No. 1281 **5 December 2008**

SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)

In accordance with Regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Task Team for

Radiography & Clinical Technology

registered by Organising Field 06 – Manufacturing, Engineering and Technology, publishes the following Qualification for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the Qualification. The full Qualification can be accessed via the SAQA web-site at **www.saqa.org.za**. Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the Qualification should reach SAQA at the address below and ***no later than 5 January 2009.*** All correspondence should be marked **Standards Setting – Task Team for Radiography & Clinical Technology** and addressed to

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ACTING DIRECTOR: STANDARDS SETTING AND DEVELOPMENT

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
Bachelor: Clinical Science

SAQA QUAL ID	***QUALIFICATION TITLE***		
64698	Bachelor: Clinical Science		
ORIGINATOR		***PROVIDER***	
TT - Radiography and Clinical Technology			
QUALIFICATION TYPE	***FIELD***	***SUBFIELD***	
National First Degree	9 - Health Sciences and Social Services	Curative Health	
ABET BAND	***MINIMUM CREDITS***	***NQF LEVEL***	***QUAL CLASS***
Undefined	480	Level 7	Regular-ELOAC

This qualification does not replace any other qualification and is not replaced by another qualification.

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

This qualification will enable the learner to acquire the necessary knowledge, skills, attitudes and values to practice as a Clinical Technologist in one of the following specialist categories: Cardiology, Cardiovascular Perfusion, Critical Care, Nephrology, Neurology, Pulmonology or Reproductive Biology. The Technologist will be able to perform procedures in one of the above seven specialist categories in order to contribute to the diagnosis and treatment of various patho-physiological conditions. They also perform organ system support, diagnostic, therapeutic and corrective procedures on patients using specialized health technology and techniques for the treatment of physiological dysfunction.

Learning in a clinical context, will be conducted under the supervision of a graduated clinical technologist. This will guide practice towards higher skills levels with progress and performance measured against set criteria. Achievement of this qualification will allow the learner to be registered as a Clinical Technologist with the relevant statutory Health Council. Practicing Clinical Technologists will perform professional acts in accordance with the Scope of Practice for Clinical Technology.

Learners obtaining this qualification can apply for registration as a Clinical Technologist with the Health Professions Council of South Africa (HPCSA).

Rationale:

The South African Government is committed to provide a framework for a structured uniform national health care system, and to combine the national health plan and human resource development strategy for an effective and efficient system of co-operative governance and management of health care service.

The Department of Health is leading the implementation of a multi-professional team-based approach to health care delivery, where each member of the team has a defined role to ensure there is minimum duplication and overlapping of functions. This process will also ensure that no single member of the team dominates but that different members of the team will lead at different times depending on the services to be rendered.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
It is assumed that learners are competent in:

> Mathematics at NQF Level 4.
> Life Sciences at NQF Level 4.
> Physical Science at NQF Level 4.
> Communication at NQF Level 4.
> Life Orientation at NQF level 4.

Recognition of Prior Learning:

Rules for awarding RPL credits will be in accordance with the policy of the provider institution and in agreement with the relevant ETQA.
Access to the Qualification:

Access to the qualification is open to learners in possession of a National Senior Certificate, a Senior Certificate or equivalent NQF Level 4 qualification.

All learners assessing this qualification are required to be registered as learners by the relevant professional council (HPCSA) for the duration of the period of study.

QUALIFICATION RULES
The qualification structure is as follows:

> Fundamental Component (20 credits).
> Compulsory for all learners.
> Core Component (210 credits).
> Compulsory for all learners:

The Core is divided into Foundations of Professional Practice, Scientific Knowledge and Clinical Science Practice.

Foundations of Professional Practice:
> The Learner will perform and monitor safety, health, environmental and quality assurance procedures in the clinical environment to ensure professional service and the safety of all (40 credits).

Scientific knowledge:
> The Learner will apply scientific and technological knowledge for the management of the patient during clinical procedures (80 credits).

Clinical Science Practice:

> The Learner will perform therapeutic, corrective procedures and organ system support on patients using specialized health technology independently to facilitate the management of the patient (80 credits).
> Apply management principles and concepts in a health establishment to ensure professional, legal and ethical service delivery (10 credits).
> Plan, design, and conduct research in either Cardiology, Cardiovascular Perfusion, Critical Care, Nephrology, Neurology, Pulmonology or Reproductive Biology to the benefit of the patient (20 credits).

Elective Component:

230 credits are required in the Elective Component.

Learners can choose from any of the following elective options:

> Cardiology.
> Cardiovascular Perfusion.
> Critical care.
> Nephrology.
> Neurology.
> Pulmonology.
> Reproductive Biology.

Learners must select whole Elective options, and complete all learning assigned to that Elective Specialisation.

Sub-Electives:
> Learners must also complete a Sub-Elective Component totaling 10 credits.

Learners can choose from 2 different sub-elective options. These are:

> Advanced Business Practice Management.
> Educational Techniques.

In order to achieve clinical competency in this qualification, it is the requirement of the relevant Professional Council (HPCSA) that all learners complete a prescribed minimum of 3840 clinical hours under direct mentoring at an accredited training unit.

EXIT LEVEL OUTCOMES
1. Perform and monitor safety, health, environmental and quality assurance procedures in the clinical environment to ensure professional service and safety of all.

2. Apply scientific and technological knowledge for the management of the patient during clinical procedures in either Cardiology, Cardiovascular Perfusion, Critical Care, Nephrology, Neurology, Pulmonology or Reproductive Biology.

3. Perform therapeutic, corrective procedures and organ system support on patients using specialized health technology to facilitate the management of the patient.

4. Apply management principles and concepts in the health establishment to ensure professional, legal and ethical service delivery.

5. Demonstrate communication and interpersonal skills in a clinical environment.

6. Plan, design, and conduct research in a specific clinical science specialisation relating to a particular context of practice and application to the benefit of the patient.

Critical Cross-Field Outcomes:

> Identify and solve problems in the field of clinical technology in which responses display that responsible decisions using critical and creative thinking have been made.
> Demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation.
> Contribute to the full personal development of each learner:

> Reflect on and explore a variety of strategies to learn more effectively.
> Participate as a responsible citizen in the life of local, national and global communities.
> Be culturally and aesthetically sensitive across arrange of social contexts.
> Explore education and career opportunities.
> Organise and manage oneself and one's activities responsibly and effectively.
> Collect, analyze organize and critically evaluate information in Critical Care, Cardiology, Cardiovascular Perfusion, Nephrology, Neurology, Pulmonology or Reproductive Biology on a regional, national and international level.
> Communicate effectively in the learning and health care environment by using technology and associated accessories for transfer and sharing of information among healthcare workers and other stakeholders so as to deliver quality patient care and facilitate management processes.
> Demonstrate an understanding of clinical therapy principles by recognizing that problem solving contexts do not exist in isolation.
> Work effecitvely in collaboration with other health care professionals as members of a team.

ASSOCIATED ASSESSMENT CRITERIA
Associated Assessment Criteria for Exit-Level Outcome 1:

> Explain and apply relevant aspects of the current occupational health and safety legislation in a clinical context to ensure professional service and the safety of all.
> Adhere to safety measures for the performance of specified procedures to safeguard all stakeholders.
> Adhere to standard operating procedures for safety in the work environment in compliance with the current relevant legislation to mitigate litigation.
> Describe procedures to be followed in the event of fire and emergency situations for the safety of all.
> Prevention of and procedures to be followed in the event of sharp penetrable injury are explained for safety of all.
> Demonstrate knowledge of infection control, sterilization principles and methods applied in terms of best operating practices (BOP) to minimize infection and contamination.
> Demonstrate knowledge of health care risk waste management procedures to ensure safety of workplace environment.
> Evaluate standards used in performance of procedures according to documented criteria to establish adherence to minimum requirements.
> Interpret and remediate problems related to malfunctioning of equipment that affect procedures and results.
> Apply principles of quality control in the context of the procedures performed to ensure quality service.
> Compare test results to a standard norm and take corrective action to address variances.

Associated Assessment Criteria for Exit-Level Outcome 2:

> Apply knowledge of anatomy, physiology and physiological chemistry in clinical context.
> Explain Patho-physiological conditions in context when performing clinical procedures to ensure compliance.
> Describe Patho-physiological conditions affecting results, when performing clinical procedures.
> Explain bio-physical/scientific principles by which different types of equipment function in terms of clinical procedures to ensure patient safety and effectiveness of the procedures.
> Explain principles, methods and application of different test procedures in context to ensure accuracy and effective monitoring of the processes.
> Demonstrate knowledge in the clinical pharmacological and related fields to facilitate patient management.
> Recognise equipment related factors that affect procedures and results for remediation, referral or problem-solving for effective patient management.
> Evaluate results according to the clinical history of the patient and submit reports to the referring medical practitioner.

Associated Assessment Criteria for Exit-Level Outcome 3:

> Apply diagnostic, therapeutic, corrective procedures and organ system support of physiological dysfunctions and required procedures for optimal patient care.
> Apply problem solving skills in the areas of diagnostics, therapeutic, corrective procedures and organ system support to resolve them according to health policies and standard operating procedures.
> Explain the specialized procedures, risks and side effects to the patient and family with due regard for ethical diversity to ensure equitable health care delivery.
> Explain the implications of compliance and non-compliance to requirements in relation to legal liability and the protection of both patient and practitioner.
> Explain the specific manner for preparing the patient and equipment for the therapy step- by - step according to procedure to allay anxiety and maximize compliance.
> Monitor the patient's physiological and general psychological reaction to the therapy, and report to the referring medical practitioner for effective patient care.
> Administer relevant drugs and report any side effects to the referring medical practitioner for effective patient care.
> Interpret the outcome of the procedure and take remedial action.
> Explain the appropriate requirements for post treatment care to the patient and family for rehabilitation purposes.
> Communicate the outcomes of the specialized procedures to other applicable health care professionals for information and continuing treatment.
> Correlate, interpret and evaluate results based on knowledge of physiological and patho-physiological conditions that may affect outcomes and submit to the referring medical practitioner for appropriate action.

Associated Assessment Criteria for Exit-Level Outcome 4:

> Manage self, time and resources efficiently in order to ensure professional and ethical service delivery.
> Treat all health care practitioners and patients and significant others with due respect based on the principles of human rights, ethics and medical law to uphold human dignity.
> Apply legal, professional and institutional policies in managing human resources to ensure compliance in a clinical environment.
> Explain the functions of the relevant statutory health councils and recognized professional associations in terms of the services they offer to the profession.
> Manage administrative functions to ensure proper record keeping and use of consumables for auditing control.
> Investigate the physical and human resource requirements needed to adequately equip and staff a clinical facility/unit.
> Compile a budget in accordance with the current legislation applicable to public finance to ensure the financial needs of a clinical unit within the scope of relevant financial policies.
> Apply and evaluate training and continuing professional development programmes for personal application and fellow personnel.
> Assess performance of self and others according to the norms of the health care environment for the provision of quality service.
> Demonstrate of the completion of medico-legal reporting for compliance to prescribed procedures.
> Investigate public liability insurance and malpractice insurance for clinical practice.

Associated Assessment Criteria for Exit-Level Outcome 5:

> Demonstrate verbal and non-verbal skills in a clinical context for optimum service delivery.
> Use retrieval systems (electronic and non-electronic) for information gathering.

> Apply and integrate relevant information to solving problems and accomplishing specific applications.
> Apply acknowledged academic referencing procedures to avoid plagiarism.
> Apply industry specific software information technology skills to ensure professional services.
> Descibe the impact of socio-cultural, emotional and religious factors on human behaviour and communication in clinical context.
> Apply counselling skills to inform patients about treatment procedures and management of conditions.
> Apply conflict management, negotiation, mediation and collaboration in the clinical context to facilitate resolutions to problems.
> Plan a wellness programme in conjunction with management to deal with stress and burnout.
> Compile medico-legal reports concisely, comprehensively, clearly and courteously for transparency.
> Present patient cases systematically to other medical professionals for any legitimate purpose within the ordinary course and scope of health practitioners duties.
> Record patient information accurately and efficiently to assure optimal patient management.
> Explain the benefit of meetings, networking and collaboration within the clinical science and medical profession in terms of service delivery.

Associated Assessment Criteria for Exit-Level Outcome 6:

> Identify research problems and articulate to initiate research projects.
> Investigate quantitative and qualitative research methods to identify possible research strategies to address identified issues.
> Apply statistical research methods in chosen research.
> Review and evaluate research publications.
> Develop a mini research proposal within either Cardiology, Cardiovascular Perfusion, Critical Care, Nephrology, Neurology, Pulmonology or Reproductive Biology.
> Apply principles of research ethics.
> Collect data using appropriate methods.
> Interpret data using appropriate statistical tools.
> Present relevant research findings.

Integrated Assessment:

Integrated assessment takes the form of an appropriate variety of assessment methods for example: written and oral examinations, problem-solving assignments, projects, presentations, case studies, portfolios, log books, clinical reports, assessment of clinical competence through simulated and clinical assessment in situ, and the successful completion of a mini-dissertation.

The qualification will be awarded to a learner who has provided evidence to the satisfaction of the assessors that the qualification, as detailed in the stated outcomes, has been achieved, either through education and training in a single provider's learning programme or though experience that complies with the stated specific outcomes i.e. RPL is applied.

However, the integrated assessment needs to have the following characteristics:

It should assess the extent to which learners can practice competently, effectively and safely in any clinical context nationally and internationally:

> It should measure the extent to which learners have integrated the professional roles, knowledge, practice and skills delivered through the different outcomes reflected in the programme.
> It should provide opportunities for reflection-in-action and reflection-on-action to develop reflexive competence.

Clinical Competence:

Clinical competence is ensured by close supervision by clinical staff during the period of training. Learners need to complete a clinical work record based on integrated work experience with a specified minimum amount of cases to be recorded.

Clinical assessments are performed on actual patients to determine clinical competence in routine procedures in either Critical Care, Cardiology, Cardiovascular Perfusion, Nephrology, Neurology, Pulmonology or Reproductive Biology. In order to achieve clinical competency in this qualification, it is the requirement of the HPCSA that the all learners complete a minimum of 3840 clinical hours at an accredited training facility and are mentored by a registered practitioner. On completion all learners must successfully complete a competency-based test (CBT) in order to register with the HPCSA as a Clinical Technology Scientist in either Critical Care, Cardiology, Cardiovascular Perfusion, Nephrology, Neurology, Pulmonology or Reproductive Biology.

INTERNATIONAL COMPARABILITY
Introduction:

The primary reason for designing this qualification was to meet the needs of the South African community as identified by the National Department of Health and also ensure that it is compatible with the international standards. This qualification was benchmarked against 1st world countries, such as the United Kingdom, the United States of America, New Zealand, Australia and Canada, since a similar course is currently not offered in any other African country.

Cardiology, Cardiovascular Perfusion, Neurophysiology:

United Kingdom (UK):

The UK offers a 4-year degree in Clinical Physiology (Cardiology, Cardiovascular Perfusion or Neurophysiology). The degree course can be done full time at university, or, for trainee physiologists already working in a cardiac unit/theatre, courses are available with day or block release attendance at college. Trainee clinical technologists currently follow a two-year, mainly in-service programme.

United States of America (USA) and Canada:

In the USA and Canada, the Cardiology/Cardiovascular Perfusion is a full time, two year programme (including the Summer session), spans five consecutive semesters, and is designed for students who have already completed approximately two or more years of college in science disciplines that include biological, physical, social, mechanical and/or prior health preparation. Upon graduation, the learner is awarded a Bachelor of Science Degree. Upon successful completion of the cardiology/perfusion rotations, the candidate will receive a Master's degree from the relevant University.

The Cleveland Clinic Foundation School of Cardiovascular Perfusion, in collaboration with Cleveland State University, offers a four year Bachelor of Sciences in Health Sciences with an emphasis in Cardiovascular Perfusion Science.

In the USA the electroneurodiagnostic course is offered at colleges and one obtains an associate degree on completion of the course. All electroneurodiagnostic technologists register with American Society of Electroneurodiagnostic Technologists (ASET). Currently there are 12 centres in USA that offer this programme. The Clinical Neurophysiology Technology Program is accredited by the Commission on Accreditation of Allied Health Education Programs upon the recommendation of the Committee on Institutions offering the END Technology Program in the

Nursing and Allied Health Sectors Accreditation for Education in Electroneurodiagnostic Technology (CoA-END):

WCTC - Waukesha county technical college:
> 71 credit associate of applied science degree.

St. John's Hospital School of Electroneurodiagnostic (END) Technology:
> 21-month associate degree programme in conjunction with Lincoln Land Community College. Chicago Illinois.

Mayo School of Health Sciences in Rochester, Minnesota:
> 24 month associate degree.

Formal Neurophysiology training programmes in Canada can be found in community colleges, technical schools, private school, and hospitals. Programmes last from 12-24 months and successful learners are awarded a diploma, certificate or associate degree. There are only 12 accredited END schools in the United States. The curriculum includes electronics, neuroanatomy, neuropathology, computer skills, instrumentation, clinical science, neuropharmacology, neurophysiology, psychology, and clinical practicum. Qualified Electroneurodiagnostic Technologists register with the American Board of Registration of Electroencephalographic and Evoked Potential Technologists (ABRET) who in turn awards the credentials of "Registered EEG Technologist" and "Registered Evoked Potential Technologist" and the Association of Polysomnographic Technologists (APT) registers polysomnographic technologists.

China:

The Chinese University of Hong Kong offers a Diploma Programme in Cardiovascular Perfusion Technology. For Hong Kong learners, the programme lasts for six months part-time, with one full day of lecture per week for three months followed by two full days of practicum per week for another three months. For overseas learners, the programme lasts for three months, with one full day of lecture and two full days of practicum per week.

Australia:

Currently, learner Neurophysiology Technologists in Australia enrol in the 3 year Diploma in Clinical Neurophysiology at the RMIT University in Victoria. This program is offered by distance education. As the course has a large component of "on the job" training, students must be employed in a Clinical Neurophysiology Department or clinic. Once qualified they are known as Neurophysiology Technologists.

New Zealand:

In New Zealand Neurophysiology technicians undertake four years of practical and theoretical training. The first part of the training is fully supervised by a qualified technician. In New Zealand neurophysiology technicians study by correspondence to obtain an Advanced Diploma in Health Sciences, majoring in clinical neurophysiology.

Auckland is the main training centre. Smaller centers are less likely to take on trainees due to large commitment in terms of expense and supervisory time.

The New Zealand Society of Neurophysiology/Technologists (NZSNPT) is looking at setting up a registration system, but the small workforce in NZ makes this difficult.

Pulmonology:

Joint American and European Thoracic and Respiratory Societies recommend personnel qualifications as completion of secondary education and at least 2 years of college education. A recommended frequency of refresher courses is offered every 3-5 years. They operate under the banner of the society.

According to the Committee on Accreditation for Respiratory therapists there are 327 registered respiratory therapist programmes and 134 certified respiratory therapist programmes. In most programmes, the last 2 years lead to an associate degree. Some are 4-year bachelor's degree programmes, which qualified the successful learner for a supervisory or managerial position. High school learners should have courses in health, biology, mathematics, chemistry and physics. Respiratory therapy programmes include human anatomy and physiology, chemistry, physics, microbiology and mathematics. Technical courses deal with procedures, equipment and clinical tests.

Nephrology:

Europe:

Many European countries are leaders in the field of renal therapies. These countries include the UK, Italy, France and Germany. Health practitioners in Europe with similar qualifications are known as Renal or Hemodialysis Technicians. Training institutions utilizes the European Core Curriculum in Renal Technology (ECCRT). The course of study is mainly conducted in the work place with support lectures and demonstrations, drawing upon the experience and knowledge of colleagues and other professions within the department where possible. The course follows a modular approach and has no set time limit.

The learning outcomes and assessment methods of the ECCRT compare favorably with this qualification.

USA:

The USA is the country with the largest renal care programme in the world. Health practitioners in the USA with similar qualifications are known as Dialysis Technicians, Hemodialysis Technicians or Renal Dialysis Technicians/Technologists.

There are three Credentialing Programs for Dialysis Technicians/Technologists:

National Nephrology Certification Council (NNCC):

> The NNCC offers the Certified Clinical Hemodialysis Technician (CCHT) examination. Technicians are eligible to take the CCHT examination with a suggested minimum of six months experience in nephrology technology. The CCHT examination measures cognitive levels in four dialysis practice areas: clinical (50%), technical (23%), environmental (15%), and role (12%). NANT recognizes the CCHT examination as a valid measure of basic competency for hemodialysis patient care technicians. This qualification is comparable to the 240 credit exit level course.

The Board of Nephrology Examiners Nursing and Technology (BONENT):

> BONENT offers an examination for Hemodialysis Technician Certification, leading to the Certified Hemodialysis Technician (CHT) designation. Technicians are eligible to take the CHT exam with a minimum of 12 months experience in nephrology technology. The BONENT Hemodialysis Technician Certification Examination measures technical proficiency in five major domains of practice and tasks performed in the scope of hemodialysis technology: patient care (65%), machine technology (10%), water treatment (5%), dialyzer reprocessing (5%) and education/personal development (15%). This qualification compares favorably with the Bachelor

of Clinical science Degree: Nephrology with the 480 credit exit level but differs with respect to practical experience required.

The National Nephrology Certification Organization (NNCO):

> NNCO offers two examinations: Clinical Nephrology Technology, leading to the Certified in Clinical Nephrology Technology (CCNT) designation and Biomedical Nephrology Technology, leading to the Certified in Biomedical Nephrology Technology (CBNT) designation. Technicians are eligible to take the CCNT and CBNT exams with a minimum of 12 months experience in nephrology technology. The Clinical Nephrology Technology examination measures knowledge in four major areas: principles of dialysis (25%), machine preparation and operation (20%), patient assessment (20%) and treatment (35%). NANT recognizes the CCNT examination as a valid measure of current competence in the specialized area of practice of patient care hemodialysis technicians. The Biomedical Nephrology Technology examination measures knowledge in six major areas: principles of dialysis (25%), scientific concepts (15%), electronic applications (10%), water treatment (20%), equipment functions (20%) and environmental/regulatory issues (10%). NANT recognizes the CBNT examination as a measure of current competence in the specialized area of practice of biomedical hemodialysis technicians. This qualification compares favorably with the Bachelor of Clinical science Degree: Nephrology with the 480 credit exit level but differs with respect to practical experience required.

A diploma course leading to qualification as a Dialysis Technician is offered by the Georgia Medical Institute. The Dialysis Technician programme is designed to provide the learner with a comprehensive introduction to the field of hemodialysis and the skills required for entry-level employment as a Dialysis Technician. Classroom instruction includes principles of dialysis, anatomy and physiology of the kidney, fluid and electrolyte balance, hematologic aspects, infectious diseases, dialysis systems and equipment, vascular access to circulation, dietary regulation, blood chemistries, complications of renal failure, psychosocial aspects, and an overview of peritoneal dialysis and renal transplantation. The externship includes instruction and hands-on experience in the preparation of artificial kidneys, physical assessments, universal precautions, fluid management, initiating and concluding dialysis, access to circulation, patient equipment monitoring, and the treatment of routine hemodialysis problems in accordance with dialysis procedures. Modular courses are also offered online. This qualification compares favorably with the Bachelor of Clinical science Degree: Nephrology with the 480 credit exit level.

India:

India is currently the only Asian country offering a similar qualification leading to employment as a Dialysis/Renal Technician. Manipol Hospital offers a one-year Diploma course leading to qualification as a Dialysis Technician. Singapore uses the American BONENT examinations to certify Renal Technologists.

Africa:

An Internet search indicates that a similar course is currently not offered in any other African country. Because dialysis therapies are in their infancy in most African countries, including SADC, this course could be useful for implementation in those countries.

Australia and New Zealand use the American BONENT examinations to certify Renal Technologists in their countries.

Reproductive Biology:

Africa:

Assisted reproduction is not widely practiced in most Africa countries, except for Egypt. The occasional clinics or units may be found in countries like Nigeria, Zimbabwe, Kenya and Libya There is therefore, little demand for training of Clinical Reproductive Biologists or Embryologists as mostly called in other countries, in other Africa countries. The worldwide trend is that all workers, clinical technologists/embryologists and scientists, are trained in-house after obtaining a basic tertiary qualification for a period of one to two years. Except for the UK, all basic tertiary qualifications will be at least a BSc degree or even a MSc degree, while in the USA persons who have qualified as Medical Technologists will be trained in-house to work in the field of Assisted Reproduction but in most cases minimum qualification will also be a BSc degree. In the UK two courses are offered by the Association of Clinical Embryologist and is formally recognized by the NHS.

Critical Care:

Australia:

In Australia there are people who almost resemble Critical Care Technologist (South Africa) but they are called Anaesthetic Technicians. Their qualification is a Diploma of Applied Sciences (Anaesthetic Technology) which is currently being reviewed and restructured. The Anaesthetic Technicians are mainly employed by the anaesthetic department or Operating theatre suites, but they may also be found in emergency departments. Australia also has Anaesthetic Technicians who work in the anaesthetic and emergency departments. Two qualifications are currently being offered by different institutes: Diploma of Anaesthetic Technology - Integrated Care Management, New South Wales, and Diploma of Science (Anaesthetics) - South bank Institute of TAFE Queensland.

UK:

The United Kingdom has Operating Department Practitioners who can also specialize further as Anaesthetic Care Practitioners or Surgical Care Practitioners. Their qualification is a Diploma in Higher Education [DipHE] in Operating Department Practice. However, a degree programme is currently being developed. The course is 3 years full time with 40% theory and 60% practicals. To specialize one has to complete a year after completing a diploma. These individuals are employed in surgical operating departments but may also be found in accident and emergency units and in ICU. In some hospitals they are members of "In-hospital" cardiac arrest teams. They also attend trauma calls and emergency inter-hospital transfers. In other areas like East Midlands, there are individuals who are called Intensive Care Unit Technicians who are trained as they work in ICU. There is no formal structure in place for these people. They have a background knowledge of laboratory equipments.

In other countries Critical Care Technologist have no set educational requirements, but most enter with at least 4 GCSEs/S grades (A-C/1-3) and may have higher qualifications, such as A levels/H grades. There is no formal career structure compared to the Clinical Technology (Critical Care) offered here in SA.

Namibia:

An agreement was signed with the Kenyatta National Hospital in Kenya in 2002 with the emphasis on surgery for patients with cardiac defects. The decision was made because the South African counterparts were too expensive. At that time the basic fees was R80, 000.00 for general heart surgery. Kenyatta Hospital treated patients as state patients who then paid up to R27, 000.00 no matter what the complication was. The biggest problem was that most of the patients were from the rural areas, and therefore, no prompt follow-ups were done after surgery. Also a major set back was that the mortality rate was more than 10% of those who went for surgery.

A meeting was held in February 2008 in Cape Town by a ministerial delegation from Namibia and the Minister of Health in connection with assistance in the setup of a cardiac unit and treatment of patients. The team visited Groote Schuur Hospital. An agreement was reached and a Cardiac unit is currently being setup.

Currently there are patients from Angola and Zambia that are treated in Namibian hospitals. People that work for American companies in Angola are sometimes flown in from the work site to the critical care unit in Namibia. Most of them are flown to America for major surgery, such as cardiac, kidney and lung operations. Dialysis patients are usually provided with peritoneal dialysis even if the need is for haemodialysis.

Conclusion:

Although this qualification is designed to meet the needs of the South African population as identified by the National Department of Health, there is a great need for it in the other African countries as well. No similar qualification exists in the African states. The only qualification that is closely related to this one is to be found in the developed countries such as the United States, Canada and Europe.

Attempts to benchmark South African Clinical Technology practice have seen a review of international best practice. The quality and scope of South African Qualifications is endorsed by the fact that both developed and semi-developed countries readily accept South African Clinical Technology qualifications. This is evidenced by the fact that developed countries, such as the UK, USA, New Zealand, Australia Canada, Holland, Switzerland, and the UAE, and semi-developed countries, such as Namibia, Erythrea and Kenya, are keen to employ South African Clinical Technologists.

ARTICULATION OPTIONS
Vertical articulation is possible with:

> Masters Degree in Clinical Science (Critical Care/Cardiology/CardiovascularPerfusion/Nephrology/Neurology/Pulmonology/ Reproductive Biology) or an equivalent Masters Degree, NQF Level 8.

Horizontal articulation with any relevant Level 7 qualification.

MODERATION OPTIONS
> Assessments are conducted by one or more internal assessors/examiners appointed by the relevant provider as well as an external moderator appointed from industry/other academic institution.

> Assessors are to be accredited by the relevant ETQA or ETQA that has Memorandum of Understanding (MoU) in place with the relevant ETQA. Assessors and moderators are expected to be in possession of at least a qualification at one level higher as this qualification and have relevant experience in this field of training.

NOTES
Embedded Knowledge:

Cardiology:

The following procedures are performed according to standardized operating procedures and quality criteria:

> Basic resting electrocardiogram.
> Basic and advanced cardiac life support and automated external defibrillator.

> Spirometry measurement.
> Anthropometric measurement.
> Activating clotting time testing.
> Respiratory rate measurement.
> Non-invasive blood pressure measurement.
> Oral and axillary temperature measurement.
> Radial and femoral pulse measurement.
> Blood gas testing.
> Oximetry.
> Non provocative nebulisers.
> Oxygen therapy (mask and nasal cannula).
> Setting up of pressure transducers, ventilators, infusion devices.
> Phlebotomy.
> 12 Lead Electrocardiogram (ECG).
> Exercise Stress Test.
> 24hr/48hr Ambulatory Blood Pressure Monitor; 24hr/48hr Holter Monitor.
> Cardiac Catheterization Procedures.
> Electro Physiology Studies.
> Temporary and Permanent Pacemakers.
> Cardioversion; Defibrillation.
> Echocardiography; Testing/Programming of Permanent Pacemakers - Dual, Biventricular, ICD, Loop Devices, Trans -Telephonic Diagnostic Checks.
> Permanent Pacemaker Selections.
> Intra Aortic Balloon Pump.
> Left Ventricular Assist Therapy.
> Trans Oesophageal Echocardiography.
> Advanced Cardio Pulmonary Resuscitation.
> Drug Administration and management of side effects.

Cardiovascular Perfusion:

The following procedures are performed according to standardized operating procedures and quality criteria:

> Basic resting electrocardiogram.
> Basic and advanced cardiac life support and automated external defibrillator.
> Spirometry measurement.
> Anthropometric measurement.
> Activating clotting time testing.
> Respiratory rate measurement.
> Non-invasive blood pressure measurement.
> Oral and axillary temperature measurement.
> Radial and femoral pulse measurement.
> Blood gas testing and analysis.
> Oximetry.
> Non-provocative nebulisers.
> Oxygen therapy (mask and nasal cannula).
> Setting up of pressure transducers, ventilators, infusion devices.
> Phlebotomy.
> Aortic balloon pump.
> Autologous blood recovery.
> Cardiovascular monitoring.
> Activated clotting time.
> CPR.
> Cardioversion.

> Defibrillation.
> Extracorporeal cardiovascular perfusion on pediatric and neonatal patients or [200 extracorporeal cardiovascular perfusion procedures on high risk adult and paediatric/neonatal patients].
> Left ventricle assist therapy.
> Drug Administration and management of side effects.

Critical Care:

The following procedures are performed according to standardized operating procedures and quality criteria:

> Basic resting electrocardiogram.
> Basic and advanced cardiac life support and automated external defibrillator.
> Spirometry measurement.
> Anthropometric measurement.
> Activating clotting time testing.
> Respiratory rate measurement.
> Non-invasive blood pressure measurement.
> Oral and axillary temperature measurement.
> Radial and femoral pulse measurement.
> Blood gas testing.
> Oximetry.
> Non provocative nebulisers.
> Oxygen therapy (mask and nasal cannula).
> Setting up of pressure transducers, ventilators, infusion devices.
> Phlebotomy.
> Quality Control of life Support equipment.
> Statistical analysis and patient scoring.
> Bloodgas sampling, measurement and interpretation.
> Invasive heamodynamic monitoring procedures.
> Set up equipments for Intrahospital transportation of critically ill patients, non-invasive heamodynamic monitoring, monitoring of an anesthetized patient.
> Preparation of ICU drugs.
> Handling of Infusion devices and drugs.
> Capnography.
> Assists with bronchoscopy and right heart catheterization.
> Advanced Cardiac Life Support (ACLS).
> CPR.
> Intubation, intravenous cannulation, emergency drug therapy.
> Monitor Intra-Aortic Balloon Pump.
> Ventilation therapy: monitoring and resuscitation.
> Assist with acute haemodialysis and continuous renal replacement therapy (CRRT).
> Determine blood flow (Doppler).
> Autologous blood recovery.
> Cell saving.
> Metabolic studies.
> Left ventricle assist therapy.
> Cardioversion.
> Defibrillation.
> Electrolyte determination.
> Coagulation studies.
> Endoscopy.
> Ultrasonography.
> General equipment management.

> Assist with ICU/Trauma/Theatre clinical procedures.
> Physiological data management.
> Advanced patient transport.
> Drug Administration and management of side effects.

Nephrology:

The following procedures are performed according to standardized operating procedures and quality criteria:

> Basic resting electrocardiogram.
> Basic and advanced cardiac life support and automated external defibrillator.
> Peak flow measurement.
> Anthropometric measurement.
> Activating clotting time testing.
> Respiratory rate measurement.
> Non-invasive blood pressure measurement.
> Oral and axillary temperature measurement.
> Radial and femoral pulse measurement.
> Blood gas testing.
> Non-invasive oximetry.
> Non provocative nebulisers.
> Oxygen therapy (mask and nasal cannula).
> Skin prick test.
> Intravenous cannulation and administration.
> Phlebotomy.
> Chronic and acute haemodialysis.
> Continuous veno-venous haemodialysis (CVVHD).
> Peritoneal dialysis.
> Administer blood transfusion.
> Exchange transfusions.
> Paediatric haemodialyses.
> Apheresis.
> Plasma filtration.
> Haemoperfusion.
> Haemofiltration and haemodiafiltration.
> Plasmapheresis.
> Slow continuous ultrafiltration (SCUF).
> Cell Saving.
> Stem Cell Harvesting.
> Reuse of dialysers (automated and manual).
> Water analysis and quality control.
> Drug administration and management of side effects.
> Slow low efficiency daily dialysis (SLEDD).

Neurology:

The following procedures are performed according to standardized operating procedures and quality criteria:

> Basic resting electrocardiogram.
> Basic and advanced cardiac life support and automated external defibrillator.
> Spirometry measurement.
> Anthropometric measurement.
> Activating clotting time testing.

> Respiratory rate measurement.
> Non-invasive blood pressure measurement.
> Oral and axillary temperature measurement.
> Radial and femoral pulse measurement.
> Blood gas testing.
> Non-invasive oximetry.
> Non-provocative nebulisers.
> Oxygen therapy (mask and nasal cannula).
> Setting up of pressure transducers, ventilators, infusion devices.
> Phlebotomy.
> Electroencephalography (EEG).
> Multiple sleep latency test (MSLT).
> Polysomnography.
> Nerve conduction studies (NCS).
> Assist in Electromyography (EMG).
> Transcranial dopplers (TCD).
> Evoke potentials (EP).
> Long-term epilepsy monitoring video studies (LTEM).
> Brain mapping.
> Subdural monitoring.
> Memory testing and WADA testing.
> Drug Administration and management of side effects.

Pulmonology:

The following procedures are performed according to standardized operating procedures and quality criteria:

> Basic resting electrocardiogram.
> Basic and advanced cardiac life support and automated external defibrillator.
> Spirometry measurement.
> Anthropometric measurement.
> Activating clotting time testing.
> Respiratory rate measurement.
> Non-invasive blood pressure measurement.
> Oral and axillary temperature measurement.
> Radial and femoral pulse measurement.
> Blood gas testing and analysis.
> Oximetry (Pulse-oximetry).
> Non-provocative nebulisers.
> Oxygen therapy (mask and nasal cannula).
> Setting up of pressure transducers, ventilators, infusion devices.
> Phlebotomy.
> MIP and MEP measurement.
> Vital signs monitoring.
> Assist with bronchoscopy procedure.
> Plethysmography.
> Diffusion measurement.
> Histamine challenge Due I replace this with Provocation Testing.
> Polysomnography (neurological and respiratory).
> Lung compliance, Exercise, Shunt, and Endurance studies.
> Drug Administration and management of side effects.

Reproductive Biology:

The following procedures are performed according to standardized operating procedures and quality criteria:

> Basic resting electrocardiogram.
> Basic and advanced cardiac life support and automated external defibrillator.
> Spirometry measurement.
> Anthropometric measurement.
> Activating clotting time testing.
> Respiratory rate measurement.
> Non-invasive blood pressure measurement.
> Oral and axillary temperature measurement.
> Radial and femoral pulse measurement.
> Blood gas testing.
> Non-invasive oximetry.
> Non-provocative nebulisers.
> Oxygen therapy (mask and nasal cannula).
> Setting up of pressure transducers, ventilators, infusion devices.
> Phlebotomy.
> Collection of semen/sperm samples from and through various sources and methods (inter alia MESA/TESA).
> Performance of standard and advanced semen analyses.
> Cervical mucus collection and examination.
> Spermatozoa (Semen) -cervical mucus interaction tests.
> Immunological (male/female sperm antibody) tests - basic and advanced.
> Advanced semen/spermatozoa preparation/separation methods.
> Preparation of media (including blood).
> Identification and evaluation of ova/embryos.
> Insemination and transfer of ova/embryos in the laboratory.
> Embryo transfers in patients.
> Cryopreservation/vitrivication of semen, ova and embryos.
> Artificial insemination (sperm preparation and transfer).
> Experimental animal work.
> Advanced micromanipulation procedures (ICSI/cell biopsies/assisted hatching).
> Drug Administration and management of side effects.

UNIT STANDARDS
This qualification is not based on Unit Standards.

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None