SPARTANBURG COMMUNITY COLLEGE

New Program Proposal

Associate Degree in Industrial Technology
major in
Radiation Protection Technology

For Implementation Fall 2008

Dan L. Terhune, President

Submitted November 8, 2007

Classification

Name of proposed program: Radiation Protection Technology

Academic Unit Involved: Arts and Sciences Division, Spartanburg Community College

Award: Associate Degree in Industrial Technology, Major in Radiation Protection Technology (RPT)

Number of credit hours: 72

Proposed Date of Implementation: Fall 2008

CIP Code: 51.0916

Identification of Program: New

Purpose and Objective

Spartanburg Community College (SCC) proposes to offer an Associate Degree in Industrial Technology (AIT) with a major in Radiation Protection Technology (RPT) to meet the growing demand for Radiation Protection Technicians in the college's three-county service area (Spartanburg, Union, and Cherokee) and in the upstate region of South Carolina. The proposed program will prepare students to pass the Institute of Nuclear Power Operations (INPO) and Nuclear Regulatory Commission (NRC) regulated preparatory courses as well as the on-site task performance evaluations that follow on-the-job training internships. All graduates will be prepared to function as competent junior Radiation Protection Technicians in the community's local as well as regional nuclear power plant facilities.

Program Competencies

The Associate Degree in Industrial Technology with a major in Radiation Protection Technology (AIT RPT) curriculum is designed to provide graduates with knowledge, skills, and experiences to:

- Assess, analyze, plan, and implement radiation protection to provide the nuclear power plant employee the optimum level of safety consistent with all governmental and private requirements and regulations.
- Utilize critical thinking skills as a framework for prioritizing safety needs when providing radiation protection supervision in the nuclear workplace.
- Demonstrate sufficient interpersonal communication skills so that all members within a nuclear power station receive radiation protection oversight characterized by critical thinking, radiation technology competence, utilization of therapeutic communication skills, and awareness of diverse socio-cultural practices.
- Use technology in providing and documenting radiation protection activities.
- Function as a professional member of the nuclear radiation protection work force.

Program Objectives

- To provide a comprehensive, competency-based, student-centered instructional program, using a variety of teaching/delivery strategies, so that students enrolled in the Associate Degree in Industrial Technology with a major in Radiation Protection Technology (AIT RPT) Program will receive all the necessary knowledge and skills to be successful on the INPO and NRC exams/task performance evaluations so that all graduates can become employable certified junior Radiation Protection Technicians (RP Technicians).
- To develop partnerships with nuclear power plant facilities in the service region so that Radiation Protection Technician needs will be projected and met.
- To produce RPT-eligible graduates who will gain employment as junior Radiation Protection Technicians after graduation.

Justification of Need for Program

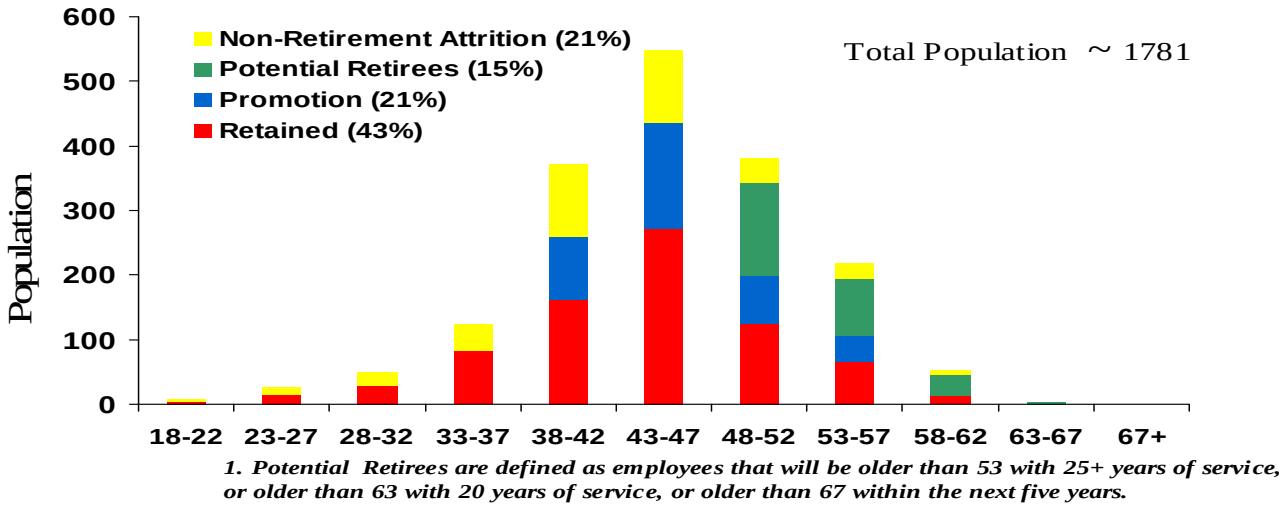
By federal law, no nuclear power facility can operate in the USA without a full complement of RP Technicians (http://www.nei.org; http://www.nrc.gov). A nuclear power plant requires 38 - 75 RP Technicians for operation. There are seven licensed commercial light water pressurized reactors (PWRs) in South Carolina. The Duke Oconee plant has the most nuclear capacity of any of the state's plants, with three light water reactors rated at 846 Megawatts (electric) each. The largest reactors, however, are the pair of PWRs at the Duke Catawba plant, rated at 1,129 MW(e) each. The other two nuclear plants are single-unit operations owned and operated by Progress Energy/Progress Carolinas and SC Electric & Gas Co. /Joint Ownership (http:/http://www.eia.doe.gov/cneaf/nuclear/page/). Of the seven SC PWRs, five are owned by Duke Energy. Besides the current seven nuclear power plants in SC, there are an additional 101 plants in the US with 28 more to be approved for licensing in the immediate future (http://www.nrc.gov). These nuclear reactors provide about 20 percent of the nation's electricity. If power demand keeps growing at the current rate, the US will need 50 more reactors to maintain that percentage by 2050 (Luis Reyes in *NRC Sees Renaissance of Nuclear Power,* http://www.newsmax.com/archives/articles).

The nuclear energy industry, like many other segments of America's industrial infrastructure, faces a critical shortage of workers over the next five years, according to Nuclear Energy Institute (NEI) surveys conducted in 2004 and 2005 (http://www.nei.org). The surveys have prompted the nuclear industry to focus on staffing and recruitment issues to hire and retain the high-quality work force it needs for the future. NEI's latest survey examined several sectors of the commercial nuclear energy industry (Graph 3; http://www.nei.org). Results of the survey indicate that up to 15,600 workers may be eligible to retire, representing 27 percent of all jobs in the sector. Another 7,600, or 13 percent, may be lost to other attrition. Additionally, the survey found that nearly half of the industry's employees are more than 47 years old, and as of 2007, less than 4% of the nuclear technician workforce is under the age of 33. (http://www.nei.org). This imbalance suggests a potentially inadequate supply of trained employees to replace departing personnel. Key suppliers to the nuclear energy industry, which include architectural engineering firms, construction firms, fuel suppliers, and reactor manufacturers, anticipate that 32 percent of their workers will be eligible to retire by the end of 2009. Included in this group are the contract Radiation Protection Technicians (Bartlett Nuclear) used during the required power plant outages approximately every 18 months (http://www.nei.org).

It is estimated within the nuclear power industry that by the year 2015, 60% of the current RP Technician population will have retired (http://www.nei.org; Graph 3). When viewed in tandem with the development and activation of approximately 28 new facilities (http://www.nrc.gov), the growing need for new RP Technicians becomes an immediate concern. A conservative estimate of the total number of RP Technicians currently employed by the 103 operational nuclear power plants in the United States is given as 4,500. With 60% of this workforce retiring by 2015, there will be a potential for approximately 2,700 *replacement* RP Technicians nationwide. The 28 new power plants will provide an additional need for 1,200 *new* RP Technicians nationwide.

Duke Energy has described the nuclear industry's shortage of RP Technicians as a "desperate" situation and asked the college to assist them in quickly addressing this pressing need for training a new generation of RP Technicians in the upstate region of South Carolina. The Employment Needs Survey completed by Duke Energy shows the need for 60 full-time RP Technicians over the next three years to meet the needs of the Catawba, Oconee, and Lee plants. The regional nuclear outage RP Technician staffing company, Bartlett Nuclear, has communicated a projected need of 26 *full*-time RP Technicians over the next three years. Bartlett Nuclear has also stated their immediate need of 25 *part*-time RP Technicians as well as 85 additional *part*-time RP Technicians over the next three years (See **Table 1**).

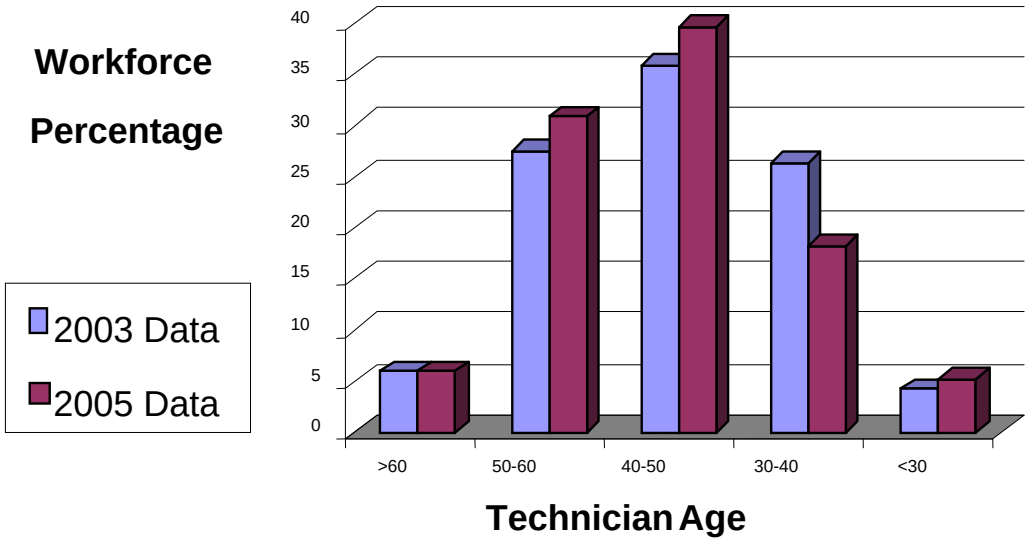
GRAPH 1: Nuclear Power Generation RP Attrition



1. Potential Retirees are defined as employees that will be older than 53 with 25+ years of service, or older than 63 with 20 years of service, or older than 67 within the next five years.

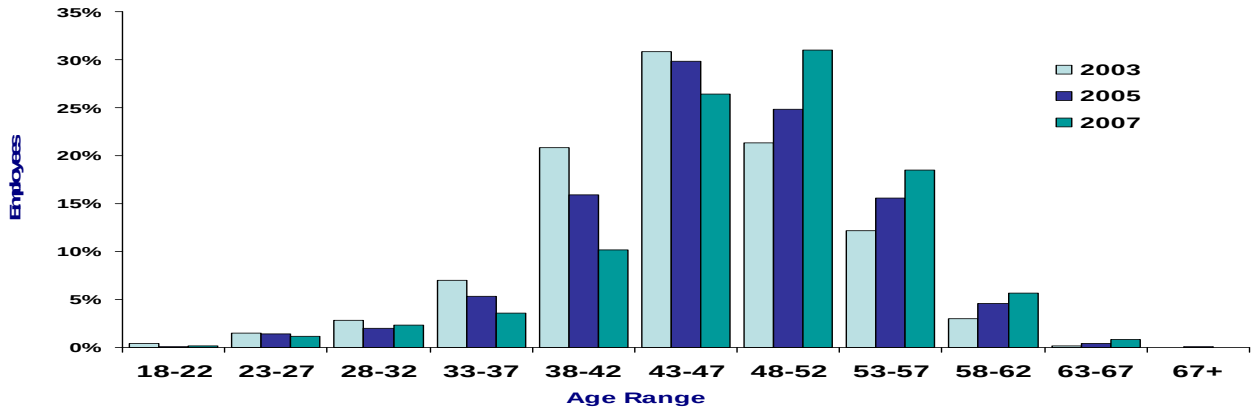
In **GRAPH 1** the Nuclear Energy Institute (NEI) provides the 2003 numbers for radiation protection employee attrition with the 43% retention value supportive of the needs assessment numbers received from Duke Energy (2003 NEI Report: "*Workforce Survey Findings & Recommendations*").

GRAPH 2: Bartlett RP Technician Demographics



GRAPH 2, provided by Bartlett Nuclear, demonstrates the increasing age of their RP Technician population and their need of younger replacements. This graph is in agreement with data from the 2003 NEI Report "Workforce Survey Finding & Recommendations" displayed in **Graph 1**.

GRAPH 3: Commercial Nuclear Generation
Radiation Protection Distribution by Age



GRAPH 3 clearly shows the universal trend of RP Technician aging in the nuclear industry and the need of immediate replacement training to maintain plant operation (2007 NEI Pipeline Survey Preliminary Results).

TABLE 1

SPARTANBURG COMMUNITY COLLEGE **RADIATION PROTECTION TECHNICIAN NEEDS ASSESSMENT SURVEY 2007** **2008 – 2010 Job Openings in Spartanburg, Cherokee, and Union Counties** ***Information Provided by Duke Energy and Bartlett Nuclear***					
Job Openings (Estimated)	***New positions Full-Time***	***Turnover Positions Full-Time***	***Total Full-time Position Openings***	***Total Part-time Position Openings***	***Total of Position Openings***
Immediate Needs	0	0	0	25	25
First Year 2008	25	3	28	30	58
Second Year 2009	25	3	28	25	53
Third Year 2010	27*****	3	30	30	60
Total	77	9	86	110	**196**

*****includes 7 Duke Energy RP Technician new hires for Lee Plant

The need for RP Technicians will increase even more in SCC's service area with the projected development of an additional Duke Energy nuclear power plant in Cherokee county (i.e. the Lee Plant). The management at Duke Energy anticipates that the Lee Plant staffing requirements will necessitate hiring RP Technicians in 2009 so that the plant will be fully operational by 2015. With the development of the Lee Plant an additional 84 associate degree RP Technicians will be needed to meet the anticipated new plant staffing requirements through 2015 (See **Table 2**). Duke Energy line managers have recently recommended (due to the ageing/sickness of their RP Technician population) an increase in the RP staffing number for the continued safe operation of their nuclear plants. As a result, Duke has made a corporate decision to increase the number of RP Technicians present during each shift by two RP Technicians.

Table 2

New Capacity	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Lee Plant				7	12	22	19	12	12		84

It is important to note that all graduates of the proposed program will graduate as *junior* Radiation Protection Technicians and will require additional training of two - three years at an operational Duke Energy nuclear facility before they can be employed as senior RP Technicians. The two - three additional years are required to complete the American National Standards Institute (ANSI) qualifications or to complete On the Job Training (OJT)/Task Performance Evaluation (TPE) task qualifications for senior RP Technician certification. A sufficient number of senior RP Technicians must be available in order for the Lee Plant to be operational. SCC developed and currently offers the Radiation Protection Technician program as an Associate of Occupational Technology degree. This program will be phased out when the proposed program is approved and implemented (Fall 2008). Offering the program as an Associate Degree in Occupational Technology allowed the college to begin to meet the Lee facilities time frame for becoming operational.

SCC proposes the implementation of the Associate Degree in Industrial Technology, major in Radiation Protection Technology, based on this documented need for Radiation Protection Technicians in the upstate of South Carolina. The proposed program will serve to meet the nuclear power plant safety employment demands for INPO-certified Radiation Protection Technicians in Oconee, York, and Cherokee counties, which are the locations of the Oconee, Catawba, and proposed Lee nuclear power plants. SCC has received permission from the presidents of York Technical College and Tri-County Technical College to conduct the needs survey for this program and to place students in nuclear plant internships in those colleges' service areas.

To meet attrition at their existing plants due to retirements and in preparation for staffing the new Lee facility, Duke Energy has made a corporate decision to *limit the RP job listings* in their employment assessment survey numbers exclusively to the graduates of the SCC AIT RPT Program. The limitation of Duke Energy RPT position postings to the college's Career Planning and Placement Office will provide SCC's AIT RPT graduates the opportunity of first interviews with Duke as well as a much greater hiring potential. Duke's unsolicited and singular decision was based on the excellence of SCC's first AOT RPT cohort as well as the excellent working relationship Duke enjoys with the college.

Anticipated Program Demand and Productivity

Duke Energy currently retains 15 core RP personnel at each of its three nuclear power facilities (45 total) that are provided on a contract basis by Bartlett Nuclear, Inc. Duke Energy hopes to replace the RP core teams with permanent employees. The planned construction of a new AP-1000 Lee plant in Cherokee County would require 84 new employees as Radiation Protection Technicians (through 2014). In addition, technicians at the existing plants who will be promoted into management positions for Lee would need to be replaced. A total of 196 graduates from the AIT RPT Associate Degree are needed to meet the projected Duke and Bartlett Nuclear staffing needs through 2010. With a cohort enrollment of approximately 24 students each year, the development of the RPT Program will further expand the capacity of SCC to meet current and future local workforce needs. SCC has Duke Energy's stated desire to recruit approximately 10 - 20 top graduates from each graduating class of the AIT RPT Program for the next ten years. In addition, Bartlett Nuclear has indicated their intention to interview all AIT RPT graduates that are not hired by Duke Energy. Graduates of the RPT Program who do well as Junior RP Technicians will be provided opportunities within the nuclear industry for advancement to senior RP Technician grade or, if qualified and desired, RP managerial positions.

Centrality of the Program to the Institution's Mission

The SCC Catalog states, "Spartanburg Community College is a public, suburban, two-year comprehensive, open-admission institution of higher education serving the citizens of the upstate counties of Spartanburg, Cherokee and Union in South Carolina. The college advances economic development of

the region through programs, services and partnerships that address emerging and continuing employment needs in a rapidly changing global environment." The proposed program directly relates to this mission.

Relation of Program within the College

The Associate Degree in Industrial Technology with a major in Radiation Protection Technology is a newly developed major within the Technical College System. While the first year of study contains a general education component similar to that of other science-based curricula, the second-year radiation protection courses have not been and are not being taught anywhere else in the state. The general education component is sound in theory, facts, scientific principles, mathematical principles, and social science knowledge. The program will benefit from the college's experience in providing rigorous general education courses for many other associate degree programs, including the Associate of Science.

Assessment and Comparison to other Programs

Although there are no programs in South Carolina similar to the proposed AIT RPT Program, there is another program in a western state that can be used as a comparison: The Associate of Applied Science Degree in Nuclear Technology located at Linn State Technical College (LSTC) in Linn, MO. (http://www.linnstate.edu/academic/mnt/default.asp). While there are limited similarities between this program and the proposed AIT RPT Program, there are also numerous differences. SCC has included greater math and physical science requirements in its proposed AIT RPT Program than LSTC includes in its Nuclear Technology Program. SCC has chosen general psychology over LSTC's choice of American government due to the social and cultural issues surrounding nuclear power. While LSTC's program provides for a single nuclear power plant internship, SCC's program provides for two – each at a different facility to provide knowledge of different operating systems. Of greater importance, SCC requires that instructors teaching radiation protection course work be Duke Energy nuclear power plant veterans, employed by the college as adjunct faculty members, so as to provide INPO-certified faculty for all RPT courses. LSTC has no such requirement and has yet to hire any faculty that are nuclear power plant professionals (http://www.linnstate.edu/academic/mnt/inst; Bruce Meffert, Linn State Nuclear Technology Program Chair, personal communication).

Whenever deemed necessary, Duke Energy adjunct faculty will provide team teaching in the radiation protection course work so that the most qualified, veteran instructor will present the most up-to-date information and will meet all current INPO requirements. This method of instruction provides a mirror image to all coursework taught to current Duke RP employees and will allow for the transferability of all SCC RPT coursework to any of the current 103 nuclear power facilities in the USA. Furthermore, all SCC radiation protection classes are under regularly scheduled observation by veteran Duke Energy line managers. This is a notable and significant difference, since it is the plant's line management's active participation in the program that will provide industry's unqualified acceptance and approval. This acceptance is vital to the employability of the program graduates by the program's nuclear partner.

The college is seeking to offer the better of two worlds: the academic strength of a one-year general education transferable core and the nuclear industrial strength of three semesters of instruction by INPO-certified veteran Duke Energy instructors. As previously stated, as of 2006-2007 no South Carolina community/technical colleges are approved to offer an Associate Degree in Industrial Technology with a major in Radiation Protection Technology. In May, 2007, the Duke Energy RP Technician trainer for the Catawba Nuclear Power Station received communication from INPO that the RPT Program at SCC was considered by INPO to be the best available – the INPO representative stated that the RPT Program is "the model for the nuclear industry" (Gary Hamilton, Catawba Technical Training Manager).

Enrollment

Enrollment at SCC in fall 2004 - 2006 averages 4,261 credit students and 2,953 Full Time Equivalents (FTE's). Historically, 55 - 58 % of the student population attends full-time. **Table 3** gives the enrollment fall averages for the years 2004, 2005, and 2006.

TABLE 3

2004-2006 FALL ENROLLMENT AVERAGES					
Head Count	Credit Hours	Contact Hours	FTE	Tri-county FTE%	Percentage Full-Time
4,261	44,299	818,524	2,953	2,746	55-58%

SCC estimates that more than 30 new students will declare the Radiation Protection Technology (RPT) Program major each year. As of Summer 2007, there were 64 students enrolled in the Associate Degree in Occupational Technology (AOT) Radiation Protection Program with 16 of them taking second-year radiation protection courses. These students, in combination with new RPT Program majors, provide the group of students from which the college plans to admit an average of 24 qualified (completed all the first year general education classes and RPT 101) students to the final three semesters of radiation protection cohort once yearly, beginning summer 2009. **Table 4** shows the projected total number of enrollees each semester who will actually qualify for the Associate Degree in Industrial Technology with a major in Radiation Protection. The increased number of enrollees for fall and spring of the second and third years reflects the addition of a number of students who finished the program's first year of required general education courses but failed to gain entrance into the second year's radiation protection cohort. These numbers also reflect the class size restrictions placed on the second-year cohort by the Duke Energy internship limitation of 24 students. These projected annual enrollments were derived from the 2007 - 2008 data generated from SCC's first year's AOT with a major in Radiation Protection enrollment.

TABLE 4

SCC PROPOSED ASSOCIATE DEGREE in RADIATION PROTECTION TECHNOLOGY Projected Second-year Radiation Protection Cohort Total Enrollment						
Year	***Summer***		***Fall***		***Spring***	
	Head Count	*Credits*	*Head Count*	*Credits*	*Head Count*	*Credits*
2008-2009	20	**280**	18*	**216**	16	**192**
2009-2010	24	**336**	22	**264**	20	**240**
2010-2011	24	**336**	22	**264**	20	**240**

* RPT cohort will be transferred from the AOT degree to the proposed degree program upon program approval for Fall 2008.

With a projected five-semester curriculum and 20% attrition, the first graduating class would be Spring 2010, with an estimated 20 RP Technician-eligible graduates. **Table 5** describes the projected enrollment based on 30 general education students beginning in the Fall of each year and 24 second-year radiation protection cohort students beginning each Summer. **Table 4** and **Table 5** collectively provide the projected <u>total</u> enrollment for those expected to finish the first year of general education classes as well as those continuing students who gain entrance into the second year's radiation protection cohort. The data contained in **Tables 4 & 5** is based on the below outlined 72-credit curriculum semester plan:

First Year

First Semester, fall (general education):	18 credit hours
Second Semester, spring (general education):	16 credit hours

Second Year

Third Semester, summer (RP cohort):	14 credit hours
Fourth Semester, fall (RP cohort):	12 credit hours
Fifth Semester, spring (RP cohort):	12 credit hours

For each academic year, the data shown in **Tables 4 & 5** is based on the following assumptions:

1. An average of 24 RPT eligible students will be admitted to second-year radiation protection cohort courses each summer at SCC. Their admission will be determined by their scores on a weighted admissions sheet which is available on the college's Radiation Protection website.
2. There is an anticipated 20% average attrition year-to-year in the second-year RP cohort.
3. Some of the students who fail in the RPT cohort may be eligible to re-enter the next year and are included in these data.
4. The program will maintain a student completion/graduation rate of 80% within the time frame of five semesters allowed.
5. Duke Energy adjunct faculty will teach internships at a 4 Contact Hour: 1 Credit Hour ratio in nuclear power facilities settings, with INPO-certified college adjunct faculty teaching all on-site, on-the–job training (OJTs) and providing all training performance evaluations (TPEs).

TABLE 5

PROJECTED TOTAL ENROLLMENT Second Year (RP cohort) Begins in Summer							
Year	***Fall***		***Spring***		***Summer***		**TOTAL**
	Headcount	*Credit*	*Headcount*	*Credit*	*Headcount*	*Credit*	**HOURS**
2008-2009	30 first yr. students 18 second yr. students	**540** **216**	30 first yr. students 16 second yr. students	**480** **192**	24 students admitted to RPT cohort	**336**	**1356** **408**
2009-2010	30 first yr. students 22 second yr. students	**540** **264**	30 first yr. students 20 second yr. students	**480** **240**	24 students admitted to RPT cohort	**336**	**1356** **504**
2010-2011	30 first yr. students 22 second yr. students	**540** **264**	30 first yr. students 20 second yr. students	**480** **240**	24 students admitted to RPT cohort	**336**	**1356** **504**

Table 6 contains an estimate of those student enrollment numbers above the 30 projected in **Table 5** who will be taking general education courses and will be enrolled in the RPT Program. The college plans to enroll an average of 24 students annually into the proposed AIT RPT Program over the next 10 years in an effort to meet the nuclear industry's need. The starting salary of a RP Technician is $40,000/year with overtime/holiday work providing a potential $100,000/year income.

TABLE 6

ESTIMATED ADDITIONAL ENROLLMENT						
YEAR	**FALL**		**SPRING**		**SUMMER**	
	Headcount	Credit Hours	Headcount	Credit Hours	Headcount	Credit Hours
2008 – 09	10 first yr. students	**180**	10 first yr. students	**160**	8 RPT cohort students	**112**
2009 – 10	10 first yr. students 8 second yr. students	**180** **96**	10 first yr. students 7 second yr. students	**160** **84**	8 RPT cohort students	**112**
2010 – 11	10 first yr. students 8 second yr. students	**180** **96**	10 first yr. students 7 second yr. students	**160** **84**	8 RPT cohort students	**112**

Admission Criteria

For entrance into the RPT Program, the college requires that all students satisfy the following requirements:

> COMPASS writing scores of 78 or higher, COMPASS reading scores of 81 or higher; ASSET writing scores of 44 or higher; ASSET reading scores of 41 or higher; verbal SAT 480 or higher; verbal ACT 19 or higher; or completion of ENG 155 Communications or ENG 101 English Composition I with a C or better. The college has defined math placement skills as COMPASS Algebra scores of 66 or higher; ASSET Intermediate Algebra scores of 44 or higher; math SAT 480 or higher; math ACT 19 or higher; or C (or better) in MAT 101-Beginning Algebra, MAT 155-Contemporary Mathematics or MAT 110- College Algebra.

SCC is an open admission institution with *advised* placement, so students are placed in course work based on placement test scores. After placement, students may enroll in the program's first year of required general education courses to meet prerequisites for admission to the second-year Radiation Protection cohort. In addition to these program admission criteria, the second year's Radiation Protection internships will require students to have updated immunizations and clear criminal background checks and drug screenings prior to nuclear power facility placement. The students will receive information about criminal background checks and drug testing in writing and in public information sessions, to be provided upon acceptance into the program.

Students will have access to information about admission criteria in the addendum to the SCC 2007-08 Course Catalog and via the website, as soon as the program is approved. The college will publish deadlines to apply for program admission and will publish times for advisement or placement testing for all students to access.

Curriculum

Duke Energy believes there is a strong correlation between receiving a college education and making the right decisions as an RP Technician. As a result a full year (36 semester hours) of general education

courses were included in the curriculum. The remaining 36 semester credit hours are RPT courses. The proposed second year curriculum content is accredited by the Institute of Nuclear Power Operations (INPO), which supervises all safety issues in the nuclear industry. In addition, to ensure the highest quality RP Technicians, two 240-hour internships for students are included in the second year of the curriculum – one each in the fall and the spring semester. The internships will be at nearby Duke Energy nuclear power facilities and will require a satisfactory plant supervisory evaluation prior to graduation. In addition to supplying faculty for the instruction of all radiation protection classes, Duke Energy will provide two paid nuclear facility internships including on-site housing, all student textbooks, and all travel expenses for on-site visits. Additionally, Duke has outfitted a room on SCC's Central Campus to simulate a nuclear power plant workplace. To date, Duke Energy's real and promised investment is over a million dollars. The college has partnered with Duke Energy in the training of RP Technicians to provide the best overall teaching and training experience for the students. The college has secured commitments for internship sites from the three Duke Energy nuclear power facilities located near the college's service area: Oconee, Catawba, and McGuire. In addition, by 2014 the Lee nuclear facility is scheduled to be fully operational and will provide the fourth available site. With the support of Duke Energy, the college plans to provide a safe, extensive training facility that simulates the nuclear power plant configuration without the possibility of receiving exposure to ionizing radiation or becoming contaminated with radioactive material.

SCC has added 15 new courses to the college's course catalog and has added 14 new courses to the System's Catalog of Approved Courses to support the current program, the Associate in Occupational Technology with a primary technical specialty in Radiation Protection. The course titles and descriptions are contained in **Table 7**.

TABLE 7

RADIATION PROTECTION COURSE INFORMATION					
RPT 101	Introduction to Radiation Protection	150704	1.00 **(1-0-1)**	20061	This course provides a study of the radiation protection profession to include career paths, opportunities and challenges, roles and responsibilities of a Radiation Protection Technician, and the culture of the nuclear industry.
RPT 201	Power Plant Fundamentals	150704	4.00 **(4-0-4)**	20063	This course provides an introduction to the fundamental operation of a nuclear power plant and addresses administrative guidelines that govern plant operations.
RPT 202	Fundamental Plant Systems	150704	1.00 **(1-0-1)**	20063	This course is the study of the purpose and function of the primary and secondary systems and components in nuclear power plants.
RPT 203	General Employee Training	150704	3.00 **(3-0-3)**	20063	This course includes basic requirements in nuclear, industrial, and radiological safety needed for gaining unescorted access to a nuclear facility.
RPT 204	Human Resources and Error Reduction	150704	1.00 **(1-0-1)**	20063	This course provides an orientation of employer-specific programs and processes and an overview of the skills necessary for preventing human error in the nuclear environment.
RPT 205	Radiation Detection and Standards	150704	2.00 **(2-0-2)**	20063	This course is the study of the instrumentation and principles used to detect radiation, the source of radiation in the plant, and the applicability of designated standards and guidelines to the job of the Radiation Protection Technicians.

RPT 206	Radiation Monitoring and Exposure Control	150704	4.00 **(4-0-4)**	20071	This course is the study of equipment used to monitor personal exposure to ionizing radiation and methods used to minimize the amount of exposure received during the operation and maintenance of the plant.
RPT 207	Contamination Control & Incident Prevention	150704	3.00 **(3-0-3)**	20071	This course is the study of methods used to control radioactive contamination on surfaces, liquid, and gaseous effluents. Radiological events from operating experiences in the United States and other countries are also discussed.
RPT 208	Radiation Protection Internship I	150704	1.00 **(1-0-1)**	20071	This course provides an employer-specific in-plant orientation and a list of expectations for completing the first internship at a nuclear power station. The intern evaluation form and task checklist will be discussed in terms of assisting in the performance of radiation protection activities.
RPT 210	SCWE in Radiation Protection Internship I	150704	4.00 **(0-16-4)**	20071	This practical experience provides introductory "hands-on" applications for performing basic radiation protection surveillance and control activities. During this internship the student will assist senior qualified technicians in the performance of these duties. Direct oversight is required.
RPT 212	On-Job Training and Task Performance Evaluation Preparation	150704	1.00 **(1-0-1)**	20072	This course covers nuclear industry process requirements for conducting on-the-job training (OJT) and task performance evaluations (TPE); it also orients the students to computer applications and knowledge elements for performing basic radiation protection tasks.
RPT 213	OJT/TPE on Standardized Tasks	150704	6.00 **(6-0-6)**	20072	This course includes on-the-job training & task performance evaluations of these tasks: taking, counting, & recording surveys; use of Alpha and Beta Gamma Smear Counters; posting & RCZ construction; control & storage of radioactive materials; monitoring and coaching workers entering/exiting RCA/RCZ.
RPT 216	Radiation Protection Internship II	150704	1.00 **(1-0-1)**	20072	This course provides an employer-specific in-plant orientation and a list of expectations for completing the second internship at a nuclear power station; the intern evaluation form and the intern task checklist will be discussed in terms of performing the tasks mastered in OJT/TPE.
RPT 218	SCWE in Radiation Protection Internship II	150704	4.0 **(0-16-4)**	20072	This practical experience provides hands-on applications for performing basic radiation protection surveillance and control activities. During this internship the student will perform the tasks mastered in OJT/TPE courses. Direct oversight by qualified personnel is required.

The curriculum display for the Associate Degree in Industrial Technology with a major in Radiation Protection Technology requires 72 credit hours and meets the parameters of the [SBTCE] System model for this major.

SPARTANBURG COMMUNITY COLLEGE
Associate Degree in Industrial Technology
Major in Radiation Protection Technology
SEMESTER DISPLAY

FIRST SEMESTER			**C – L – CR**
PHS	101	Physical Science I	3 – 3 – 4.0
CPT	101	Introduction to Computers	3 – 0 – 3.0
ENG	101	English Composition I	3 – 0 – 3.0
RPT	101	Introduction to Radiation Protection	1 – 0 – 1.0
CHM	105	General, Organic and Biochemistry	3 – 3 – 4.0
MAT	168	Geometry and Trigonometry	3 – 0 – 3.0
			16 – 6 – 18.0
SECOND SEMESTER			
PHS	102	Physical Science II	3 – 3 – 4.0
CPT	174	Microcomputer Spreadsheets	3 – 0 – 3.0
ENG	260	Advanced Technical Communications	3 – 0 – 3.0
SPC	209	Interpersonal Communications	3 – 0 – 3.0
MAT	110	College Algebra	3 – 0 – 3.0
			15 – 3 – 16.0
THIRD SEMESTER			
RPT	201	Power Plant Fundamentals	4 – 0 – 4.0
RPT	202	Fundamental Plant Systems	1 – 0 – 1.0
RPT	203	General Employee Training	3 – 0 – 3.0
RPT	204	Human Resources and Error Reduction	1 – 0 – 1.0
RPT	205	Radiation Detection and Standards	2 – 0 – 2.0
PSY	201	General Psychology	3 – 0 – 3.0
			14 – 0 – 14.0
FOURTH SEMESTER			
RPT	206	Radiation Monitoring and Exposure Control	4 – 0 – 4.0
RPT	207	Contamination Control and Incident Prevention	3 – 0 – 3.0
RPT	208	Introduction to Radiation Protection Internship I	1 – 0 – 1.0
RPT	210	SCWE in Radiation Protection Internship I	0 – 16 – 4.0
			8 – 16 – 12.0
FIFTH SEMESTER			
RPT	212	On-the-Job Training and Task Performance Evaluation Preparation	1 – 0 – 1.0
RPT	213	On-the-Job Training and Task Performance Evaluation on Standardized Tasks	6 – 0 – 6.0
RPT	216	Introduction to Radiation Protection Internship II	1 – 0 – 1.0
RPT	218	SCWE in Radiation Protection Internship II	0 – 16 – 4.0
			8 – 16 – 12.0

Minimum total credits: 72
Additions: None
Deletions: None

Physical Facilities

SCC has included the development of a new associate degree program in Radiation Protection Technology in the college's strategic planning process. This plan included the addition of a new academic building at the Cherokee County Campus containing a well-equipped physical science laboratory. The new building, completed in the Fall 2007 semester, houses all classrooms and equipment required for completion of the RPT Program's first year of required general education courses. This new facility is also utilized by other college certificate and degree programs. The new campus library contains the radiation protection materials necessary for radiation protection research with additional faculty offices available in the new building. With the current exception of the *On-the-Job Training/Task Performance Preparation and Evaluation* (OJT/TPPE) class, all the program's courses are held in the new Cherokee County Campus facility. The nuclear plant flow loop required for the OJT/TPPE class is housed at the Central Campus.

Faculty

In order to provide up-to-date RP instruction, all radiation protection courses (including the first year RPT 101 – Introduction to Radiation Protection) will be taught by INPO-certified instructors. These instructors are veteran Duke Energy employees who will be hired as adjunct faculty by the college. The Duke Energy-supplied adjunct faculty members will be assigned to teach RPT prefix courses and will not teach outside the RPT Program. Course syllabi and objectives for all RPT prefix courses have been designed in a fashion that will satisfy SACS and INPO accreditation requirements. All curricula in the program will be a joint effort between the college and Duke Energy with the college retaining the academic oversight of all courses. Administrative release time and/or a stipend will be given to the radiation protection department head for RPT Program supervision. SCC defines a science full-time equivalent (FTE) as a faculty member who teaches 12 credit hours (18 contact hours) plus a minimum of 8 office hours weekly and all other general education full-time equivalents (FTE) as faculty members who teach 15 credit hours (15 contact hours) with a minimum of 8 office hours as well. This is in compliance with state and local (college) policies and procedures.

RPT Faculty	Highest Degree Earned	Field of Study	Teaching in Field (Yes/No)
Primary Duke faculty partner	Ph.D. and full INPO Certification	Education Radiation Protection	Yes
All other Duke supplied faculty	INPO certification in all courses taught	Radiation Protection	Yes

Divisional administrative specialists will perform clerical duties for the full-time RPT Program Department Head as well as all RPT full-time and adjunct faculty. In the near future, a full-time faculty member within the college will be assigned as the RPT Program Director to aid in the day-to-day operation of the RPT Department. This individual will work closely with the Duke faculty liaison and RPT Department Head. The Dean of Instruction will provide administrative supervision. Faculty development is expected and funded by the college through departmental budgets and Faculty and Staff Development funds. In support of continuing professional development, SCC will budget a minimum of $2,000 annually for faculty travel to visit other programs and attend professional meetings and conferences. Adjunct faculty will be invited to faculty meetings and oriented to curriculum and program procedures prior to instruction. **Table 8** contains the RPT Program yearly distribution of new and existing administration, faculty, and staff.

TABLE 8

UNIT ADMINISTRATION/FACULTY/STAFF SUPPORT			
YEAR	**NEW**	**EXISTING**	**TOTAL**

	Headcount	FTE	Headcount	FTE	Headcount	FTE
Administration						
2008-2009	0	0	2	0.2	2	0.2
2009-2010	0	0	2	0.2	2	0.2
2010-2011	0	0	2	0.2	2	0.2
Faculty						
2008-2009	0	0	4*	3.75	4	3.75
2009-2010	0	0	4*	3.75	4	3.75
2010-2011	0	0	4*	3.75	4	3.75
Staff						
2008-2009	0	0	3	0.3	3	0.3
2009-2010	0	0	3	0.3	3	0.3
2010-2011	0	0	3	0.3	3	0.3

*These faculty headcounts include the equivalent of approximately four RPT-dedicated, full-time faculty provided to the college by Duke Energy.

Equipment

The equipment currently available for existing general education needs will provide the equipment needs for the new RPT Program's first year of required general education courses. The college estimates that increased enrollment in physical science courses due to the RPT Program will increase equipment upkeep and replacement by approximately $5,000 the first year and by $2,500 each year thereafter. In addition, the cost of disposable supplies, computer programs and licensing, chemicals, broken glassware, etc. is estimated at $10,000 for the first year and $8,000 for each year thereafter.

Due to the nature of the second-year RPT cohort nuclear facility equipment training requirements and the lack of a designated area in an operational Duke Energy nuclear power plant, Duke Energy is in the process of outfitting a large working area with a nuclear power facility flow loop that will provide a safe radiation-free training environment on the college's campus. The cost of this outfitting is approximately $900,000. The project is scheduled for completion by spring 2008.

Safety

Radiation and its risks command considerable public attention. However, a system of radiation protection has been developed over many decades as the effects of radiation have become better understood (http://www.nei.org; http://www.nrc.gov). Specifically, the United States Nuclear Regulatory Commission (NRC) ensures that all users of radioactive materials keep radiation exposures within its dose limits and as low as reasonably achievable (http://www.nrc.gov). All NRC rules and regulations are strictly adhered to in all U.S. nuclear power facilities. Users must obtain a license from the NRC and be inspected by the NRC to make sure they are following regulations and using radioactive materials safely. In its standards for protection against radiation, the NRC has requirements for dose limits for radiation workers and members of the public, monitoring and labeling radioactive materials, posting signs in and

around radiation areas, and reporting the theft or loss of radioactive material (http://www.nrc.gov). In addition, there are penalties for not following NRC regulations. The NRC requires that radioactive materials be used in a way that limits radiation exposure of individual members of the public to a dose that does not exceed 0.1 rem (100 millirem) in a year (http://www.nrc.gov). Adults working with radioactive material must be protected so as not to receive more than 5 rem (5,000 millirem) per year (http://www.nrc.gov). Because workers are exposed to various radiation sources, they are carefully monitored with the use of small instruments called dosimeters. In 1985 the NRC endorsed the Institute of Nuclear Power Operations' (INPO) training of radiation protection personnel and their ability to effectively provide a safe working environment within nuclear power facilities (http://www.nrc.gov). Duke Energy plants have consistently scored INPO 1 ratings. An INPO 1 rating is the highest possible safety rating for the operation and maintenance of a plant. The average number of millirems received by Duke Energy RP Technicians over the past five years is 50 millirem/year, which ranks Duke RP Technicians' radiation exposure among the lowest in the entire nuclear industry. It is important to note that the average number of millirems received by the general US population from all background radiation sources is 360 millirem/year - which is more than seven times that received by the Duke RP Technicians (http://www.nei.org). In the Spring 2007 nuclear power facility visits by the 63 RPT 101 college students, not a single millirem of exposure to ionizing radiation was recorded.

Central Campus Library Resources

The Library Learning Resource Center holds a collection of over 39,000 volumes including 5,100 audiovisual materials, 33,930 books, and 293 periodical subscriptions. These resources support the academic and personal needs of students, staff, and faculty, as well as members of the business and industrial community. Special resources include a growing instructional video collection, Internet access and a variety of online full-text databases such as InfoTrac, OneFile, and Academic Search Premier. The library's resources are further enhanced by online computer access to the collections of the South Carolina State Library, Spartanburg County Public Library, and other public and academic libraries. The SCC Library is a member of the South Carolina Information and Library Services Consortium and the South Carolina Library Network.

Cherokee County Campus Library Resources

Library and information resources are in place to support the academic programs at the new Cherokee County Campus (CCC). The library and information resources available at the CCC Library are comparable to that available on the Central Campus. Resources support general library services as well as the curriculum needs of specific programs such as the Radiation Protection Technology associate degree. Library collections and services are designed to support the curriculum. The collection includes books, both circulating and reference, audiovisual materials, a journal collection and over 65 online full-text and bibliographic databases that encompass journals, e-books, and links to evaluated websites. The Library's most used databases include InfoTrac, OneFile, Academic Search Premier, LexisNexis Academic, Literature Resource Center, Magill OnLiterature Plus, CINAHL, Health Reference Center Academic, Issues and Controversies, Hoover's Online, CultureGrams, and a collection of over 50,000 eBooks. The focus of the CCC Library collection is reference and circulation general education materials and materials to support the Radiation Protection Technology curricula. (See Acquisition Report to Date -- RPT and Science, Science Periodical Subject List, Radiation Protection Technology Journal Lists) Based on the projected RPT Program's state FTE generation, library funding is expected to be $3,750 in years two and three of the program.

Recommended database(s) for full-text articles:
Academic Search Premier
Expanded Academic ASAP First Search
InfoTrac, OneFile
Today's Science

Career and Technical Radiation Protection Technology Journals			
Journal	**Full Text**	**Index Start**	**Index End**
Modern Power Systems	Yes	1998	Current
Occupational Hazards	Yes	1987	Current

Books and AV Material for Radiation Protection Technology		
BUDGET YEAR		ITEMS PURCHASED
2006-2007 on order**		43
Total on order**		**43**
**Note: also have 23 donated titles for the RPT collection		

Science Periodical List by Subject
Discover
National Geographic
Nature (on-line access from library's webpage)
Physics Today
Popular Science
Science (both paper and on-line access from library's webpage)
Science News
Scientific American
South Carolina Wildlife

InfoTrac One File Radiation Protection Technology Journals		
Journal	**Full Text Start**	**Full Text End**
Energy Journal	1/1989	
Nuclear Engineering International	6/2002	
Nuclear Power Today	6/2004	
Nuclear Waste News	12/1997	
Power	2/1981	
Power Engineering	1/1991	
Power Engineering International	7/2002	

The department heads and faculty in the Associate of Arts and Radiation Protection Technology Programs have been actively involved in determining the shape of the collection in order to ensure curricula relevance. In addition, the collection of 40,000 books and audiovisual titles housed at the Central Campus will be available to CCC patrons via the online catalog, an online request function, and a daily courier for delivery. To expand both the breadth and depth of the collection, the SCC Library participates in several consortia arrangements that extend the collection boundaries. Library staff members are actively involved in these organizations, insuring maximum relevance to SCC curricula and programs.

SCC determines adequacy and curriculum relevancy of library services and resources through a strong assessment program. This program includes regular department head interviews, on going collection assessment, student surveys, graduate surveys, faculty/staff surveys, and active participation in program-

accrediting team visits. In all aspects of library programming, technology enhances the student learning process and is appropriate to the objectives of college programs. In order to facilitate easy student access to technology and training, PCs and laptops will be available for student and faculty use in the CCC Library. In addition, a classroom with laptops will be available for technology and library instruction use. The college ensures student application of library technology through a strong library instruction program. Regular and timely instruction in the use of library resources is promoted by college-wide library assignment criteria with an expectation of a set number of library assignments: twelve in an associate degree, six in a diploma program and four in a certificate program. The CCC Library is a facility that is appropriate for campus programs, supporting sufficient learning and information resources. The library facility has 1,480 square feet of space and contains seating for 39 patrons, space for 22 PCs, library staff office space, and two group study rooms. There is shelving for 1,800 titles, with additional dedicated space for journals. The library will be staffed and open for patrons 7:30 a.m. - 6:30 p.m., M - Th. Faculty may request additional hours based on program curriculum needs.

Accreditation, Approval, and Licensure

The Associate Degree in Industrial Technology with a major in Radiation Protection requires two groups for accreditation: the Southern Association of Colleges and Schools (SACS) and the Institute of Nuclear Power Operations (INPO) (www.sacscoc.org; http://www.nrc.gov). In 1979, the nuclear electric utility industry created the Institute of Nuclear Power Operations (INPO) (http://www.nei.org). INPO's mission is to promote the highest levels of safety and reliability in the operation of nuclear electric generating plants through implementation of a comprehensive system of training and accreditation for utility personnel (http://www.nei.org; http://www.nrc.gov). All U.S. organizations that operate commercial nuclear power plants are INPO members. The National Academy for Nuclear Training (NANT), created in 1985, integrates and standardizes the training efforts of INPO and all U.S. nuclear companies (http://www.nei.org; http://www.nrc.gov). NANT training embodies the U.S. commercial nuclear utility industry's commitment to high quality training and professionalism. Through the independent National Nuclear Accrediting Board (NNAB), individual utility training programs are formally verified and accredited or rejected through regular on-site teaching and performance evaluations (http://www.nei.org). The Academy integrates the training-related efforts of nuclear utilities, the independent NNAB, and INPO's training activities (http://www.nei.org). Once a company has set up its training programs, the independent NNAB determines whether they meet accreditation standards. The accreditation process covers operations, maintenance, and technical training programs (RP) for all key positions at each plant. Each of the training programs must renew its accreditation every four years (http://www.nei.org). It requires a utility self-evaluation of its training programs based on industry-wide standards; a visit from a team of training experts, which examines the training programs and recommends improvements; and a review by a panel of the NNAB, which will determine whether the programs meet accreditation standards. It is the NNAB that will continue to evaluate the Duke Energy employees who participate as SCC adjunct instructors in the RPT Program by regular observation of all RPT classes taught – whether on campus or on-site in a nuclear power plant setting.

As an additional safeguard, the United States Nuclear Regulatory Commission (USNRC) is also involved in a supervisory role in all nuclear power facility personnel training and qualifications. The NRC oversees virtually every aspect of nuclear power plant personnel training – setting regulatory requirements, providing regulatory guidance, inspecting programs, and enforcing requirements. The NRC monitors company training programs and administers initial licensing examinations for plant operators. Re-qualification exams are routinely administered by the nuclear plant's operating company, but if there is cause, the NRC may administer them. The NRC also closely monitors the industry's accreditation process: observing industry accreditation team visits to companies, observing accrediting board meetings, and conducting random audits and training inspections. In addition, the NRC nominates some members of the

National Nuclear Accrediting Board. All nuclear plant sites have a resident NRC inspector for each unit, plus an additional inspector for the site (http://www.nrc.gov). The inspectors routinely check plant performance, including training activities. Section 306 of the Nuclear Waste Policy Act of 1982 directed the NRC to issue regulations or "other appropriate regulatory guidance" on the training and qualification of nuclear plant personnel (http://www.nrc.gov). Recognizing that the nuclear industry already had developed a highly effective training program and accreditation process, the NRC complied with Section 306 by issuing a policy statement in 1985. The statement endorsed the INPO-managed accreditation program. That same year, the industry created the National Academy for Nuclear Training. Spearheaded by INPO, the nuclear industry established a comprehensive system of personnel training and qualification. It created the National Academy for Nuclear Training to integrate the training programs of INPO, the training efforts of all U.S. nuclear energy companies, and the independent activities of the National Nuclear Accrediting Board (http://www.nukeworker.com/study/radiation). Under INPO's auspices, the nuclear energy industry has created a comprehensive system of training and accreditation for utility personnel (http://www.nukeworker.com/study/radiation). The National Academy for Nuclear Training, created in 1985, integrates and standardizes the training efforts of INPO and all U.S. nuclear companies.

TABLE 9

Three Year Estimation of Cost* and Revenue				
CATEGORY	***Year 1***	***Year 2***	***Year 3***	**TOTALS**
**Program Administration and Fringe (20%)	**0**	**1,200**	**1,200**	**2,400**
Faculty Salaries and Fringe	**0**	**0**	**0**	**0**
Graduate Assistants - **N/A**	**0**	**0**	**0**	**0**
Clerical/Support Personnel	**0**	**0**	**0**	**0**
Supplies and Materials	**10,000**	**8,000**	**8,000**	**26,000**
Library Resources	**0**	**3,750**	**3,750**	**7,500**
Equipment	**5,000**	**2,500**	**2,500**	**10,000**
Facilities	**0**	**0**	**0**	**0**
Travel to campus and training sites	**2,000**	**2,000**	**2,000**	**6,000**
TOTALS	**17,000**	**17,450**	**17,450**	**51,900**
Estimated FTE Revenue Generated from the State	**0**	**14,851**	**29,742**	**44,593**
Tuition Funding (New students only)	**60,116**	**84,056**	**84,056**	**228,228**
Other State Funding	**0**	**0**	**0**	**0**
Reallocation of Existing Funds	**N/A**	**N/A**	**N/A**	**N/A**
Federal Funding	**0**	**0**	**0**	**0**
TOTALS	**60,116**	**98,907**	**113,798**	**272,821**

***There are no unique costs or special state appropriations required by the AIT RPT Program**
****This number represents the cost of a SCC full-time faculty RPT Program Director**

Institutional Approval

The Spartanburg Community College Commission approved the submission of this proposal on August 21, 2006, following approval by the college's Academic Review Committee (ARC) and input from Duke Energy representatives.

References

Commission on Colleges of the Southern Association of Colleges and Schools, 1866 Southern Lane, Decatur, GA 30033; phone: (404) 679-4500; Fax: (404) 679-4558; (www.sacscoc.org).

Energy Information Administration; (http://www.eia.doe.gov/cneaf/nuclear/page)

Hamilton, Gary, Technical Training Manager, Catawba Nuclear Station, 4800 Concord Road, Mail Code: CN06MT, York, SC. 29745, phone: (803) 831-3187; personal communication.

Linn State Technical College, One Technology Drive, Linn, MO 65051; (http://www.linnstate.edu/academic/mnt/default.asp).

Meffert, Bruce, Nuclear Technology Instructor and ATC LSTC Programs Dept. Chair, Advanced Technology Center, 2900 Doreli Lane, Mexico, MO 65265, phone: (573) 582-0817 ext 639; Fax: (573) 582-7330; bruce.meffert@linnstate.edu; personal communication.

Nuclear Energy Institute; (http://www.nei.org).

Nuclear Regulatory Commission; (http://www.nrc.gov).

Rennhack, Michael D., President & CEO NukeWorker.com, 7809 Blueberry Road, Powell, TN 37849-3406, phone: (865) 238-0203, mobile: (269) 369-8833, Fax: (865) 238-0006; (http://www.nukeworker.com/study/radiation).

Reyes, Luis, executive director for operations at the U.S. Nuclear Regulatory Commission. Quote appeared in *NRC Sees Renaissance of Nuclear Power* of NewsMax.com Wires, Wednesday, June 13, 2007; (http://www.newsmax.com/archives/articles/2007/6/12/222700.shtml?s=us).