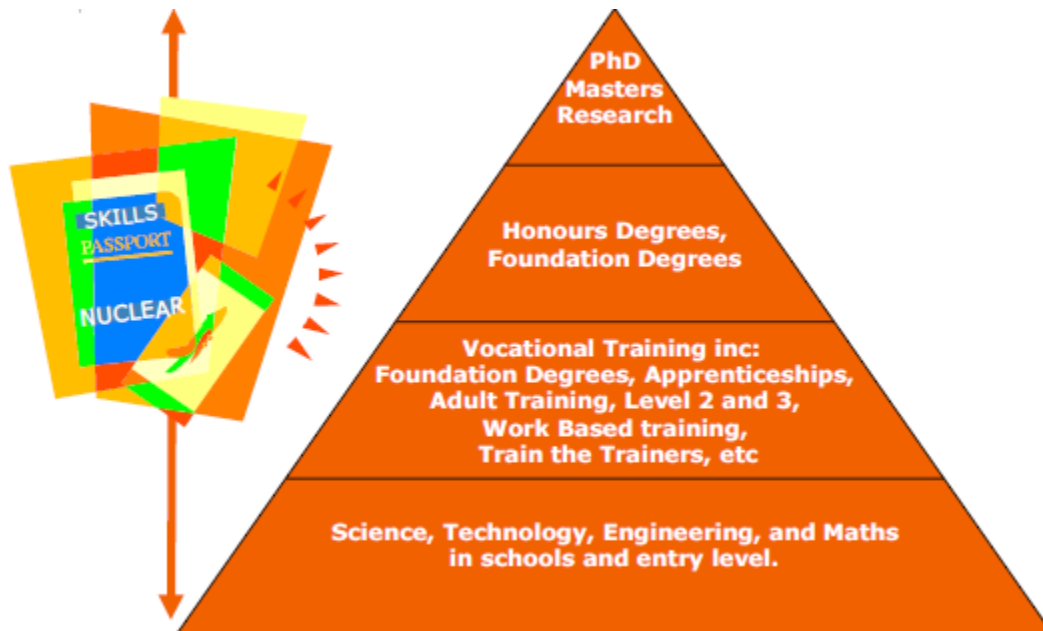


Figure 1, Skills Pyramid (Eurosafe Tribune #014, p22; Also NSAN UK 2017)

With respect to vocational and tertiary education and training in the UAE, the NQA provides a qualifications framework (QF Emirates) with 10 educational levels to meet the Principal Qualifications



for General Education (G12-GE), Vocational Education and Training (VET) and Higher Education (HE) – see Table 1 below. In each of these sectors, UAE education providers are actively working to provide nuclear education.

The UAE therefore has the capacity and capability to provide such education specifically in the Radiation Protection Area.

Table 6: Principal qualification titles

Level	Generic Nomenclature	Principal Qualification titles used in the QF Emirates (each with its own profile)		
		Vocational Education and Training (VET)	Higher Education (HE)	General Education (G 12 – GE)
10	Doctoral Degree	—	Doctoral	—
9	Master Degree	Applied Master	Master	—
8	Graduate Diploma	Applied Graduate Diploma	Postgraduate Diploma	—
7	Bachelor Degree	Applied Bachelor	Bachelor	—
6	Diploma*	Advanced Diploma	Higher Diploma	—
5	Diploma*/ Associate Degree	Diploma	Associate Degree	—
4	Certificate*	Certificate 4	—	Secondary School Certificate (G 12)
3	Certificate*	Certificate 3	—	TBA
2	Certificate*	Certificate 2	—	—
1	Certificate*	Certificate 1	—	—

* Refer to Table 5

(NQA Handbook, Page 40)



Further development of the Education Strategy should take into account the IAEA EduTA Mission to the UAE in February 2017.

The Education Strategy should comply with Section 5 of the National Strategy. The NQA VETAC and Ministry of Higher Education and Scientific Research have requirements to address the learning outcomes, performance criteria and competencies within the documented submission for National qualifications endorsement and education programs for accreditation as UAE academic qualifications.

The Education Strategy will provide for, but not be limited to, the qualification of Radiation Protection Officers (RPOs), Qualified Experts (QEs), Medical Physicists (MP), and Exposed Workers, including Emergency Workers. The newly developed applied qualifications from Certificate level 4 to Applied MSc will follow the VETAC Q+NOSS qualification development model as this most suitably aligns to applied occupational qualifications with workplace competency based assessment methodology to achieve certification.

When developing these national qualifications, benchmarking of occupational skills standards in developed IAEA Member States, where they have had the requirements for RPOs and QEs in all sectors for many years, will be part of the due diligence research for development.

Figure 2 below presents the UAE skills pyramid aligned with the occupational functional level on the QFEmirates.

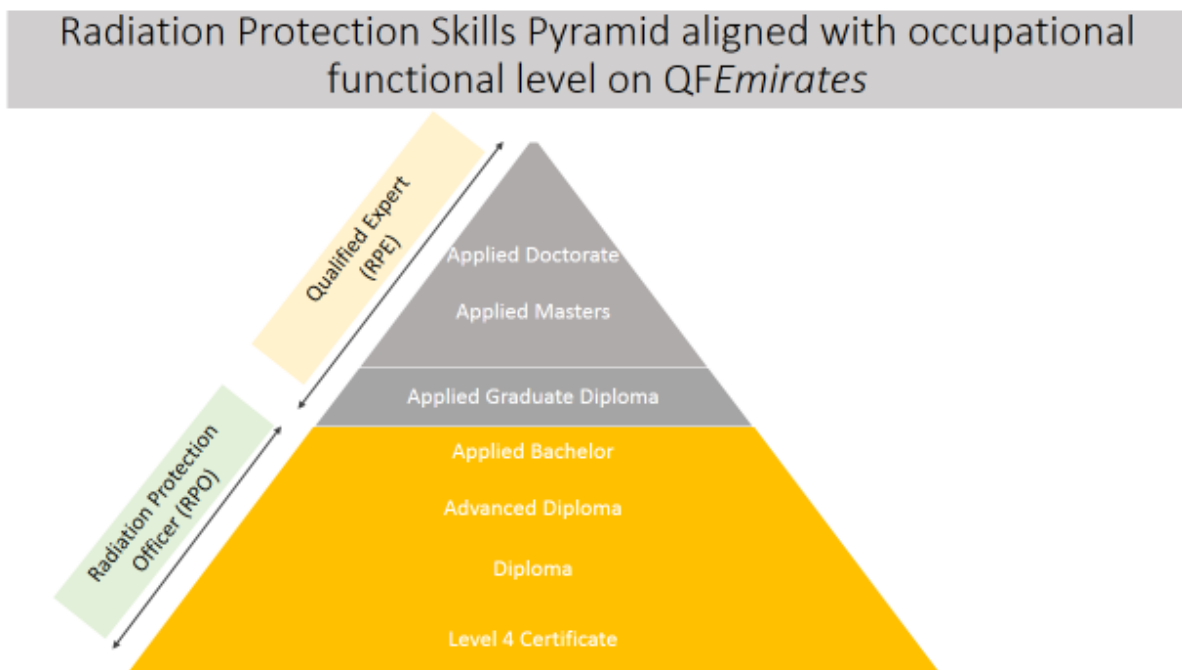


Figure 2, Radiation Protection Skills Pyramid aligned with occupational functional level on QFEmirates

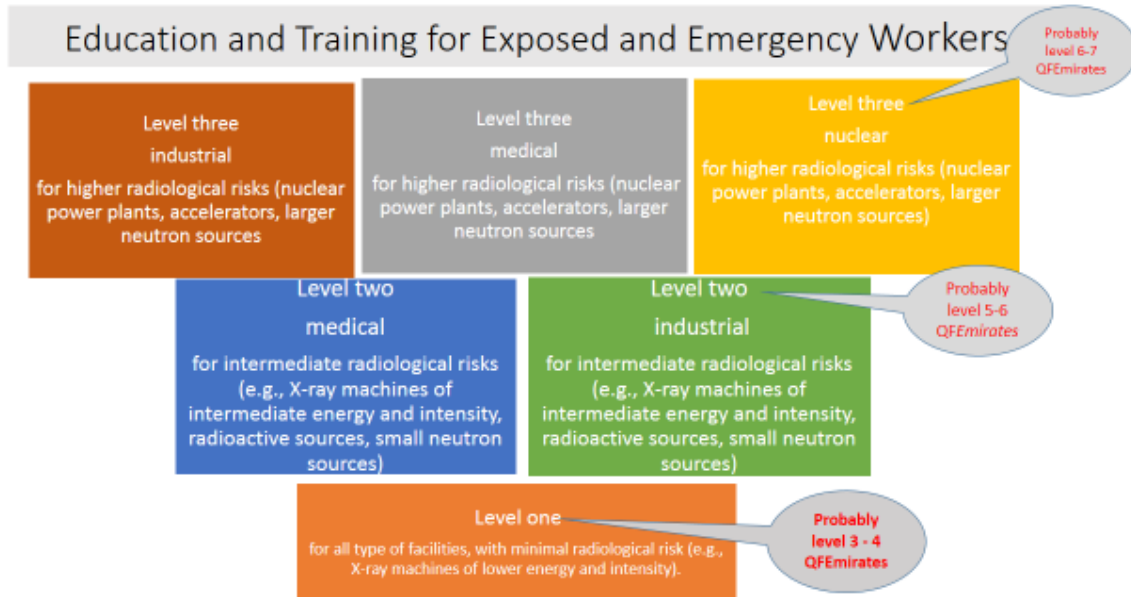


Figure 3, Education and Training for Exposed and Emergency Workers

National functional framework model aligned to QFEmirates

Scope of occupation functional levels	General Principle Qualification Titles		Level	Indicative employability indicator	Function	Function description
	VEI	Reten Protection roles				
Exposed worker Emergency exposed worker		Radiation Protection Expert	10	Leading specialist/expert	Policy and Strategy	A high level function for establishing and managing policies, philosophy and strategies
	Applied Master		9	Higher professional		
	Applied Graduate Diploma		8	Professional	Managing	The function of managing personnel, systems, resources and processes
	Applied Bachelor	Radiation Protection Officer	7	Para-professional and higher technical	Specifying	The function of specifying, implementing and assessing systems and processes
	Advanced Diploma		6	Supervisory and technical	Controlling	The function of controlling, regulating and monitoring activities related to personnel, systems, resources and processes
	Diploma		5	Highly skilled	Maintaining capability	The function of maintaining including coordinating the capability of employees and healthy organisational culture and safe workplace
	Certificate 4		4	Skilled		
	Certificate 3	3	Semi-skilled	Performing	The function of carrying out the work activities to produce and maintain goods and services	
	Certificate 2	2	General			
	Certificate 1	1	Basic	Entry level and functional employment	The function of performing simple tasks in a controlled environment	

Figure 4, National functional framework model aligned to QFEmirates



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Capacity building and awareness raising of the RP career paths for succession planning, is to be introduced using a three-pronged approach:

- community awareness raising sessions
- emphasis on RP in science curricula in partnership with Ministry of Education
- inclusion of occupational profiles for RP, MP in the UAE Careers Handbook which is available for careers education counsellors in schools, colleges and universities in the UAE.



16. Strategy for Training in Radiation Protection in the UAE

According to the analysis presented during the 2017 Second UAE National Workshop on the “Roles and Responsibilities of the QEs and the RPOs” [21], at least eight commercial RP Training Providers continuously operate in the UAE, providing RP training for the medical and industrial fields.

Specific RP training courses are also organised by several academic institutions, frequently on topical issues.

Medical Authorities also provide RP training tailored to the needs of the medical community across the Emirates.

A main training provider also exists for the nuclear sector, which is also catering for RP training needs in the nuclear sector.

Once the UAE qualifications for the five RP Professions here outlined (Qualified Expert, Radiation Protection Officer, Medical Physicist, Exposed Worker, Emergency Worker) will be fully available, it is expected that Governmental and Commercial Training Providers (TP, from now onwards) will develop RP training programmes based on the corresponding UAE NOSs, which will extensively detail the corresponding RP training requirements.

Various topical RP training courses may still be offered in the UAE, but certainly a minimum number of courses for training and retraining of the five Professions will need to be offered on a systematic basis.

With reference to §7, and to the corresponding tables, it was concluded that an average number of around 200 QEs and 2200 RPOs may be needed in the Country, while 125 QEs and 1100 RPOs may need re-training in RP every year, in the medium term, once the UAE qualification system will be in place.

This would correspond to a limited number of training and re-training sessions, in the hypothesis of 30 attendees per session, as indicated in the following table.

It should also be stressed that there is a fundamental difference between training for QEs/RPOs and for EWs/EmWs: in the first cases, a national qualification is delivered, in the second ones, basic training requirements are fixed.

It may seem, from this preliminary analysis, that the foreseen expansion of the RP Training Market can easily be absorbed by the already existing number of TPs, and possibly by new TPs entering the UAE market.



Table 13, Training and Retraining Sessions needed for QEs, RPOs and EWs

Professionals	Projected number of Professionals (in 5 y)	Average number of Professionals to be retrained (persons/year)	Number of initial training sessions	Number of re-training sessions (per year)
Qualified Experts	215	125	~7	~4
Radiation Protection Officers	2155	1095	~72	~37
Exposed Workers	7185	3600	~240	~120



17. Training Service Providers' registration

UAE-wide national qualifications are delivered only by UAE-accredited Training Providers, indicated as "Registered Training Providers" (RTP, from now onwards).

Once the full UAE RP qualification system will be in place, RTPs (Governmental or Commercial) will be able to provide both training and the corresponding UAE Qualifications for RP Professionals. Other TPs who are not RTPs will still be able to provide training conforming to the UAE NOSs, but would not be able to issue the qualification.

The NQA is the Federal Authority responsible for issuing the status of "Registered Training Provider", and its corresponding documents, namely [22], indicate the process that any TP should follow in order to be accepted as a RTP.

As an indication [22]:

"to grant "Registered Training Provider" (RTP) status to an organisation seeking to deliver training and/or assessment services under its scope of registration, an organisation is required to demonstrate that it:

- has integrity, is properly resourced and well managed*
- has systems and procedures in place to deliver such services in an effective, appropriate, legal, transparent and fair manner*
- can deploy its services effectively and proficiently, and produce the quality of outcomes required of (...) endorsed qualifications/awards or registered programs, in particular foreign awards, as per its scope of registration"*

In order to ensure harmonisation across various UAE Governmental bodies (and with reference to [12] and [11]), the **UAE Qualification as QE** will be awarded by the NQA, after successful completion of training with a RTP, provision of evidence and Candidate's documentation, and positive result in an National Exam, held by the relevant Government Bodies' Representatives.

The **UAE Qualification as RPO** will be directly delivered by the RTPs. Candidates fulfilling the requirements for the qualification, and having successfully completed the RPO training for the Sector/Level required, will be conferred by the RTP without the need for the candidate to sit a National Exam.



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The **UAE Qualification as MP** will need to be further developed and defined, and will need to also comply with the joint efforts of Medical Authorities [14]: it may be possible that the Qualification be delivered by the Registering Medical Authority, and this should be defined.

The **UAE Qualifications for EW and EmW** represent the fulfilment of minimum national training requirements in RP, and could be delivered by a RTP or by the Employer, under the supervision of the appointed QE.



18. Strategy for setting up an IAEA-recognised Regional Training Centre in Radiation Protection in the UAE

The International Atomic Energy Agency has created a network of regional training centres [23] which assist Member States in “building competence in radiation, transport and waste safety”: those centres support developing RP competence in Africa, Asia and the Pacific, Europe and Latin America, and play an important role in the implementation of the IAEA’s Strategic Approach 2011-2020 to Education and Training in RP.

The Training Centre in Syria, providing training in the Arabic Language, is currently closed.

The National Strategy includes a plan to discuss the development of a comprehensive training programme, which builds on the existing facilities and resources in RP in the UAE, and which may be recognised as a Regional Training Centre by the IAEA for the provision of the “**Post Graduate Educational Course in Radiation Protection**” (PGEC).

The Post Graduate Educational Course in Radiation Protection (PGEC), whose syllabus is presented in [24], is developed around the following topics

- Review of fundamentals
- Quantities and measurements
- Biological effects of ionizing radiation
- Principles of radiation protection and regulatory control
- Assessment of external and internal exposures
- Protection against occupational exposure
- Medical exposures in diagnostic radiology
- Radiotherapy and nuclear medicine
- Exposure of the public
- Intervention in situations of chronic and emergency exposure
- Train-the-trainers

The PGEC training material is fully provided by the IAEA.

Lecturers, normally between 30-40, can belong to the Regulatory Body, Universities, Research Institutes, etc., and are supported by a limited number of IAEA Lecturers.

The PGEC programme also includes technical visits (which may be set up at radiology and radiotherapy departments in hospitals, research reactor/NPP, emergency response facilities, industrial radiography, O&G industries, accelerator for medical or research purpose, waste management facilities, fire fighters exercises, etc.), and exams for the Participants at the end of each week.

The whole duration of the PGEC is 18 weeks (around 6 months).



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While setting up the PGEC in the UAE may represent a significant effort for those Entities involved in its delivery, it must be considered that the IAEA supports economically both the Participants and the Lecturers, and that the impact of holding the PGEC in the UAE may be very positive, nationally and internationally.

It could also be evaluated if, at some point, the course could be held in the Arabic Language.

A thorough assessment and discussion within the relevant Entities in the RPC should take place, and a feasibility study, taking into account both the resources and the facilities which are available or could be developed in the UAE.

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19. Strategy for the creation of a “UAE Radiation Protection Society”

The WG stresses that there is a need to enhance the Radiation Protection Culture in the UAE, in order to support its Nuclear Programme, to support the public opinion’s acceptance of nuclear and radiological practices, and to improve the general levels of safety in radiological activities performed in the Country.

Radiation Protection Culture will be further developed at an academic level, improving the availability of education opportunities in RP in the UAE; recognized as a specialized profession by Governmental Authorities, via a proper system of accreditation and qualification; and supported with vocational training and programmes for continuous development, as suggested in this document.

A specific effort should also be devoted to spread Radiation Protection Culture in schools and the Media, in order to improve general public knowledge of radiation and radiation risks, and therefore to address acceptance in the general public.

Various mechanisms of Stakeholders’ Involvement are already in place in the UAE [25], and should be used to engage the public also on radiological topics, for example, including an understanding of natural radiation exposure and effects.

From the standpoint of involving the public view, the creation of a “UAE Radiation Protection Society/Association” will prove to be beneficial under many aspects:

- it will create more opportunities in the UAE for training, capacity building, and a general improvement in the radiation culture in scientific and technical environments
- it will organize events, congresses, workshops, etc. aimed at discussing, clarifying and developing guidance on specific fields
- It will operate as an important reference stakeholder in the process of improvements and development of future UAE policies regarding Radiation Protection issues
- It will streamline some activities regarding Radiation Protection, including divulgation and information to the public
- It will regroup and represent the scientific interests of Professionals of the Radiation Protection field
- It will create Working Groups for the development of draft technical documents, guidance or operational practices, to be adopted as National Standards, or to be submitted to the Regulator for endorsement
- It may regroup technical and scientific UAE publications under a Bulletin, or another similar regular publication, or a website
- It may act as an informal link between universities, e.g. unifying efforts in the generation and dissemination of UAE radiation maps, surveys, research, etc.



- It may participate, at various levels, in the setup and organization of training courses, and could be given an active role in the qualification scheme for some categories of RP Professionals (as it happens in some Countries)

The creation of a UAE Radiation Protection Society, and its affiliation to IRPA (the International Radiation Protection Association, regrouping 49 Associate Societies over 61 Countries, www.irpa.net):

- will enhance UAE visibility and excellence in the RP world
- will extend the ground for collaboration and good practices exchange with other Radiation Protection Societies in other Countries

Furthermore, the creation of a UAE Radiation Protection Society may also induce a similar process in the neighbouring Countries, fostering the creation of other GCC Societies and offering a good model to other Countries to follow:

- It may act as a starting point for a process which may involve other GCC Countries, offering a model to follow for the creation of other national societies
- The UAE Society may become the reference GCC Society, leading regional activities in the Radiation Protection field

For all those reasons, the WG strongly suggests that a group of relevant Stakeholders start the process to create a **Radiation Protection Society in the UAE**, according to the existing UAE Regulations and applicable Laws.



20. Advising and Monitoring on the “National Strategy” implementation

The endorsement of the present UAE National Strategy is just the first step in its implementation.

The IAEA foresees [8] that the implementation takes place in the form of a cycle, with implementation feedback at the end of the cycle in order to re-orient the actual initiatives, and effectively reach their objectives.

Once the present document endorsed/approved, as it was highlighted in the preceding chapters, various actions need to be programmed, regrouping various UAE Stakeholders who may have various motivation and priorities in the implementation of the Strategy.

For this reason, according to the IAEA’s guidance [8], the prime Owner of the Strategy, i.e. the Member State’s Government, should oversee the NS implementation, which is an important element of the overall safety commitment of a Member State.

Strategic indications on the significance of E&T in Radiation Protection have already been embedded in the UAE Nuclear Policy [1]: the “National Strategy of Education and Training in Radiation Protection” is oriented at maintaining that direction.

It is advisable that the task of monitoring and reporting on the effective NS’s implementation be given to the Radiation Protection Committee’s corresponding Working Group: the RPC, indeed, gathers all major UAE Stakeholders in the nuclear and radiological sectors [2].

It is also advisable that the UAE Regulator, FANR, has a leading role in overseeing the implementation and reporting to the RPC.

The scope of work of the Working Group would therefore comprise the following actions:

- To define its new Terms of Reference, outlining its composition, internal organisation, overall purpose, functioning and systematic reporting mechanisms to the RPC
- To advise FANR and the RPC on the need to develop or to update national legislation and regulations for E&T in Radiation Protection
- To identify and propose to the RPC further responsibilities to certain UAE Stakeholders to allow them to more effectively contribute to the NS implementation
- To develop performance indicators (KPIs) to monitor progress on the implementation of the National Strategy
- To check completion of specific actions necessary for the implementation of the National Strategy
- To review progress of the implementation of the National Strategy
- To initiate the feedback implementation cycle review, and review assumptions and E&T needs



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- To draft and submit to the RPC proposals of adjustments to the NS which may become apparent during its implementation



21. ANNEX: Methodology for the assessment of the UAE needs reported in Chapter 7

The following tables contains the estimates which were submitted by FANR to the EduTA Mission Questionnaire (in **YELLOW**) and the collated estimates received (up to the 21-DEC-2017) from the following Entities: FANR, ADNOC, DoH, Armed Forces (AF), Dubai Municipality (DM), Sharjah University (SU), ENEC/NAWAH (EN), – each Entity being indicated after the proposed numbers with its acronym.

The intermediate numbers used to generate the table in §7 are reported in **GREEN**.

Some assumptions have been used:

- Numbers have normally been rounded to the closest 10
- A general increase in market growth has been considered, and has been put at 10% per year
- One QE per each facility has been considered, and the global number of QEs has been reduced supposing that each QE will have 10 unique clients
- One RPO per each facility has been considered, and the global number has not been reduced, considering that facilities may employ the RPO on a continuous basis, and various facilities may employ more than one RPO
- The average number of Staff requiring retraining (QE, RPO and EW) has been calculated as the total number of that category of Staff divided by two, considering an hypothetical retraining period requirement of 2 years



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TABLE 1: INDUSTRIAL and RESEARCH

Practices using radiation sources	Number of Facilities			Qualified Expert (or equivalent)				RPO (or equivalent)				Workers			
	Existing	Foreseen (< 5 yrs)	Total	Existing	Estimated experts required	Experts to be educated and trained	Educated Experts to be trained	Existing	Estimated RPO required	RPO to be educated and trained	Educated RPO to be trained	Existing	Estimated operators required	Workers to be educated and trained	Educated Workers to be trained
Industrial radiography	106 1 (ADNOC) 12 (DM) 120	+10%/y 2 (ADNOC) 3 (DM) 10	159 3 (ADNOC) 15 (DM) 130	8 (ADNOC) 10	6 (ADNOC) 12 (DM) 120	2 (ADNOC) 100	0 (ADNOC) 12 (DM) 100	5 (ADNOC) 12 (DM) 100	5 (ADNOC) 50	6 (ADNOC) 50	5 (ADNOC) 12 (DM) 50	20 (ADNOC) 1300	16 (ADNOC) 250	3 (ADNOC) 24 (DM) 250	0 (ADNOC) 96 (DM) 1300
Industrial irradiator facilities (industrial and research)	1 (ADNOC) 1	0 (ADNOC)	1 (ADNOC) 1	0 (ADNOC) 1	1 (ADNOC) 1	0 (ADNOC) 1	0 (ADNOC) 1	0 (ADNOC) 1	1 (ADNOC) 1	0 (ADNOC) 1	0 (ADNOC) 1	0 (ADNOC)	1 (ADNOC) 10	0 (ADNOC) 10	0 (ADNOC) 10
Industrial gauges and well logging	97 91 (ADNOC) 1 (DM) 100	32 (ADNOC) 50	145 119 (ADNOC) 1 (DM) 150	17 (ADNOC) 20	25 (ADNOC) 30	13 (ADNOC) 30	11 (ADNOC) 30	52 (ADNOC) 100	88 (ADNOC) 2 (DM) 100	71 (ADNOC) 100	19 (ADNOC) 2 (DM) 100	209 (ADNOC) 250	334 (ADNOC) 400	175 (ADNOC) 200	329 (ADNOC) 6 (DM) 650
Power reactors	0 0	4 4	4 4	3 (EN) 3	20 (EN) 20	17 (EN) 17	17 (EN) 17	18 (EN) 20	50 (EN) 80	10 (EN) 60	22 (EN) 60	3000 (EN) 3000	3000 3000	3000 3000	3000 3000



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Research activities: use of sealed and unsealed sources	11 1 (AF) 3 (ADNOC) 7 (SU) 20	+10%/y 1 (AF) 5	17 3 (ADNOC) 7 (SU) 25	1 (AF) 12 (SU) 15	1 (AF) 25	0 (AF) 25	1 (AF) 25	1 (AF) 4 (SU) 10	0 (AF) 50	0 (AF) 40	1 (AF) 40	5 (AF) 9 (ADNOC) 8 (SU) 60	6 (AF) 1 (ADNOC) 80	0 (AF) 80	6 (AF) 80
Research accelerators	0 0														
Research reactors	0 0														
Other (Smoke detectors, ADNOC offshore and analytical techniques)	15 (ADNOC) 15	2 (ADNOC) 5	16 (ADNOC) 20	0 (ADNOC) 0	0 (ADNOC) 20	0 (ADNOC) 20	0 (ADNOC) 20	27 (ADNOC) 0	37 (ADNOC) 40	11 (ADNOC) 40	10 (ADNOC) 40	9 (ADNOC) 60	106 (ADNOC) 60	97 (ADNOC) 80	97 (ADNOC) 80



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TABLE 2: MEDICAL

Practices using radiation sources	Number of Facilities			Qualified Expert (or equivalent)			RPO (or equivalent)			Workers			Health Professionals*						
	Existing	Foreseen (< 5 yrs)	Total	Existing	Estimated experts required	Experts to be educated and trained	Existing	Estimated RPO required	Educated RPO to be educated and trained	RPO to be trained	Existing	Estimated operators required	Workers to be educated and trained	Educated Workers to be trained	Existing	Estimated health Professionals required	Health professionals to be educated and trained	Educated Health Professionals to be trained	
Dental radiology (alone)	465 3 (ADNOC) 600 (DoH) 500	+10%/y 100 (DoH) 200	698 700 (DoH) 700	0 (DoH) 0	2 (ADNOC) 0 (DoH) 20	0 (DoH) 10	10 0 (DoH) 500	9 (ADNOC) 0 (DoH) 200	0 (ADNOC) 0 (DoH) 100	8 (ADNOC) 0 (DoH) 100	0 (DoH) 500	2 (ADNOC) 0 (DoH) 200	0 (DoH) 100	0 (DoH) 100	1000 (DoH) 1000	10 (ADNOC) 0 (DoH) 400	0 (ADNOC) 0 (DoH) 200	8 (ADNOC) 1000 (DoH) 200	
Diagnostic and interventional radiology	410 35 (AF) 100 (DoH) 400	+10%/y 20 (DoH) 200	615 35 (AF) 120 (DoH) 600	12 (DoH) 0	1 (AF) 20 (DoH) 600	1 (AF) 20 (DoH) 300	12 (DoH) 300	3 (AF) 50 (DoH) 400	4 (AF) 100 (DoH) 600	2 (AF) 100 (DoH) 300	2 (AF) 50 (DoH) 300	190 (AF) 0 (DoH) 400	200 (AF) 0 (DoH) 200	0 (DoH) 100	30 (AF) 0 (DoH) 100	1 (AF) 1000 (DoH) 1000	3 (AF) 0 (DoH) 500	2 (AF) 0 (DoH) 250	1 (AF) 1000 (DoH) 250
Radiotherapy and brachytherapy	3 2 (DoH) 5	+10%/y 1 (DoH) 5	5 3 (DoH) 10	5 (DoH) 5	1 (ADNOC) 10 (DoH) 5	10 (DoH) 5	0 (DoH) 5	2 (DoH) 10	1 (ADNOC) 2 (DoH) 20	2 (DoH) 10	2 (DoH) 10	0 (DoH) 10	1 (ADNOC) 0 (DoH) 10	0 (DoH) 10	0 (DoH) 10	50 (DoH) 50	1 (ADNOC) 0 (DoH) 50	0 (DoH) 50	50 (DoH) 50



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TABLE 2: MEDICAL

Practices using radiation sources	Number of Facilities			Qualified Expert (or equivalent)			RPO (or equivalent)			Workers			Health Professionals*					
	Existing	Foreseen (< 5 yrs)	Total	Existing	Estimated experts required	Experts to be educated and trained	Existing	Estimated RPO required	Educated RPO to be educated and trained	RPO to be trained	Existing	Estimated operators required	Workers to be educated and trained	Educated Workers to be trained	Existing	Estimated health Professionals required	Health professionals to be educated and trained	Educated Health Professionals to be trained
Nuclear medicine	16 8 (DoH) 20	+10%/y 1 (AF) 2 (DoH) 10 10	24 1 (AF) 10 10 30	0 (DoH) 0	1 (AF) 1 (ADNOC) 10 (DoH) 30	1 (AF) 10 (DoH) 15	0 (AF) 0 (DoH) 20	1 (AF) 10 (DoH) 10	10 (DoH) 5	1 (AF) 10 (DoH) 5	1 (AF) 0 (DoH) 40	3 (AF) 0 (DoH) 20	2 (AF) 0 (DoH) 10	1 (AF) 0 (DoH) 10	1 (AF) 50 (DoH) 50	5 (AF) 0 (DoH) 30	1 (AF) 0 (DoH) 15	4 (AF) 50 (DoH) 15
Other...(specify)																		



TABLE 3: OTHER practices

Practices using radiation sources	Number of Facilities			Qualified Expert (or equivalent)				RPO (or equivalent)				Workers			
	Existing	Foreseen (< 5 yrs)	Total	Existing	Estimated experts required	Experts to be educated	Educated Experts to be trained	Existing	Estimated RPO required	RPO to be educated and trained	Educated RPO to be trained	Existing	Estimated operators required	Workers to be educated and trained	Educated Workers to be
Nuclear Facilities	0														
Waste management facility	0	2 1 (ADNOC)	2 1 (ADNOC)	1 1 (ADNOC)	4 2 (ADNOC)	2	4 2 (ADNOC)	2 2 (ADNOC)	8 5 (ADNOC)	1 5 (ADNOC)	7 5 (ADNOC)	5	15 30 (ADNOC)	15	15
Veterinary radiology	17 20	+10%/y 10	26 30	0	30	15	15	20	10	5	5	40	20	10	10
Security equipment (e.g. baggage x-ray, container inspection, etc.)	67 2 (ADNOC) 100	+10%/y 50	100 150	0	15	15	15	1 (ADNOC) 100	4 50 (ADNOC)	1 25 (ADNOC)	3 25 (ADNOC)	100	50	25	25
Fuel cycle facilities including enrichment, fuel fabrication and reprocessing facilities	0														
Isotope production operations and source manufacturing	9 1 (DM) 10	5	13 1 (DM) 15	0	15	15	15	10	2 (DM) 5	5	2 (DM) 5	10	10	5 (DM) 5	5
Uranium mines	0	-													



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TABLE 3: OTHER practices

Practices using radiation sources	Number of Facilities			Qualified Expert (or equivalent)				RPO (or equivalent)				Workers			
	Existing	Foreseen (< 5 yrs)	Total	Existing	Estimated experts required	Experts to be educated	Educated Experts to be trained	Existing	Estimated RPO required	RPO to be educated and trained	Educated RPO to be trained	Existing	Estimated operators required	Workers to be educated and trained	Educated Workers to be
Mineral extraction and processing companies (NORM)	1 (DM) 1		1 (DM) 1	0	1	1	1	1	2 (DM) 2	2	2 (DM) 2	2	2	5 (DM) 5	5
<i>Training services</i>	13 15	+10%/y 5	20 20	0	20	10	10	15	5	5	5	15	20	5	5
<i>Analytical Techniques</i>	35 16 (ADNOC) 35	+10%/y 3 (ADNOC) 25	53 19 (ADNOC) 60	5 (ADNOC) 5	60	30	30	5 (ADNOC) 10	5 (ADNOC) 50	25	25	33 (ADNOC) 50	80	25	25
<i>Others</i>	23 25	+10%/y 10	35 35	0	35	15	15	25	10	5	5	25	50	25	25



Table 4: REGULATORY STAFF qualified & trained in radiation protection

	Existing	Estimated Regulatory staff required	Regulatory staff to be educated and trained	Regulatory staff to be trained
Authorisation	40 ⁶	10	10	10
Inspection	70	20	20	20
Assessment	40	10	10	10
Enforcement	-	10	10	10
<i>Other... (specify)</i>				

⁶ Please note that some FANR Staff operating in Authorization also operates in Inspection and/or in Assessment



Number of existing industrial facilities (300) and projections (400): data have been regrouped by including all applications in industry and research:

- For “Industrial radiography”: 106 existing facilities, 1 indicated by ADNOC, 12 indicated by DM, total around 120. 2 more projected by ADNOC, 3 more projected by DM, general growth of 10% per year considered, for a total number of around 160 in 5 years. Number has been corrected at 130 for conservatism. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated as 100 and has been estimated as 150 in five years. The number of current EWs has been evaluated as 1300 and has been estimated as 1550 in five years.
- For “Industrial irradiator facilities (industrial and research)”: estimates by ADNOC put this projected number at 1, hence it has been omitted in the new tables.
- For “Industrial gauges and well logging”: 97 existing facilities, of which 91 indicated by ADNOC, 1 indicated by DM, total around 100. 32 more projected by ADNOC, for a total number of around 145 in 5 years. Number has been kept as 150. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated as 100 and has been estimated as 200 in five years. The number of current EWs has been evaluated as 250 and has been estimated as 650 in five years.
- For “Research activities: use of sealed and unsealed sources”: 11 existing facilities, of which 1 indicated by Armed Forces, 3 by ADNOC, 7 indicated by UoS, total around 20. 1 more projected by AF, general growth of 10% per year considered, for a total number of around 17 in 5 years. Number has been put at 25 for conservatism. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated as 60 and has been estimated as 80 in five years.
- For other applications “Other(Smoke detectors, ADNOC offshore and analytical techniques)”: 15 existing facilities indicated by ADNOC. 2 more projected by ADNOC, general growth of 10% per year considered, for a total number of around 16 in 5 years. Number has been put at 20 for conservatism. The number of QEs needed in 5 years has been estimated as indicated previously. The required number of RPOs has been evaluated as 40 in five years. The number of current EWs has been evaluated as 60 and has been estimated as 80 in five years.
- For “Isotope production operations and source manufacturing”: 9 existing facilities, of which 1 indicated by DM, total around 10. 5 more projected, for a total number of around 15 in 5 years. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated as 10 and has been estimated as 15 in five years. The number of current EWs has been evaluated as 10 and has been estimated as 15 in five years.
- For “Analytical Techniques”: ”: 35 existing facilities, of which 16 indicated by ADNOC. 3 more projected by ADNOC, general growth of 10% per year considered, for a total number of around 53 in 5 years. Number has been put at 60 for conservatism. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated as 10 and has been estimated as 60 in five years. The number of current EWs has been evaluated as 50 and has been estimated as 80 in five years.



Number of existing Security equipment facilities (100) and projections (150): 67 existing facilities, 2 indicated by ADNOC, plus possibly other X-ray machines, total around 100. General growth of 10% per year considered, for a total number of around 150 in 5 years. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated as 100 and has been estimated as 150 in five years. The number of current EWs has been evaluated as 100 and has been estimated as 150 in five years.

Number of existing nuclear fuel cycle facilities (0) and projections (10): data have been regrouped by including all applications in the fuel cycle and similar industries:

- For “Power reactors”: 4 facilities being built, which will be fully operational within 5 years. No available data for “Research accelerators”, “Research reactors”, “Nuclear Facilities”, “Fuel cycle facilities including enrichment, fuel fabrication and reprocessing facilities”, and “Uranium mines”. The number of QEs needed in 5 years has been estimated as 12. The number of current RPOs has been evaluated as 20 and has been estimated as 80 in five years. The number of required EWs has been evaluated as 3000, number kept also on the five years.
- For “Waste management facility”: 0 existing facilities, 1 indicated by ADNOC, total around, general growth of this field may add more facilities, for a total number of 2 in five years. The number of QEs needed in 5 years has been estimated as 2. The number of RPOs has been estimated as 10 in five years. The number of current EWs has been evaluated as 5 and has been estimated as 30 in five years.
- For “Mineral extraction and processing companies (NORM)”: 1 facility being built, which will be fully operational within the 5 years period. The number of QEs needed in 5 years has been estimated as 1. The number of RPOs has been estimated as 5 in five years. The number of current EWs has been evaluated as 5 and has been estimated as 10 in five years.

Number of existing Diagnostic medical facilities (520) and projections (730): data have been regrouped by including all applications in human and veterinary medicine:

- For “Dental radiology”: 465 existing facilities, 3 indicated by ADNOC, 600 indicated by DoH, total around 500. 100 more projected by DoH, general growth of 10% per year considered, for a total number of around 700 in 5 years. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated as 500 and has been estimated as 700 in five years. The number of current EWs has been evaluated as 500 and has been estimated as 700 in five years.
- For “Veterinary radiology”: 17 existing facilities, around 20, general growth of 10% per year considered, for a total number of around 30 in 5 years. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated



as 20 and has been estimated as 30 in five years. The number of current EWs has been evaluated as 40 and has been estimated as 60 in five years.

Number of existing Nuclear Medicine and Diagnostic and interventional radiology Facilities (420) and projections (630): data have been regrouped by:

- For “Nuclear medicine”: 16 existing facilities, 8 indicated by DoH, total around 20. 1 more projected by AF, 2 by DoH, general growth of 10% per year considered, for a total number of around 30 in 5 years. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated as 20 and has been estimated as 30 in five years. The number of current EWs has been evaluated as 40 and has been estimated as 60 in five years.
- For “Diagnostic and interventional radiology”: 410 existing facilities, 35 indicated by AF, 100 indicated by DoH, around 400, general growth of 10% per year considered, and 20 more estimated by DoH, for a total number of around 615 in 5 years, Number has been rounded at 600 in 5 years. The number of QEs needed in 5 years has been estimated as indicated previously. The number of current RPOs has been evaluated as 400 and has been estimated as 600 in five years. The number of current EWs has been evaluated as 400 and has been estimated as 600 in five years.

Number of existing Radiotherapy and brachytherapy Facilities: 3 existing facilities, 2 indicated by DoH, total around 5. 1 more projected by DoH, general growth of 10% per year considered, for a total number of around 10 in 5 years. The number of QEs needed in 5 years has been estimated as 10. The number of current RPOs has been evaluated as 10 and has been estimated as 20 in five years. The number of current EWs has been evaluated as 10 and has been estimated as 20 in five years.

Number of existing Regulator’s Staff having competence in RP and operating in Authorisation, Inspection, Assessment or Enforcement is estimated as follows:

- At the level of QE, current number is around 3, and some more are projected to be trained in this field in the next years, for a total number of around 5 in 5 years
- At the level of RPO, current number is around 5, and some more are projected to be trained in this field in the next years, for a total number of around 10 in 5 years
- Staff operating as Exposed Workers is around 70, and 30-50 are projected to be trained in this field in the next years, for a total number of around 100 in 5 years.



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