APPLIED BACCALAUREATE DEGREE PROGRAM PROPOSAL

Bachelor of Applied Science
Health Physics

November 2019

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NEW DEGREE PROGRAM PROPOSAL

Program Information

Institution Name: **Columbia Basin College**

Degree: **Bachelor of Applied Science in Health physics** CIP Code: **51.0916**

Name(s) of the existing technical associate degree(s) that will serve as the foundation for this program:

Degree:		CIP Code:	Year Began:
	AAS in Nuclear Technology – Radiation Protection Technician	**51.0916**	**2009**

Planned Implementation Date (i.e. Fall 2014): **Fall 2020**

Proposal Criteria: *Please respond to all eight (8) areas listed in proposal criteria.*
Page Limit: 30 pages

Contact Information

Name: Jesus Mota

Title: Dean for School of Professional Technical Education

Address: 2600 N. 20th Ave. Pasco, WA 99301

Telephone: 509-542-4424

Fax:

Email: jmota@columbiabasin.edu

Michael J Lee 11/15/19

Dr. Michael Lee, Vice President for Instruction
Chief Academic Officer

Date

INTRODUCTION

Serving the Benton and Franklin counties, the home of the biggest environmental cleanup job in U.S. history, Columbia Basin College (CBC) has offered an Associate of Applied Science (AAS) degree and one-year certificates in Nuclear Technology (NT) to help fulfill the industry needs at Hanford Site. Despite the CBC's contribution to the Hanford workforce for the past 10 years, one of the Hanford positions that has not been benefited from CBC's programs is that of health physicist.

Including CBC, the institutions located within 100 miles radius from the Hanford Site have not yet offered education programs that lead students to the local health physicist positions which require baccalaureate-level education. The 2019 local employer survey revealed that "retirement" is the top reason for attrition, and the number of retirees will increase in the next 10 years. Furthermore, the employers specifically identified limited pool of qualified applicants as the hardship in filling the positions.

To provide local educational and professional enrichment opportunities to current and future Hanford workers and create a quality local employment pool, CBC proposes to deliver its eighth Bachelor of Applied Science degree, Bachelor of Applied Science in Health Physics (BASHP). To accomplish the primary goal of preparing competent health physicists who are immediately employable upon degree completion, the BASHP program will enroll students who earned an AAS in NT with Radiation Protection Technician (RPT) option or completed the equivalent coursework by incorporating the AAS degree curriculum into the BASHP's prerequisites. In addition, the program will form an advisory board consisted of the local Hanford contractors to ensure that the curriculum is current and rigorous.

CBC proposes to start enrolling qualified students to the BASHP program in fall 2020 as both full- and part-time cohorts. With all prerequisites completed through an AAS in NT degree with RPT option or equivalent, students who enroll full-time can expect to complete a BASHP degree within six quarters without summer quarter enrollment. Depending upon transcript evaluation results, students with an associate degree in similar disciplines (e.g., nuclear engineering, nuclear science) or equivalent coursework will be advised to complete the prerequisites on campus in order to become eligible applicants. Upon an articulation agreement, the BASHP graduates will be eligible to start a graduate's degree at Washington State University Tri-Cities when it becomes available.

CBC is committed to "be the educational home that strengthens the local communities through meeting the ever changing educational needs of the region and state.[1]" In addition to providing access to education for associate degrees and certificates, CBC has provided professional and technical students an opportunity to achieve applied baccalaureate degrees since 2009. CBC successfully implemented seven applied baccalaureate degree programs and produced a total of 666 graduates as of summer 2019. Based on the positive outcomes and experience, CBC is confident in successfully implementing and operating the BASHP program.

This proposal addresses the eight standard criteria for a new BAS degree program established by the Washington State Board for Community and Technical Colleges (SBCTC) and provides corresponding evidences for CBC's capacity to manage the program.

STANDARD 1. CURRICULUM WITH BACCALAUREATE LEVEL RIGOR

Student Learning Outcomes

The proposed program is designed for students to gain higher level of competence in applied health physics. The Accreditation Board of Engineering and Technology, Inc. (ABET) requires baccalaureate level health physics programs to "demonstrate that graduates possess the necessary knowledge, skills, and attitudes to competently and ethically implement and practice applicable scientific, technical, and regulatory aspects of Health Physics"[1]. Aligning with the ABET's requirement, the BASHP curriculum framework can be best demonstrated in the Figure 1 developed by Fadel, Bialik, and Trilling (2015)[2] of the Center for Curriculum Redesign.

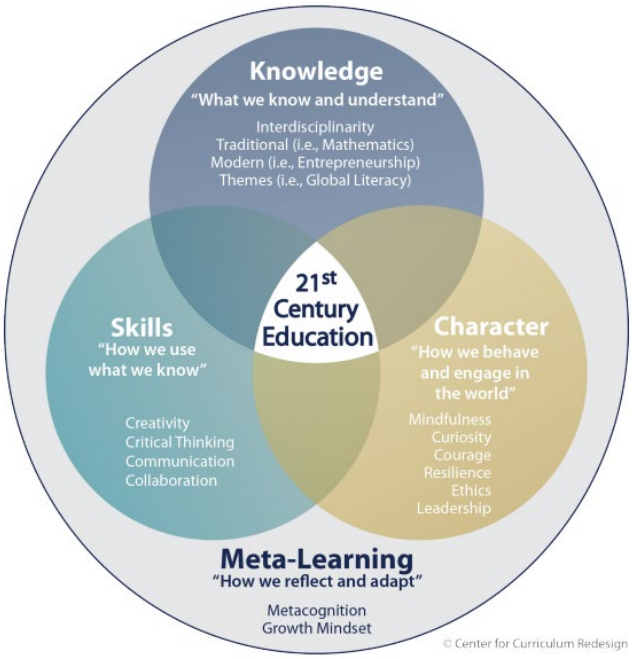


Figure 1. 21st Century Education Framework

Based on the ABET's recommendation, the Program Learning Outcomes (PLOs) of the BASHP program will emphasize strong foundation of technical knowledge, practical skills application, and team-oriented performance proficiency. The BASHP program graduates will be able to:

1. Apply knowledge of mathematics, science, and engineering;
2. Design and conduct experiments, as well as to analyze and interpret data;
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
4. Function on multi-disciplinary teams;
5. Identify, formulate, and solve engineering problems;
6. Use the techniques, skills, and modern engineering tools necessary for engineering practice;
7. Apply knowledge of atomic and nuclear physics to nuclear and radiological systems and processes;
8. Apply knowledge of transport and interaction of radiation with matter to nuclear and radiation processes;
9. Measure nuclear and radiation processes;
10. Identify professional and ethical responsibility;

[1] The Accreditation Board of Engineering and Technology, Inc. (2019). *Health Physics and Similarly Named Applied and Natural Science Programs: Program Criteria for Baccalaureate Level Programs – Curriculum.* https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-applied-and-natural-science-programs-2019-2020/

[2] Fadel, C., Bialik, M., & Trilling, B. (2015). *Four-dimensional education: The Competencies Learners Need to Succeed* (pp. 43). Boston, MA: Center for Curriculum Redesign.

11. Explain the impact of engineering solutions in a global, economic, environmental and societal context; and
12. Discuss contemporary issues.

In addition to achieving the program-specific knowledge, skills, and abilities, the BASHP graduates will also have developed the skills and knowledge associated with the CBC campus-wide Student Learning Outcomes (SLOs). All CBC graduates will be able to:

1. Think Critically
   - Understand, analyze, and evaluate the elements of one's environment and one's habits of thought.
   - Conceptualize alternatives to both.
2. Reason Quantitatively and Symbolically
   - Develop a sense of number and pattern.
   - Analyze, evaluate, and synthesize symbolic statement and quantitative arguments.
3. Communicate Effectively
   - Use spoken and written language to express opinions, discuss concepts, and persuade an audience.
   - Synthesize ideas and supporting information to create effective messages.
4. Apply Information Tools and Resources
   - Accurately assess information needs.
   - Select appropriate information tools and resources and use them effectively.
   - Evaluate, manage, and use information effectively and responsibly.
5. Develop Cultural Awareness
   - Respect self and others.
   - Explore and appreciate different cultures in an increasingly diverse, global community.
   - Challenge culture-bound assumptions.

Program Evaluation Criteria and Process

Curriculum Committee

To ensure quality, CBC requires all new degrees to follow a systematic process for curricular review by the curriculum committee consisting of Instruction and Student Services. All new degrees require a first and second reading and all new courses listed on the proposed degree must be approved prior to the degree can be brought to the committee.

New BASHP courses requests will include the Course Outcome Guide form, Course Master Coding form, and a syllabus. The CBC Course Outcome Guide form requires basic course information (e.g., prefix, title, effective quarter, prerequisite), catalog description, rationale for new course, required library resources, development history (e.g., discussion with advisory committee and local employers), linkages between the CBC SLOs and curriculum, and linkages between the CBC SLOs and the course SLOs. Course Master Coding form requires technical course information such as hours of lecture and lab and course distribution, if applicable. Each course will be voted as an individual agenda item, rather than a part of a new degree, to ensure standalone quality of every course.

Upon approval of the new courses, the BASHP degree program with the approved courses will be presented to the curriculum committee summary with a Cover Memo explaining the detailed rationale for the BASHP degree and the Degree Worksheet showing all major, major support, and general education courses required for the degree.

Annual Program Review

The Program Review, a part of the CBC's ongoing program review process, requires all programs to submit self-studies based on their program knowledge, observations, and analysis of data provided by the CBC Office of Institutional Research. The Program Review consists of four sections, shown in Table 1, which examine how the program self-identifies its contexts and captures in-depth analysis that statistical data do not reveal.

The findings from each program are assembled by the Office of Institutional Research to form a report representative of CBC that describes the overall mission, and includes data to help understand and identify key opportunities, challenges, and successes.

As demonstrated in Figure 2, the Program Survey is distributed in January of the following academic year, collected in March, presented to the Board of Trustees in summer, and shared with all faculty and staff during In-Service week prior to a new academic year.

Table 1. CBC Annual Program Review Items

Section	Method	Finding/Evaluation
Program Introduction	Open-ended	• How a program fits in the CBC's portfolio of student services • What opportunities and challenges a program has encountered or foresees
Data Observation	Open-ended	• How the data aligns with program faculty's observation • Program characteristics that are not represented in the data
Program Objectives and Outcomes	4-scale	• Program objectives/outcomes and how well each item is achieved based on self-reflection
Course SLOs	4-scale	• A list of courses and how each of the program and campus-wide SLOs relate to each course

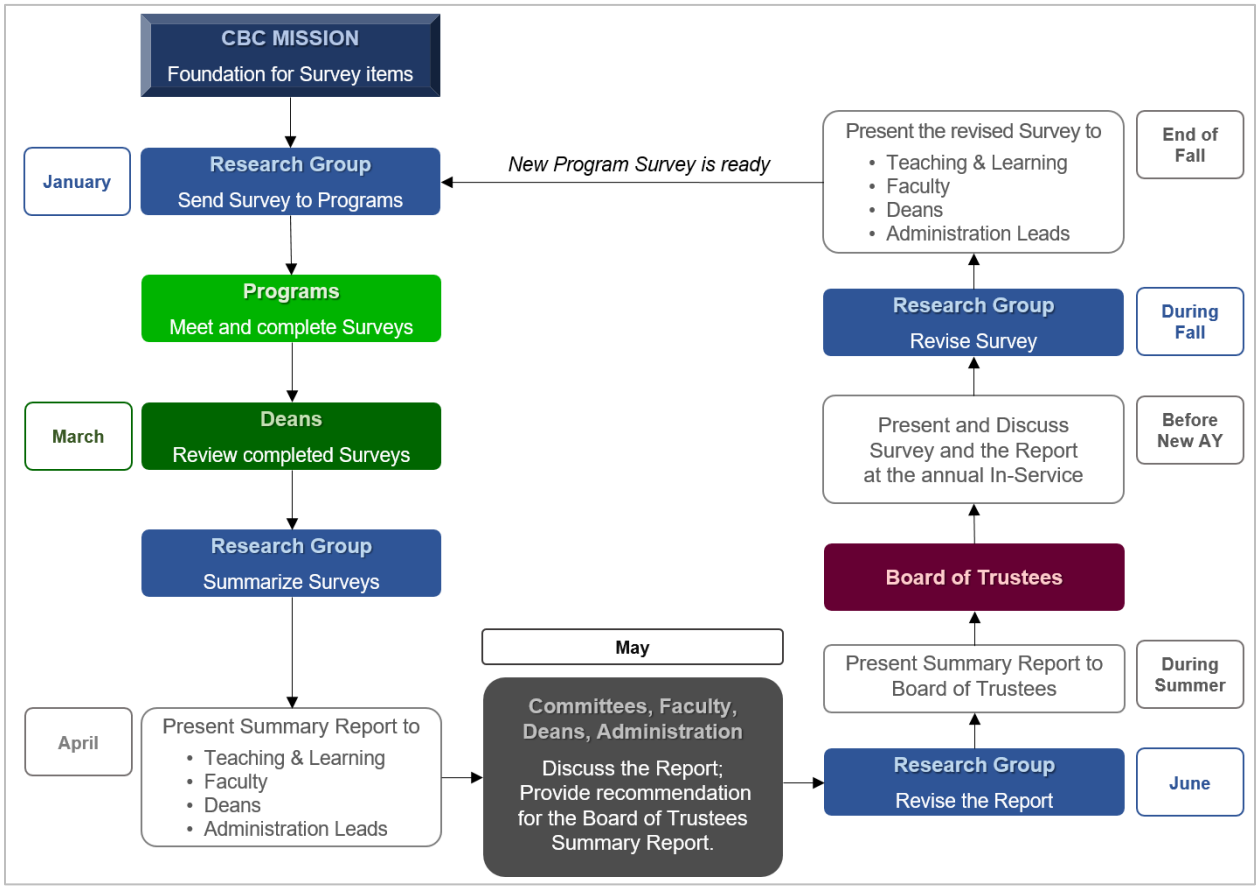


Figure 2. CBC Annual Program Review Process

Student and Employer Survey

In addition to the institution-wide program evaluation, the BASHP program will employ diverse evaluation tools to acquire multifaceted data from students, faculty, and local employers for ongoing holistic evaluation of the program effectiveness.

BASHP students will provide their analyses of each BASHP course, the overall program, and the job placement by participating in three types of voluntary surveys: Course Evaluation (at the end of each quarter), Student Exit Survey (at the end of the program), and SBCTC Alumni Survey (after graduation). The BASHP faculty will evaluate all course syllabi at the end of each academic year to discuss student achievement and performance and make necessary changes as needed. The local employers will provide annual feedback on the overall performance of the BASHP graduates who are employed by the employers.

The evaluation tools described above are summarized in Table 2.

Table 2. BASHP Program Evaluation Plan

Subject	Evaluation Tool	Description
BASHP Students	• Course Evaluation • Student Exit Survey • Annual Alumni Survey	• Identify program satisfaction level, job placement, job satisfaction level, and course satisfaction level
BASHP Faculty	• Annual Syllabus Evaluation	• Discuss student course achievement and student performance.
Employers	• Annual Employer Survey	• Monitor the BASHP graduates performance

Accreditation: NWCCU

As a regionally accredited institution, all programs at CBC also conduct a self-study as a part of its review process through Northwest Commission of Colleges and Universities (NWCCU) to demonstrate how effective CBC is in fulfilling the mission and the plans that support that mission.

Accreditation: ABET

ABET accreditation is a proof that a collegiate program has met standards essential to produce graduates ready to enter the critical fields of STEM education[3]. CBC will prepare for this voluntary and rigorous accreditation process by designing and operating the BASHP program according to the ABET Readiness Review[4] criteria which include the following:

- Program educational objectives and alignment with institutional mission;
- Admission process, graduation requirements, and transcripts of recent graduates;
- Program review process and continuous improvement plan;
- Faculty qualification and professional development opportunities;
- Facilities and equipment; and
- Institutional support for the program.

The program will become eligible for the accreditation review at the end of the 2021-2022 academic year upon the first cohort graduation.

Advisory Committee

In compliance with the SBCTC policy 4.40.20 (RCW 28B.50.252)[5], the proposed program will have an advisory committee consisted of key stakeholders. The member of the current CBC NT Program advisory committee listed in Table 3 will be asked to extend their advisory role for the BASHP degree, if their interest aligns with the BASHP program. The faculty members for the 300/400 RPT courses will join the committee as new members in 2020-2021 academic year.

[3] The Accreditation Board of Engineering and Technology, Inc. (2019). *Why ABET Accreditation Matters.* https://www.abet.org/accreditation/what-is-accreditation/why-abet-accreditation-matters/

[4] The Accreditation Board of Engineering and Technology, Inc. (2019). *Readiness Review.* https://www.abet.org/accreditation/get-accredited/accreditation-step-by-step/readiness-review/

[5] Washington State Legislature (2019) RCW 28B.50.252 Districts offering vocational educational programs – Local advisory committees – Advice on current job needs. https://app.leg.wa.gov/RCW/default.aspx?cite=28B.50.252.

The members will meet three times a year at the end of fall, winter, and spring quarters to provide guidance and recommendations for curriculum and student performance evaluation and to share local labor market status.

Table 3. BASHP Potential Advisory Committee Members

Name	Title	Organization
Stephanie Doll	Health Physicist	WRPS
David Hearnsberger	Health Physicist	CH2M Hill Plateau Remediation (CH2MH)
Kevin Konzen	Radiological Engineering Manager * *Current CBC NT Program committee member*	WRPS
Brett Rosenberg	Internal Dosimetrist	MSA/NV5
Michael Stabin	Principal Health Physicist	NV5/Dade Moeller
Kate Lyons-Holestine	Director Career & Technical Education Programs	CBC
Jesus Mota	Interim Dean for School of Professional Technical Education	CBC
Interested members from the current CBC NT Program Advisory Committee below:		
Kelly Byrne	Radiological Control Technician	Pacific Northwest National Laboratory (PNNL)
Robert Ford	Radiation Protection Manager	PNNL
Richard Hatten	Instrumentation & Control Supervisor	Energy Northwest
Gover Hettel	Chief Nuclear Officer	Energy Northwest
Blain Highland	Instructional Technologist	Energy Northwest
Lloyd Keith	Training Manager	WRPS
Cami Krumm	Human Resources Administrator	URS-Bechtel
Stephen Lorence	Human Resources Manager	Energy Northwest
James Morris	Training Manager	CH2MH
Christopher Royce	Health Physicist	Framatome
Alan Sage or Randy Coleman	International Brotherhood of Electrical Workers Representative	IBEW Local 77
Brad Sawatzke	Chief Nuclear Operator	Energy Northwest
Tracey Shinsato	Vice President	NV5
Michael Shobe	Chemistry Spec. IV	Energy Northwest
Craig Smith	Conduct of Operations Technical Authority	CH2MH
Brenda Wiesner	Health Physics Technician	PNNL

Program Structure

The program will build on the CBC's AAS degree in NT with RPT option which has produced radiation protection technicians since 2009. Both the ABET and the local employers strongly

emphasize importance of 1) the higher level of theoretical knowledge and practical applications in radiation protection and 2) the Calculus level of math. The proposed BASHP curriculum includes a series of 300/400 level RPT courses and both Calculus I and II courses to prepare students for immediate employment as a competent health physicist upon degree completion.

BASHP students will be required to complete 183 credits which includes 60 general education course credits as outlined by SBCTC[6]. The total credits are categorized in Table 4.

Table 4. Credit Requirements BASHP Degree

Requirement	Credit
AAS General Education	30
BASHP General Education (includes two 300/400 level courses)	30
AAS NT - RPT 100/200 Level	66
BASHP RPT 300/400 Level	57
Total	**183**

Prerequisites

Prior to the start of the program, students will have completed all of the following:

- A technical associate degree in NT (or closely relevant disciplines) *or* more than 90 college-level credits from a regionally accredited institution;
- The prerequisites listed in Table 5, which aligns with the major courses of the CBC AAS degree in NT with RPT option; and
- MATH&144: Precalculus I & II *or* both MATH&141: Precalculus I and MATH&142: Precalculus II to satisfy the prerequisite for MATH& 151: Calculus I, which is required in the first quarter of the BASHP program.

Table 5. BASHP Prerequisite Requirements

Course	No.	Course Title	Credit
MATH&	144	Precalculus I & II	5
NT	111	Basic Nuclear Math & Physics	5
NT	121	Reactor Plant Operations ***or***	4
NT	122	Basic Nuclear Facilities	
NT	131	Nuclear Facility Components	4
NT	141	Basic Reactor Safety, Theory, & Operations ***or***	5
NT	142	Basic Nuclear Safety & Environmental Compliance	
NT	160	Nuclear Chemistry	3
ELT	124	Direct Current Circuits	5

[6] Washington State Board for Community and Technical Colleges (2015) *Recommendation to Instruction Commission from BAS committee for minimum general education requirements for applied baccalaureate degrees.* https://www.sbctc.edu/resources/documents/colleges-staff/programs-services/applied-baccalaureate/RecommendationforGenEdRequirementsforBASJuly2015.pdf

NT	170	Mechanical & Fluid Power Transmission	4
RPT	111	Radiation Fundamentals	5
RPT	121	Radiation Monitoring	5
RPT	131	Radiation Effects	5
RPT	141	Radioactive Materials Handling	5
RPT	211	Radiological Safety and Response	5
RPT	222	Radiation Protection	5
		IHT 100: OSHA 10 ***or*** IHST 130: OSHA 30 ***or*** IHST 154: Hazwoper Certification ***or*** NT 200: Nuclear Industry Exam Preparation ***or*** NT 261: Nuclear Facilities Management ***or*** NT 152: Internship ***or*** NT 154: Industry Project	6
		Total	**71**

The current AAS in NT with RPT option requires students to complete either MATH&141: Precalculus I or MATH&146: Introduction to Statistics. For seamless transition from AAS to BASHP degree, MATH&141 will be replaced with MATH&144. The 2020-2021 AAS degree revision will be submitted to the CBC curriculum committee in March of 2020.

The graduates who completed a degree without Precalculus I and II will be conditionally admitted to the program and required to complete MATH&144 during summer prior to their first BASHP fall quarter. The math revision is summarized in Table 6.

Table 6. Math Requirement Revision

	AAS	BASHP
Prior to 2020-2021	MATH&141: Precalculus I *or* MATH&146: Introduction to Statistics	- Applicants are conditionally admitted contingent upon MATH&144 completion with a minimum 2.0 in summer quarter.
2020-2021	MATH&144: Precalculus I & II *or* *equivalent* with a minimum 2.0	- Applicants are admissible.

General Education Courses

In compliance with the SBCTC's guideline for the general education requirements shown in Table 7, students will complete 60 credits of general education courses shown in Table 8 prior to graduation from the BASHP program. Given the emphasis on the math and science in health physics discipline, the additional 15 general education courses credits will be fulfilled by courses in the Quantitative and Symbolic Reasoning and Mathematical and Natural Science distributions.

Table 7. BASHP General Education per Distribution

Distribution	SBCTC Required	In Program	Balance
Communication Skills	10	10	-
Quantitative/Symbolic Reasoning	5	15	10

Humanities	10	10	-
Social and Behavioral Sciences	10	10	-
Mathematical and Natural Science	10	15	5
Additional General Education	15	-	(15)
Total	**60**	**60**	**-**

Table 8. BASHP General Education Requirements

Completed	Course No.	Course Description	Credit
Communication Skills (10 Credits)			
Associate	ENGL& 101	English Composition I *or*	5
	ENGL& 235	Technical Writing	
	Select one from the following:		
	CMST& 210	Interpersonal Communication	5
	CMST& 220	Public Speaking	
	CMST& 260	Multicultural Communication	
	Total Communication Skills credits		10
Quantitative/ Symbolic Reasoning Skills (15 Credits)			
Associate	MATH&144	Precalculus I & II	5
BASHP	MATH& 151	Calculus I	5
	MATH& 152	Calculus II	5
	Total Quantitative/Symbolic Skills credits		15
Humanities (10 Credits)			
BASHP	PHIL 305	Professional Ethics	5
		Any from the distribution list	5
	Total Humanities credits		10
Social and Behavioral Sciences (10 Credits)			
Associate	PSYC& 100	General Psychology	5
BASHP		*Any from the distribution list*	5
	Total Social Sciences credits		10
Mathematical & Natural Science (15 Credits)			
Associate	PHYS& 100+	Physics for Non-Science Major w/ Lab or above *or*	5
	CHEM& 140	General Chemistry w/ Lab	
	BIOL& 175	Human Biology w/ Lab	5
BASHP	ENVS 310	Environmental Issues	5
	Total Mathematical and Natural Science credits		15
	Total General Education Course Credits		**60**

The course description of the BASHP general education courses are provided as follows.

MATH& 151 Calculus I (5 Credits) The first course in the sequence for students whose major field of study requires a full year of calculus. Topics include: limits of algebraic and trigonometric expressions and exponential and logarithm functions; the derivatives of algebraic, trigonometric functions, and their inverses; exponential and logarithm functions; hyperbolic functions and their inverses; applications of the derivative, and an introduction to antiderivatives and the definite and indefinite integral. *Prerequisite: grade of 2.0 or better in MATH& 141 and MATH& 142 or MATH& 144, or appropriate placement.*

MATH& 152 Calculus II (5 Credits) A continuation of MATH& 151. Topics include: the fundamental theorem of calculus; techniques of integration; trigonometric integrals and substitution; applications of the definite integral including areas, average values, and volumes; improper integrals; and parametric equations, polar coordinates, arc length, and surface area with polar functions. *Prerequisite: grade of 2.0 or better in MATH& 151 or equivalent.*

PHIL 305 Professional Ethics (5 Credits) Examine the role of ethics and social responsibility in the management of public and private sector organizations and businesses. Concentrate on contemporary trends in corporate responsibilities with respect to ethical, legal, economic, and regulatory conditions in the global marketplace, utilizing the case study approach. *Prerequisite: meets the criteria for acceptance into a BAS/BSN program.*

ENVS 310 Environmental Issue (5 Credits) Discuss basic concepts of ecology and environmental science, illustrate them through lab experiences, and further elaborate through discussing environmental issues from a strategic business perspective. Discussions include how environmental pressures (e.g. sustainable development) and environmental problems (e.g. global warming, air pollution, waste-disposal), impact corporate mission, competitive strategy, technology choices, product development decisions, production processes, and corporate responsibility. *Prerequisite: meets the criteria for acceptance into a BAS/BSN program.*

Upper Division Courses

The 300/400 level courses listed in Table 9 incorporate the major courses that are recommended by the ABET in the following curricular areas:

1. Radiation physics
2. Radiation biology
3. Radiation detection and measurements with laboratory experience
4. Internal and external radiation dosimetry
5. Principles of radiation safety and health physics
6. Contemporary issues in health physics

Table 9. BASHP Upper Division Course Requirements

Course	Course Title	Credit	Prerequisite
RPT 301	Radiation Physics I	5	Acceptance to BASHP
RPT 302	Radiation Physics II	5	RPT 301 with minimum 2.5 *or* instructor permission
RPT 310	Nuclear Forensics	5	Acceptance to BASHP

RPT 311	Radiation Emergency Response	5	RPT 302 with minimum 2.5 *or* instructor permission
RPT 312	Environmental Radioactivity	5	
RPT 399	Health Physics Seminar I	1	Acceptance to BASHP
RPT 401	External Dosimetry	5	RPT 302 with minimum 2.5 *or* instructor permission
RPT 402	Internal Dosimetry	5	
RPT 403	Radiation Biology	5	
RPT 404	Radiation Detection and Measurement	4	
RPT 405	Radiation Detection and Measurement Lab	1	RPT 302 with minimum 2.5 *or* instructor permission; Must be taken with RPT 404
RPT 411	Medical Health Physics	5	Acceptance to BASHP
RPT 412	Nuclear and Regulatory Regulations Framework	5	Acceptance to BASHP
RPT 499	Health Physics Seminar II	1	Acceptance to BASHP
	Total	**57**	

The course descriptions are provided as follows; the full course descriptions and a sample academic plan are provided in Appendix I and II, respectively.

RPT 301 Radiation Physics I (5 Credits) Examine the basic fundamentals of health physics beginning with a review of physical principles, atomic and nuclear structure, radiation sources, radioactive decay series and differential equations, and the physical theory of interaction of radiation with matter; Develop skills by learning how to use available resources such as Brookhaven National Laboratory (BNL)'s National Nuclear Data Center and Oak Ridge National Laboratory (ORNL)'s Radiological Toolbox.

RPT 302 Radiation Physics II (5 Credits) Examine the advanced fundamentals of health physics beginning with radiation exposure, dosimetric quantities, radiation biology, standards and guidance relating to radiation safety, radiation detector theory and measurement counting statistics; Develop skills by learning how to use available resources such as BNL's National Nuclear Data Center and ORNL's Radiological Toolbox.

RPT 310 Nuclear Forensics (5 Credits) Identify the chemical, physical and nuclear aspects associated with nuclear material production and identification. Topics include: nuclear fuel cycle, analysis of recovered material, nuclear policy and nuclear forensic case histories.

RPT 311 Radiation Emergency Response (5 Credits) Examine the national framework for responding to incidents involving radiological and nuclear materials and the role of historical impacts on shaping policy and accident analysis; Discuss the National Contingency Plan and how it envelopes the Environmental Protection Agency, investigative units, medical management of patients, response and recovery, societal issues, and factors affecting decision making.

RPT 312 Environmental Radioactivity (5 Credits) Identify the sources of natural and technologically enhanced radioactivity in the environment; Explore basic environmental transport methods and software and apply to determine dose to a worker and a member of the

public based on a composite of real-world situations, in a hypothetical setting, that have historically occurred in the health physics industry.

RPT 399 Health Physics Seminar I (1 Credit) Explore a broad spectrum of topics in contemporary health physics (e.g., state and federal regulations, waste disposal, emergency response, the International Atomic Energy Agency activities, nuclear nonproliferation, radiation oncology, etc.) delivered by field experts; Increase knowledge of employment opportunities and learn basic skills, such as resume writing and interview techniques.

RPT 401 External Dosimetry (5 Credits) Examine external radiation protection, point kernel techniques, shielding calculations including the National Council on Radiation Protection and Measurements (NCRP) 147, and external dosimetry measurement techniques; Develop skills by learning how to use industry shielding software and available resources.

RPT 402 Internal Dosimetry (5 Credits) Examine internal radiation protection based on international recommendations that include the NCRP and the International Commission on Radiological Protection and journal publications. Discuss and apply the Medical Internal Radiation Dose methods for calculating internal dose; Develop skills by learning how to use industry dosimetry software.

RPT 403 Radiation Biology (5 Credits) Examine molecular mechanisms of radiation interaction, cell survival curves, cellular radiosensitivity, dose fractionation, acute radiation syndrome, medical countermeasures, radiation carcinogenesis, teratogenesis, and radiation protection.

RPT 404/405 Radiation Detection and Measurement with Lab (A total of 5 Credits) Examine the basic physics principles and applications of radiation detecting instruments, with laboratory exercises. Emphasis on the techniques and instrumentation for nuclear radiation detection and measurements as they relate to health physics and nuclear physics.

RPT 411 Medical Health Physics (5 Credits) Introduction to the field of Medical Health Physics. Topics include: the diagnostic and therapeutic use of x-rays and nuclear medicine, radiation protection and regulation, radiation accidents, waste management and disposal.

RPT 412 Nuclear and Regulatory Regulations Framework (5 Credits) Examine the formation of the nuclear and regulatory environment in the U.S. and the role of Independent Domestic and International Consensus Standards.

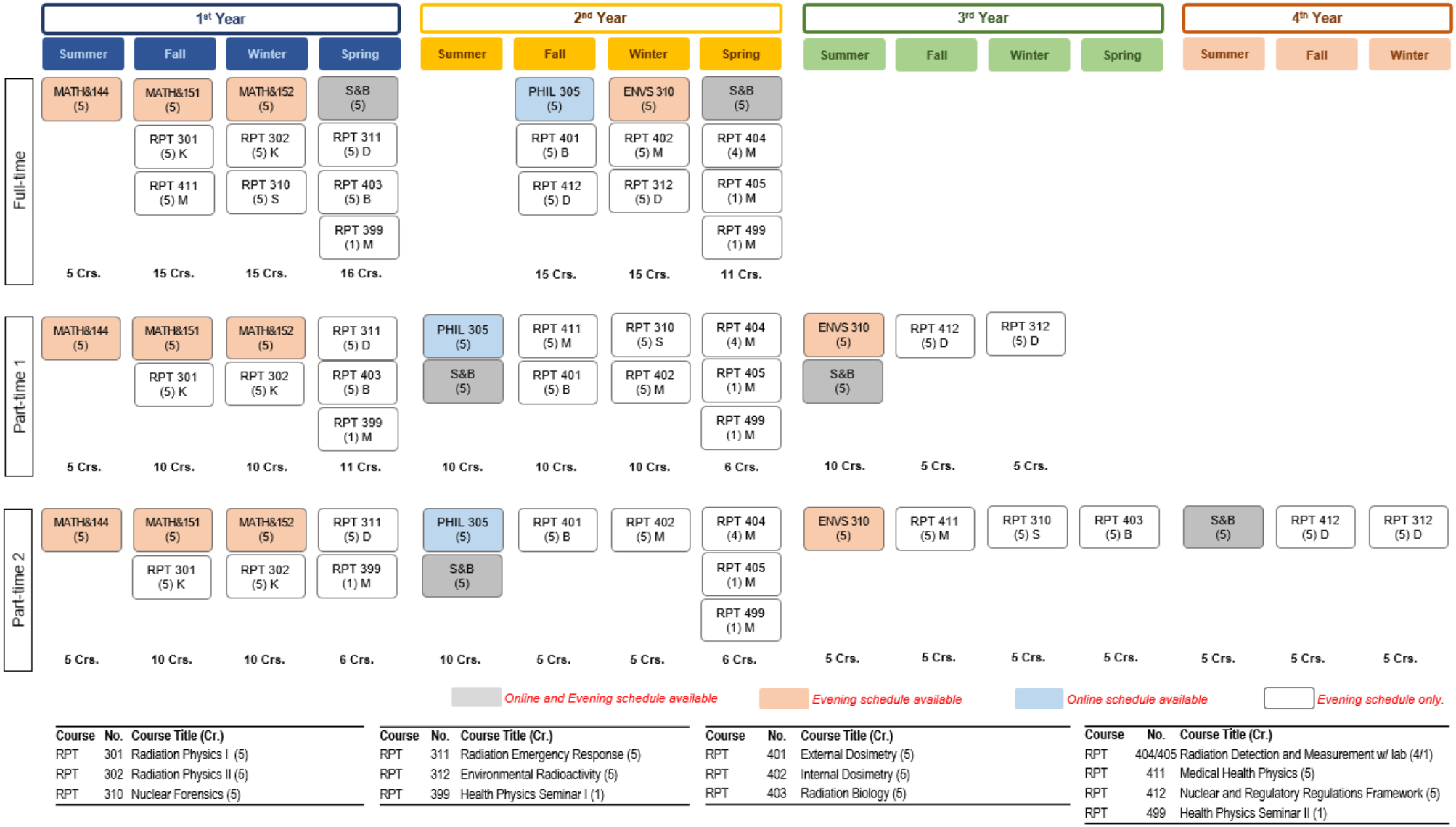
RPT 499 Health Physics Seminar II (1 Credit) Expand knowledge spectrum of topics in contemporary health physics, delivered by field experts, and explore local employment opportunities.

Program Schedules

BASHP students will enroll starting fall 2020 in one of three cohort programs: full-time (6 quarters), part-time 1 (10 quarters including summer), and part-time 2 (14 quarters including summer). Students who graduated without Precalculus I and II will enroll in an additional summer quarter prior to the program start in order to satisfy the math requirements.

Although a cohort is expected to take major specific courses together throughout the program duration, full-time students will be allowed to switch to part-time depending on personal

situations (e.g., work schedule, family obligation, and financial difficulties) but may expect delay in program completion. The School of Professional Technical Education Completion Coach will work with the students to accommodate a transition between full- and part-time enrollments. The anticipated program schedules for full-time and part-time are illustrated in Figure 3.



Course	No.	Course Title (Cr.)
RPT	301	Radiation Physics I (5)
RPT	302	Radiation Physics II (5)
RPT	310	Nuclear Forensics (5)

Course	No.	Course Title (Cr.)
RPT	311	Radiation Emergency Response (5)
RPT	312	Environmental Radioactivity (5)
RPT	399	Health Physics Seminar I (1)

Course	No.	Course Title (Cr.)
RPT	401	External Dosimetry (5)
RPT	402	Internal Dosimetry (5)
RPT	403	Radiation Biology (5)

Course	No.	Course Title (Cr.)
RPT	404/405	Radiation Detection and Measurement w/ lab (4/1)
RPT	411	Medical Health Physics (5)
RPT	412	Nuclear and Regulatory Regulations Framework (5)
RPT	499	Health Physics Seminar II (1)

Figure 3. BASHP Program Schedules

STANDARD 2. QUALIFIED FACULTY

General Education Faculty

Complying with the recommendation from SBCTC, the BASHP's upper-level general education courses will be taught by the CBC faculty who have a terminal degree in their discipline. Table 10 shows the credentials of the faculty who will teach the courses included in the BASHP curriculum.

The faculty are excited to welcome a new BAS program to CBC as they are not only enjoy teaching specific context in depth that is well matched to their academic interest but have also seen many BAS students in seven other applied baccalaureate degree programs on campus highly motivated and well performed in class.

Table 10. General Education Faculty

Faculty	Course	Credentials
Dr. Rik Smith	ENVS 310: Environmental Issues	▪ Associate Professor, CBC ▪ Ph.D. in Ecology, University of California, Davis ▪ B.S. in Environmental Education, Western Washington University
Dr. Matt Kincaid	PHIL 305: Professional Ethics	▪ Adjunct Faculty, CBC ▪ Associate Professor, Heritage University ▪ Ph.D. in Leadership Studies, Gonzaga University ▪ M.B.A. in Business, Gonzaga University ▪ B.A. in Business, Gonzaga University

Major Specific Education Faculty

There are five adjunct faculty who teach 100/200 RPT courses. Upon approval of the program, CBC will hire adjunct faculty members who have been actively involved in the BASHP curriculum development and are fully qualified to teach the proposed 300/400 RPT courses with the credentials listed in Table 11. The letter of support from the potential adjunct faculty is provided in Appendix III.

CBC has been working with the community partners (e.g., Hanford-associated organizations) and researching potential grant opportunities to find fund for a full-time faculty who can lead the program. As of November of 2019, CBC plans to recruit more instructors with similar credentials to expand the adjunct pool until a full-time faculty hiring is supported.

Table 11. 300/400 RPT Course Adjunct Faculty

Faculty	Course	Credentials
Dr. Stephanie Doll	▪ RPT 310: Nuclear Forensics	▪ Health Physicist, Washington River Protection Solutions ▪ 10+ years of experience in nuclear industry ▪ Participant of the Washington River Protection Solutions STAR Development Program ▪ Former Scientist, Washington River Protection Solutions ▪ Former Postdoctoral Research Assistant, Ohio State University and Pacific Northwest National Laboratory ▪ Ph.D. in Radiochemistry, University of Missouri ▪ B.S. in Chemistry, University of Missouri
Dr. David Hearnsberger	▪ RPT 311: Radiation Emergency Response ▪ RPT 312: Environmental Radioactivity ▪ RPT 412: Nuclear and Regulatory Regulations Framework	▪ Compliance Officer/ Independent Consultant, CH2M Hill Plateau Remediation Company ▪ Certified Health Physicist ▪ 20+ year of experience in nuclear industry and academia ▪ Former Adjunct Professor, University of Texas – Austin (20007-2008): Curriculum Development in Radiological Engineering, Radioactive Waste Management, and Radiation Shielding. ▪ Co-PI funded by the Office of Naval Research, University of Texas – Austin: Undergraduate/Graduate Program Development at Minority Institutions ▪ Ph.D. in Nuclear Engineering, Texas A&M University ▪ M.S. in Health Physics, Texas A&M University ▪ B.S. in Radiological Health Engineering, Texas A&M University
Dr. Kevin Konzen	▪ RPT 301: Radiation Physics I ▪ RPT 302: Radiation Physics II	▪ Radiological Engineering Manager, Washington River Protection Solutions ▪ Certified Health Physicist ▪ 30+ years of experience in nuclear industry and academia ▪ Member of Health Physics Society, American Association of Health Physics, International Biometric Society, and Energy Facilities Contractors Group. ▪ Former Adjunct Professor, Idaho State University (2016~2018): Courses include Radiation Physics II, Internal Dosimetry, and ABHP Review

		▪ Former Health Physics Consultant to the Idaho Cleanup Project ▪ Ph.D. in Applied Physics, Idaho State University ▪ M.S. in Physics (Emphasis: Health Physics), Idaho State University ▪ B.S. in Radiation Protection, Thomas Edison State College
Dr. Brett Rosenberg	▪ RPT 401 External Dosimetry ▪ RPT 403 Radiation Biology	▪ Internal Dosimetrist, Mission Support Alliance, NV5 ▪ 10+ years of experience in nuclear industry and academia ▪ Former Health Physicist and Radiological Engineer at Hanford agencies. ▪ Former Adjunct Faculty at Washington State University Tri-Cities ▪ Membership Chair for Columbia Chapter Health Physics Society ▪ Member of Health Physics Society and American Board of Health Physics ▪ Ph.D. in Health Physics, Colorado State University ▪ M.S. in Environmental and Radiological Health (Emphasis: Health Physics), Colorado State University ▪ M.S. in Environmental and Radiological Health (Emphasis: Toxicology), Colorado State University ▪ B.S. in Biomedical Science, Colorado State University
Dr. Michael Stabin	▪ RPT 399: Health Physics Seminar I ▪ RPT 402: Internal Dosimetry ▪ RPT 404/405: Radiation Detection and Measurement w/ Lab ▪ RPT 411: Medical Health Physics ▪ RPT 499: Health Physics Seminar II	▪ Principal Health Physicist, NV5/Dade Moeller ▪ Certified Health Physicist ▪ 35+ years of experience in nuclear industry and academia ▪ 2013 Recipient of the Hal Anger Lectureship honored by the Society of Nuclear Medicine ▪ Renowned Industry Consultant ▪ Chair, Radiation Dose Assessment Resource (RADAR) Committee ▪ Editorial Board for academic journals including Health Physics Journal ▪ Author of numerous textbooks including The Practice of Internal Dosimetry (2015) ▪ Former Faculty, Vanderbilt University (2000~2018) and Illinois Institute of Technology (2008~2012). ▪ Ph.D. in Nuclear Engineering (Emphasis: Health Physics), University of Tennessee ▪ M.E. in Environmental Engineering (Emphasis: Health Physics), University of Florida ▪ B.S. in Environmental Engineering, University of Florida

STANDARD 3. SELECTIVE ADMISSIONS PROCESS

Open Access

In accordance with WAC 131-12-010, CBC operates under an open door admission policy granting admission to all applicants who are 18 years of age or older and/or graduated from high schools accredited by a regional accrediting association. This aligns with the CBC Mission Statement specifically stating its commitment to diversity, equity, and inclusion to eliminate barriers to success through intentional and equitable efforts to provide quality learning opportunities. The BASHP program will adopt an open door admission policy until there are more applicants than available seats in the program.

Support for Diversity

Franklin County, one of the counties in CBC's service district, became the Pacific Northwest's first Hispanic-majority county in 2006[7]. In 2017-18, Hispanic students made up more than 40% of the student body at CBC, a federally designated Hispanic Serving Institution. While the number of non-Hispanic students has been decreasing, the number of Hispanic students at CBC have been continuously increasing as shown in Figure 4[8]. The BASHP program expects its student demographics to be similar to the institution's recent trend.

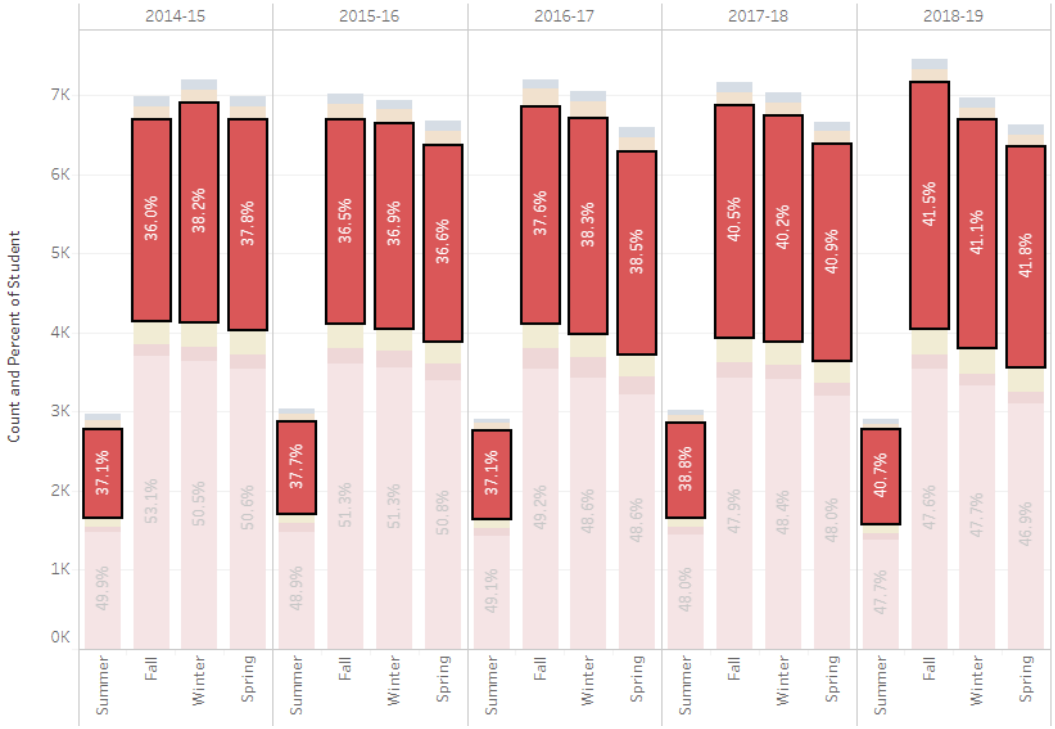


Figure 4. CBC Student Hispanic Demographics

In addition to the institution-side trend, the NT program has served diverse population: 40 % non-white, 18% female, 36% economically disadvantaged student group whose average age was 29, as shown in Figure 5. Graduates from the CBC NT program will be the majority of incoming students to the BASHP program, which in turn will serve the similar population.

[7] Suljic, A. (2017). *Franklin County profile: Overview*. Washington State Employment Security Department. https://esd.wa.gov/labormarketinfo/county-profiles/franklin

[8] Columbia Basin College (2019). *Demographics by Headcount: Unduplicated Headcount.* Office of the Institutional Research.

The College recruitment team visits high schools in rural areas within 100 miles radius where relatively high number of special population (e.g., economically disadvantaged) exists. Information presentation is available in both English and Spanish for bilingual students who might come from a monolingual home.

The College also visits underserved areas such as Benton County Jail to recruit students for a short-term certificate or AAS degree program so that they can build qualifying foundations for a BAS degree program. The College recruitment team also work closely with the support programs available on campus, such as MESA, TRiO, and CAMP, to ensure the relevant information can be shared during recruitment visits.

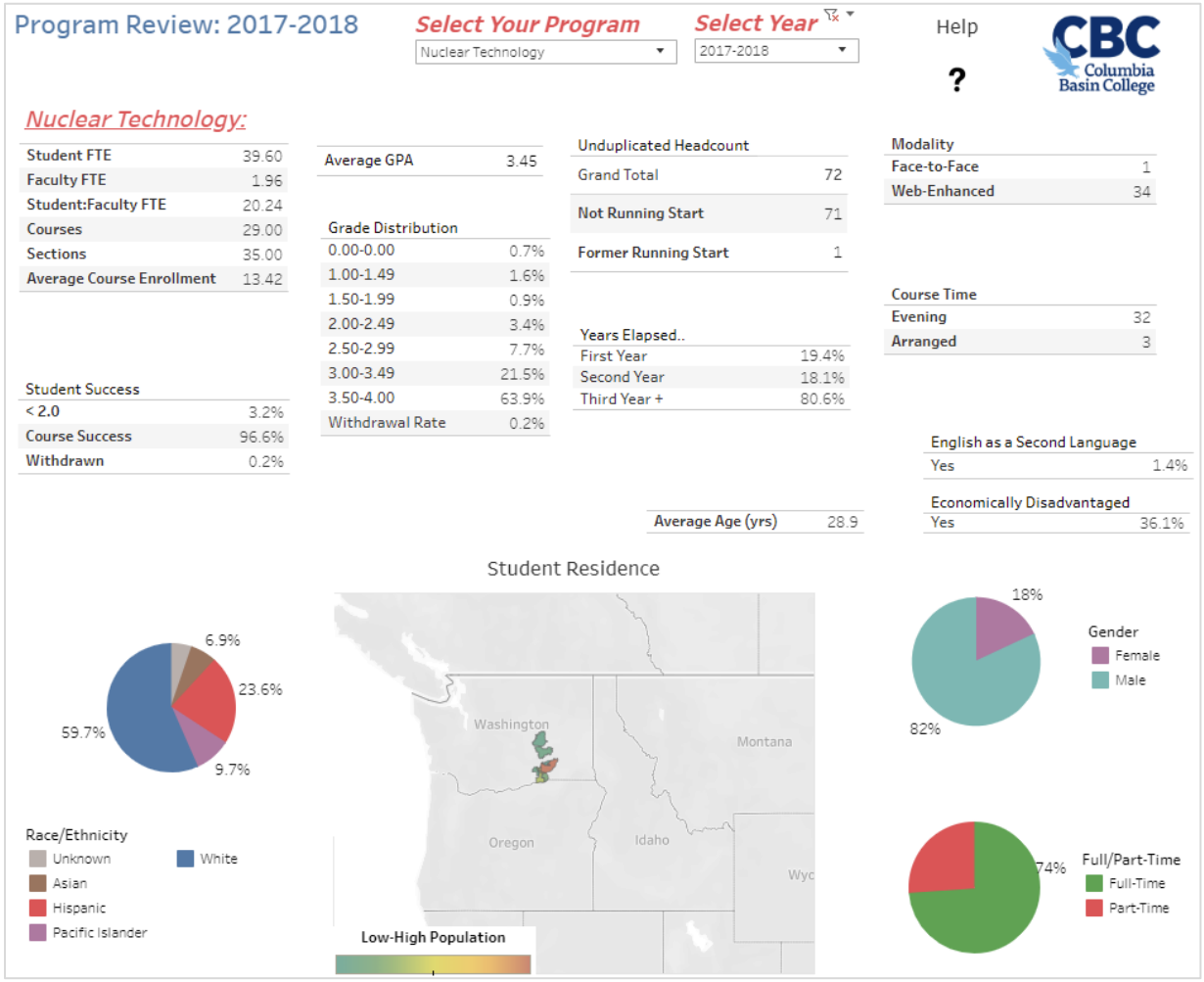


Figure 5. Nuclear Technology Program Review 2017-18

Admissions Criteria

The admission eligibility requirements shown in Table 12 have been identified to create opportunities for a broad spectrum of applicants and optimize the likelihood of successful completion of the BASHP degree and employment as a competent health physicist at Hanford.

Table 12. BASHP Admission Eligibility

Degree/Min. GPA	Prerequisites/Min. GPA	Eligibility
AAS in NT with RPT at CBC/2.0	Completed/2.0	Eligible

AAS in NT at a regionally accredited institution/2.0	Completed/2.0	Eligible
Associate degree in relevant discipline at CBC or a regionally accredited institution/2.0	Transcript must be evaluated for equivalency; eligible for admission after the prerequisites are completed with min. 2.0.	Not yet eligible
None but completed 90 or more college-level credits at a regionally accredited institution/2.0		

Students who completed an associate-level degree in NT or equivalent without both Precalculus I and II will be conditionally admitted and advised to complete MATH& 144: Precalculus I and II course during the summer quarter prior to their first fall quarter as a fully admitted BASHP student. All applicants are required to submit an application packet which includes:

- Completed CBC Application for Admission;
- Completed BASHP Program Application;
- Official college transcripts showing completion of a degree or equivalent number of credits and all prerequisite courses;
- Work experience summary (i.e., Resume); and
- Personal Statement of Purpose (Max. 500 words) outlining career goals in the field of radiation protection and how a BASHP degree will support those goals.

Selection Process

If the number of qualified applicants exceeds space availability, a BASHP admission committee will be formed to evaluate applications to identify individual likelihood of successful program completion using the BASHP Application Evaluation form shown in Figure 6.

Bachelor of Applied Science in Health Physics

Application Evaluation

Applicant Name: _____ Reviewer: _____ Review Date: _____

I. APPLICATION PACKET SCREENING Reject if all of the following were not met:

Accept	Reject

(Circle one)

☐ Associate degree or 90 or more college-level credits from a regionally accredited institution
☐ Completion of all prerequisite courses (see a separate sheet)
☐ Personal Statement of Purpose ☐ Work Experience Summary

II. APPLICATION RATING Please rate each criteria based on the Rating Scale Guideline.

Rating Scale Guideline

Rating	Cumulative GPA	Major Course GPA	Work Experience	Statement of Purpose
5	3.5+	3.5+	*Criteria per Rating to be discussed with Advisory Committee*	*Criteria per Rating to be discussed with Advisory Committee*
4	3.0-3.49	3.0-3.49		
3	2.5-2.99	2.5-2.99		
2	2.0-2.49	2.0-2.49		
1	2.0<	2.0<		

Evaluation

Criteria	Rating
Cumulative GPA	/5
Major Course Grade	/5
Work Experience	/5
Statement of Purpose	/5
TOTAL	**/20**

III. DISCUSION Please note any remarks regarding the evaluation.

IV. FINAL SCORE _____ (Reviewer 1 score) + _____ (Reviewer 2 score) / 2 = _____/ 20

V. RESULTS

Admitted	Not Admitted

Figure 6. BASHP Application Evaluation Form

Prior to the first cohort selection, the advisory committee members will determine adequate scale and evaluation method for work experience and personal statement criteria. The committee will be trained to use the guideline in a reliable and valid manner. The process includes the following steps which will be led by the Career and Technical Education (CTE) Programs Director and the advisory committee chair:

1. Check application packets to ensure all required items are included. The CTE Programs Director will screen each packet prior to distributing to the committee.
2. Grade each application packet item according to the Application Rating Scale Guideline. Each application packet will be graded by two reviewers.
3. Calculate an average score and identify the top scored applicants sufficient to fill available spaces. A waiting list of applicants will also be developed in case not all of those selected subsequently enroll in the program.

STANDARD 4. APPROPRIATE STUDENT SERVICES PLAN

CBC offers a wide variety of support services for enrolled students. The CTE Programs Director and faculty will be responsible to direct BASHP students to access to the appropriate student services and resources described below for successful completion of their degree.

Counseling/Advising Center

The primary responsibility of the Counseling/Advising Center is to assist students in their personal, educational, and professional growth and planning.

- Academic Advising
  BASHP students will receive academic advising specified to the degree completion directly from the School of Professional Technical Education Completion Coaches. To ensure cohort scheduling and graduation progress, all BASHP students will be required to meet with the Completion Coaches prior to each quarter for course registration.
- Career Counseling
  In coordination with the Completion Coaches, counselors will plan career, job search, and personal/professional development workshops throughout the year to sustain the BASHP students' interest in the field. Counselors will also help the students gain broader knowledge about the industry through health physics career focused workshops and career demonstration activities annually.
- Personal Counseling
  CBC counselors are registered by the state of Washington to provide personal counseling and assist students with issues that may affect their academic performance or progress in meeting their educational goals. The BASHP students will be offered workshops and other interventions aimed at improving student educational success and personal development. Counselors will provide short-term personal counseling and refer students to community mental professionals if needed.

Academic Success Center

The Academic Success Center provides CBC students free instructional support in subject areas for which there is high demand. The Center is equipped with computers and printers for student use, as well as whiteboards and group study areas. The Center provides drop-in and online tutoring and designated centers for writing and math.

- Math Center
  The Math Center provides students free access to tutors and use of textbooks and computers. Students can schedule a 30-minute to one hour one-on-one tutoring session with a math tutor. The center is equipped with 41 computers, textbooks for most math classes, a touchscreen computer, and quiet study rooms. Tutors will available during summer for BASHP students who are conditionally admitted and in need of completing the MATH& 144: Precalculus I and II course in the summer quarter.
- Writing Center
  For writing assistance, tutors offer advice and assistance with revising, reorganizing, and elaborating drafts of papers, as well as with syntax, usage, mechanics, citations, and documentation. Students also come in to receive assistance with prewriting-related tasks such as brainstorming ideas, outlining, and locating research information, while others come in to receive help with developing writing skills in general. BASHP students will be served mainly for their upper level writing assignments.
- Drop-in Tutoring and tutoring
  The tutors, trained with research-based practices aligned with College Reading & Learning Association certification requirements, assist students with course review and learning strategies to maintain academic success. In partnership with The Connecticut Distance Learning Consortium, CBC also provides the free one-on-one eTutoring service

in Accounting, Science, Economics, Math, Spanish, Statistics, and Writing. The School of PTE will communicate with the Academic Success Center if the tutoring needed to include additional subject areas for the BASHP curriculum.

Library Services

Students have access to the resources at CBC libraries in Pasco and Richland campuses and through online library databases, which include articles necessary for both lower and upper level courses. Both facilities provide desktop computer access and laptops for checkout and contain individual, group, and collaborative study spaces. Databases providing full text access to articles, videos, and e-books are available for use on and off campus. Librarians are available during scheduled hours or by appointment to provide research assistance while an online reference chat service is available 24/7.

Librarians also work with instructional faculty to provide students with information on effectively finding and using library resources to complete course-related research. The School of Professional Technical Education will regularly communicate with the library to ensure that all BASHP course materials including textbooks and reading lists are up-to-date and available.

Resource Center

The Resource Center is dedicated to assisting students and community members in reaching their personal and educational goals. The Resource Center is open to those who want to begin college but are not sure how to get started, as well as, to currently enrolled students who need assistance to overcome obstacles that make reaching their educational goals more difficult.

- Disability Services
  The disability services ensure that all students have equal access to educational programs and services. The service includes accessible facilities, materials in alternate format, sign language interpreters, priority registration, adaptive equipment, learning needs assessment, and testing accommodations.

  The Assistive Technology Center provides equal access to education by using adaptive technology to support a broad range of disabilities. The available technology includes text-to-speech with screen readers, speech-to-text with voice recognition, Braille and tactile with text reading and image visualization software, and captioning with Virtual Relay, Communication Access Realtime Translation, and closed captioning.
- Family Services
  Three services are available to low-income students with families attending CBC: Childcare Assistance, Holiday Adopt a Family Program, Food Pantry, and Community Referrals.
- Student Assistance
  Financial assistance is available to students attending CBC: Short-term emergency book and tuition loans, Travel assistance, Night taxi service, Dial-a-Ride passes, and Emergency personal assistance.

Financial Aid

Financial Aid personnel assist CBC students and their parents to find funding for basic educational costs. BASHP students will be considered for all aid programs unless specified with academic disciplines, in three major forms: gift aid, employment, and loans.

Scholarships

CBC Foundation offers a variety of scholarships for students based on many factors including academic achievement, field of study, and financial need. In 2018-19, the Foundation awarded over $1.1 million in scholarships to 630 students including those pursuing a Bachelor of Applied Science degree.

Veterans Education & Transition Services

The Veterans Education and Transition Services (V.E.T.S.) Center supports military connected students in their transition to CBC through customized academic advising, education benefits certification, navigating the college system, workshops tailed to veteran student success, and access to the Veterans Integration to Academic Leadership (VITAL)*. The Center provides a separate study space and computer access.

* *The collaboration between the Walla Walla Veterans Affairs Medical Center, CBC and Washington State University Tri-Cities. With a Veterans Affairs Psychologist located directly on the campus, student Veterans can access College Success Coaching and Transition Services, Resource Referral, and a wide range of Behavioral Health Services that promote health and achieving career goals.*

STANDARD 5. COMMITMENT TO BUILD/SUSTAIN A HIGH QUALITY PROGRAM

Institutional Capacity

CBC has been successful with developing, implementing, and sustaining instructional programs that contribute to the growth of the region by leveraging non-traditional resources such as grants, contracts, and donations through the CBC Foundation.

Some notable programs are an AAS and a BAS degrees in Project Management developed by the Department of Energy funded grant. Multiple Nuclear Regulatory Commission grants and support from the local nuclear industry led to the development of an AAS degree in NT. An AAS degree in Cyber Security program was launched with the support of the Battelle Memorial Institute Foundation, which led to the BAS degree in Cyber Security program in 2013. As of 2019-20, CBC offers seven applied bachelor's degrees as shown in Figure 7.

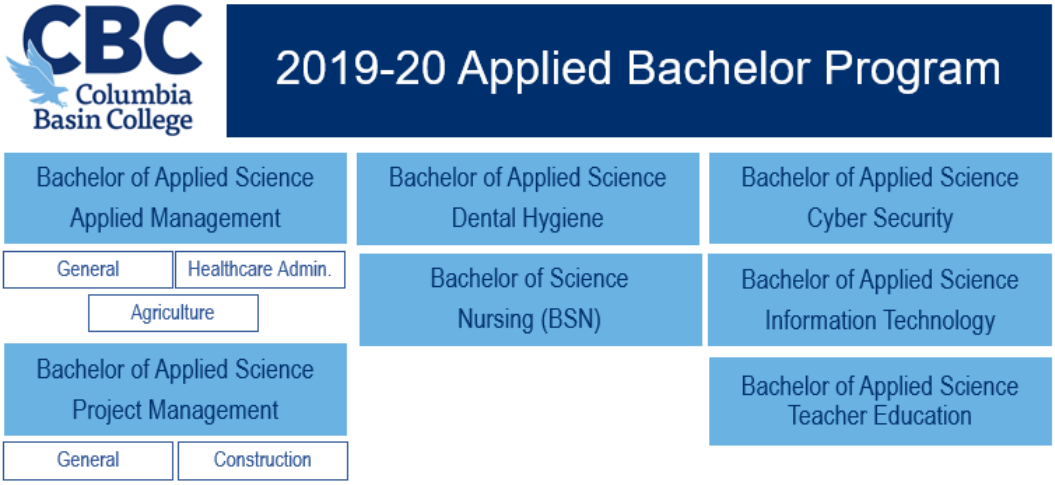


Figure 7. 2019-20 CBC Applied Baccalaureate Degree Program

Program Support Funds and Expenses Projections

The BASHP program will be funded as a state supported program for the projected enrollments (40% full-time and 60% part-time) shown in Table 13. The revenue projection is shown in Table 14 with 1% annual tuition increase and state support. The projected expenses include salaries and benefits for faculty. The upper level general education courses (i.e., PHIL 305) will be taught by the faculty outside the School of Professional Technical Education and those courses will be budgeted in the appropriate Schools.

The expense also includes a potential lab staff. CBC and Washington State University Tri-Cities (WSUTC) had discussions on possibility of co-employing a lab staff (i.e., sharing the staff hours for both campuses) after WSU Tri-Cities start its master's program in health physics, which will lower the cost of employing a lab staff after WSUTC implements its program. The existing staff at the School of Professional Technical Education including the CTE Director, two School of Professional Technical Education Completion Coaches, and the Interim Dean of School of Professional Technical Education will closely work on implementing the BASHP program and supporting the adjunct faculty.

Other expenses include lab equipment and material purchase, outreach and marketing, books and supplies, library materials, travel and professional development. The one-time expense for the NWCCU application, ABET accreditation, and the lab license fee is also budgeted. The indirect expense is estimated at 20% of the total projected expense to cover any unforeseen expense. All projected expenses are summarized in Table 15.

CBC will allocate funds from its current operating budgets to cover all start-up costs during the implementation and the first year to ensure that the BASHP program is built and operated professionally and efficiently.

Table 13. 5-Year Enrollment Projection

	2020-21	2021-22	2022-23	2023-24	2024-25
Full-Time Students (Headcount)	8	16	16	16	16
Part-Time Students (Headcount)	13	26	26	26	26
Total FTEs	20	40	40	40	40

Table 14. Revenue Projection (US$)

	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
	(19-20)	(20-21)	(21-22)	(22-23)	(23-24)	(24-25)
State Support	0	69,660	139,320	139,320	139,320	139,320
Tuition and Fee	0	144,581	289,162	292,053	294,974	297,923
Lab Fee	0	1,000	2,000	2,000	2,000	2,000
CBC Operating Budget	222,320	*If needed*	*If needed*	*If needed*	*If needed*	*If needed*
Total Revenue	222,320	215,241	430,482	433,373	436,294	439,243

Table 15. Expenditures Projection (US$)

	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
	(18-19)	(19-20)	(20-21)	(21-22)	(22-23)	(23-24)
PT Faculty (5) Salary	0	21,398	47,835	50,226	52,738	55,375
FT Faculty Salary	0	0	70,000	73,500	77,175	81,034
FT Faculty Benefits (33%)	0	0	23,100	24,255	25,468	26,741
Faculty Subtotal	0	21,398	140,935	147,981	155,381	163,150
Lab Establishment and Maintenance	113,267	10,000	10,000	10,000	10,000	10,000
Expendable Items	1,000	2,000	2,000	2,000	2,000	2,000
Radiation Material Licensed Staff (TBD)	50,000	50,000	50,000	50,000	50,000	50,000
Lab Operation Subtotal	164,267	62,000	62,000	62,000	62,000	62,000
Goods and Services	5,000	5,000	5,000	5,000	5,000	5,000
Travel/Professional Development	5,000	5,000	7,500	7,500	7,500	7,500
Marketing, Outreach and Recruitment	5,000	5,000	5,000	5,000	5,000	5,000
Books and Library	5,000	3,000	3,000	3,000	3,000	3,000
Operational Cost Subtotal	20,000	18,000	20,500	20,500	20,500	20,500
NWCCU Fee	1,000	0	0	0	0	0
ABET Accreditation	0	0	0	15,775	0	
One-time Expense Subtotal	1,000	0	0	15,775	0	0
Indirect Cost (20%)	37,053	20,280	44,687	49,251	47,576	49,130
Expenses Grand Total	222,320	121,678	268,122	295,507	285,457	294,780

Total Revenue	**222,320**	**215,241**	**430,482**	**433,373**	**436,294**	**439,243**
Total Expenses	**222,320**	**121,678**	**268,122**	**295,507**	**285,457**	**294,780**
Net	**$0**	**93,563**	**162,360**	**137,866**	**150,837**	**144,463**

Facilities, Technology, Instructional Resources, and Equipment

Facilities

The CBC NT program is housed in the Center for CTE building on the Pasco campus. The BASHP program will also be housed in the same building to ensure consistent support that CBC provides to the NT students. The BASHP classes will be offered in both Pasco and Richland campuses. Of 21 classrooms, labs, and computer labs at the CTE building on the Pasco campus, 6 classrooms, 1 computer lab, and 1 NT lab will be available for the BASHP program. Of 28 classrooms/lecture halls, labs, and computer labs at the School of Health Science on the Richland campus, 12 classrooms and 2 computer labs will be available for the BASHP program. CBC expect no consequences in classroom shortage. The capacity of the instructional spaces available for the program is shown in the Table 16.

Table 16. Instructional Spaces

Bldg./Rm.	Purpose	Cap.	Bldg./Rm.	Purpose	Cap.
CTE 119	Classroom	32	HSC 0249	Lecture Hall	94
CTE 120	Classroom	32	HSC 0306	Classroom	32
CTE 126	CTE Computer Lab	30	HSC 0308	Computer Lab	32
CTE 201	Enhanced Classroom	32	HSC 0326	Lecture Hall	52
CTE 205	Classroom	32	HSC 0329	Lecture Hall	56
CTE 207	Classroom	32	HSC 248A	Classroom	26
CTE 210	Classroom	32	HSC 248B	Classroom	26
HSC 0120	Classroom	13	RA 102	General Classroom	45
HSC 0135	Lecture Lab Combo	20	RA 106	General Classroom	27
HSC 0204	Classroom	53	RA 108	General Classroom	30
HSC 0242	Classroom	28	RA 110	Computer Lab	28

Technology and Instructional Resources

All CBC students have free access to the campus Wi-Fi network. In addition to 92 computers available at the available computer labs, there are 122 computers in the campus library open to all students during the library hours and 200 laptop computers with academic software for one-week checkout.

The modality of all coursework will be face to face with Canvas learning management system. In addition to the campus library, the CBC online library will allow BASHP students to access instructional resources.

Equipment

In coordination with the industry partners, CBC inspected the current NT lab equipment and materials. Table 17 shows the list of equipment and materials necessary for the RPT 404/405: Radiation Detection and Measurement with Lab course and how each item will be acquired to build an adequate lab for the BASHP program:

- "Available" indicates an item CBC already acquired for its current NT program and is available for the BASHP program;
- "DOE Donation" indicates an item the Department of Energy plans to donate; and

- Purchasing amount indicates an item in need of purchase (i.e., budgeted).

Table 17. Equipment and Material Preparation

Lab Equipment/Materials	Status
NIM bin	DOE Donation
Amplifier	Available
Counter/Timer	Available
Single Channel Analyzer	Available
Pulse Generator	$19,680
Power Supply	Available
Power cables	Available
BNC cables	Available
Gas proportional detector preamplifier	Available
Semiconductor charge sensitive preamplifier	Available
Multi-channel analyzer (mca)	Available
Digital oscilloscope	DOE Donation
2x2 in NaI(Tl) detector with photomultiplier tube/preamplifier	Available
ZnS alpha scintillators for alpha detection	Available
Alpha source	$19,225
Multinuclide source	$ 4,515
Plastic scintillators for beta contamination	DOE Donation
Beta reference set with split	$6,150
44-3 low energy gamma scintillator	$3,250
Gamma reference set	$6,060
Gamma reference 4 pi set	$6,060
2pi gas-flow proportional detector (P-10 gas)	DOE Donation
Geiger-Mueller counter with rate meter	DOE Donation
Aluminum and Lead attenuation kits	DOE Donation
Computer system with gamma spec software	$2,100
Neutron source Cf-252	$10,860
Ion Chamber instruments	Available /$5,895
Pressurized Ion Chamber instruments	Available /$7,722
Radioactive sources (Cs-137, Sr-90, Co-60)	DOE Donation
NaI well counter	$21,750
Ortec Spec Amp 672	DOE Donation
Ortec HVPS 456	DOE Donation
Ortec Dual Sum/Invert 433A	DOE Donation
Ortec Amp	DOE Donation
Ortec Bias Supply	DOE Donation
Canberra ADC 8-075, Amp 9615, AMX 8224, HVPS 9645, ADC 9633, SCA 2030, AIM 556, AIM 556A	DOE Donation
ND ADC ND579, ND552, ND578	DOE Donation
Total Cost for Equipment	$ 113,267

STANDARD 6. PROGRAM SPECIFIC ACCREDITATION

CBC plans to apply for the ABET accreditation after the first cohort graduates presumably in June of 2022. The BASHP program will be reviewed by the Applied and Natural Science Accreditation Commission, one of the ABET Commissions specific to the programs that leads to professional practice utilizing science, mathematics, and engineering concepts as a foundation for discipline-specific practice[9].

STANDARD 7. PATHWAY OPTIONS BEYOND BACCALAUREATE DEGREE

WSU Tri-Cities plans to develop a master's program in health physics which will provide our BASHP graduates opportunities to further their education. Our two institutions will continue to collaborate to serve the local employment needs by working on a potential articulation agreement for the BASHP to Master's program pathway.

STANDARD 8. EXTERNAL EXPERT EVALUATION

Reviewers

In compliance with the SBCTC standards, the proposed program was thoroughly reviewed by two external experts.

Dr. Thomas E. Johnson is the Professor and Health Physics Section Lead at the Department of Environmental and Radiological Health Science of Colorado State University. Over the last 30 years Dr. Johnson has performed extensive research and taught in diverse areas of radiation safety including environmental, uranium mining and non-ionizing. He has authored or co-authored over 38 peer reviewed papers, three textbooks, one reference book, over 40 proceedings publications, mentored over 40 graduate students, and is responsible for teaching 5 graduate classes. He has been the principal investigator for multiple research projects funded by the Department of Defense, Nuclear Regulatory Commission, DOE, Department of Agriculture, NIOSH, and other agencies. Currently, he is focused on examining the environmental impact of the Fukushima Dai-ichi reactor accident and coordinating student research in the area.

Mr. Jerry Kurtz is currently the Radiological Controls Manager for WRPS, overseeing a staff of nearly 400 and holds a BS in Technology from Excelsior College. Mr. Kurtz has 36 years of combined experience in operations and radiological control. Over the years, Mr. Kurtz has held positions in Navy reactor operations, DOE Radiological Control operations, Radiological control training, dosimetry, radiological instrumentation, and various management positions. Mr. Kurtz serves as the Unified Dose Assessment Center Dose Assessment Manager, Chairman of US DOE EFCOG Radiation Protection Task Group, Chairman of Hanford Site Radiological Control Forum, and member of the Health Physics Society Instrumentation section. Mr. Kurtz maintains Diplomat status with the American Academy of Health Physics, certified Associate Safety Professional through the Board of Certified Safety Professionals, and registration with the National Registry of Radiation Protection Technologists.

[9] The Accreditation Board of Engineering and Technology, Inc. (2019). *Program Eligibility Requirements.* https://www.abet.org/accreditation/what-is-accreditation/eligibility-requirements/

Review summary

Both reviewers agreed that the proposed program meets the academic standards and is relevant and appropriate to current employer demands, leading to job placement. They agreed that the program learning outcomes demonstrate baccalaureate level rigor through a sequence of upper level RPT courses. One reviewer specifically pointed out that the courses are relevant to all health physics employers and would make a firm foundation for application to graduate school.

The general education courses are also reviewed as rigorous and appropriate, especially with calculus requirements. Although both reviewers emphasized the high quality of the adjunct faculty pool, one of the reviewers recommended a full-time faculty for the program to become less dependent upon adjunct faculty. One full-time faculty position is budgeted for academic year 2021-22. One reviewer recommended to consider replacing one laboratory material with another – replacing Cf-252 with PuBe or similar neutron source. The reviewer also recommended to consider the purchase of a Liquid Scintillation Counter. This was communicated with the industry partner who has helped with the proposed laboratory lists and will be further examined at the upcoming meeting in January.

Overall, the reviewers provided positive feedback on the overall quality of the program curriculum and faculty and the CBC's investment in the development. One of the reviewers commented that the program will have no difficulty with ABET accreditation based on the quality presented in the proposal. They expect that the program will have meaningful contribution to the local workforce needs and the part-time student enrollment will exceed expectations.

The full review reports are provided in Appendix IV.

CONCLUSION

The proposed Bachelor of Applied Science in Health Physics degree program directly responds to evident need for additional health physicists in Hanford workforce. The potential CBC BASHP graduates are more likely to live in the community and stay in the Hanford workforce, once hired. CBC is prepared and experienced in offering not only seven BAS degrees but also nuclear technology certificate and degree programs for over 10 years. The addition of the BASHP program will allow students to reach another level of education in the field of nuclear technology and a greater opportunity for career advancement. Aligned with the mission of being "the educational home that transforms students' lives and strengthens the communities through meeting the educational needs", CBC with solid industrial partnerships is committed to provide full institutional support to the successful health physics program.

APPENDIX I. BASHP MAJOR COURSE DESCRIPTION

RPT 301 Radiation Physics I (5 Credits)

CATALOG DESCRIPTION

This course is intended to teach students the basic fundamentals of health physics beginning with a review of physical principles, atomic and nuclear structure, radiation sources, radioactive decay series and differential equations, and the physical theory of interaction of radiation with matter. Students will develop skills by learning how to use available resources such as BNL's National Nuclear Data Center and ORNL's Radiological Toolbox.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

Acceptance into the Nuclear Technology Health Physics BAS program.

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

Thomas E. Johnson, "Introduction to Health Physics", 2017, ISBN: 978-0-07-183527-5

GENERAL TEACHING METHODS

Lectures, demonstrations, discussions, assignments

COURSE LEARNING OUTCOMES (CBC SLO)

- Explain the physical principles of energy transfer (SLO 1, 2, 3)
- Demonstrate by calculation the application of particle mass and energy relationships involving relativistic effects (SLO 1, 2, 4)
- Illustrate elements of the atom, transformations and radioactive decay (SLO 1, 2, 3, 4)
- Derive the transformation mechanisms of radioactive decay (SLO 1, 2, 3, 4)
- Explain serial transformation for various sources of radioactivity (SLO 1, 2, 3)
- Demonstrate understanding of radiation interaction with matter (SLO 1, 2, 4)
- Demonstrate use and application of available resources, such as BNL's National Nuclear Data Center and ORNL's Radiological Toolbox (SLO 1, 2, 4)

RPT 302 Radiation Physics II (5 Credits)

CATALOG DESCRIPTION

This course is intended to teach students advanced fundamentals of health physics beginning with radiation exposure, dosimetric quantities, radiation biology, standards and guidance relating to radiation safety, radiation detector theory and measurement counting statistics. Students will develop skills by learning how to use available resources, such as BNL's National Nuclear Data Center and ORNL's Radiological Toolbox.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

RPT 301 or instructor permission

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

Thomas E. Johnson, “Introduction to Health Physics”, 2017, ISBN: 978-0-07-183527-5

GENERAL TEACHING METHODS

Lectures, demonstrations, discussions, assignments

COURSE LEARNING OUTCOMES (CBC SLO)

- Calculate radiation exposure in air and material with dosimetric units (SLO 1, 2, 3, 4)
- Illustrate the mechanisms and interactions with radiation on tissue (SLO 1, 2, 3)
- Interpret the requirements for radiation safety regulations (SLO 1, 2, 3)
- Describe the standards and guidance applicable to radiation safety (SLO 1, 2, 3)
- Explain radiation detector theory for gas-filled, scintillation and semiconductor detectors for alpha, beta, gamma and neutron interaction (SLO 1, 2, 3)
- Calculate instrument efficiency and detection capability (SLO 1, 2, 3, 4)
- Demonstrate use and application of available resources, such as BNL’s National Nuclear Data Center and ORNL’s Radiological Toolbox (SLO 1, 2, 4)

RPT 310 Nuclear Forensics (5 Credits)

CATALOG DESCRIPTION

This course explores the chemical, physical and nuclear aspects associated with nuclear material production and identification. Topics will include nuclear fuel cycle, analysis of recovered material, nuclear policy and nuclear forensic case histories.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

RPT 302 or instructor permission

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

Kenton J. Moody, “Nuclear Forensic Analysis”, 2005, ISBN: 978-0-8493-1513-8

EPA Publication, Guide for Development of Sample Collection Plans for Radiochemical Analytes in Environmental Matrices Following Homeland Security Events, EPA/600/R-08/128

GENERAL TEACHING METHODS

Lectures, discussions, assignments

COURSE LEARNING OUTCOMES (CBC SLO)

- Illustrate the principles of the nuclear fuel cycle (SLO 1, 2, 3)
- Describe common techniques used in sample collection, preparation, and analysis (non-destructive and destructive) (SLO 1, 2, 3)
- Describe the principles of quality control needing to be applied to sampling (SLO 1, 2, 3)

» Differentiate the nuclear forensic signatures expected within the global nuclear industry (e.g., nuclear power plant, medical isotope production facility, and illicit nuclear weapons production facility) (SLO 1, 2, 3)
» Discuss the relevance of U.S. law and international agreements put in place to reduce the risk of illicit trafficking and proliferation (treaties, export controls) (SLO 1, 3, 4)
» Evaluate case histories of illicit trafficking and proliferation (SLO 1, 2, 3)

RPT 311 Radiation Emergency Response (5 Credits)

CATALOG DESCRIPTION

This course is intended to teach students the national framework for responding to incidents involving radiological and nuclear materials and the role of historical impacts on shaping policy and accident analysis. A description of the National Contingency Plan and how it envelopes the EPA, investigative units, medical management of patients, response and recovery, societal issues, and factors affecting decision making.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

RPT 302 or instructor permission.

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

EPA National Contingency Plan and National Council on Radiation Protection Report Series.

GENERAL TEACHING METHODS

Lectures, discussions, assignments, class project

COURSE LEARNING OUTCOMES (CBC SLO)

» Discuss the key provisions of the National Contingency Plan (SLO 1, 2, 3)
» Illustrate state and local agency responsibilities for hazardous substance removal (SLO 1, 2, 3)
» Describe the Clean Water Act, Superfund legislation and NCP (SLO 1, 2, 3)
» Explain nuclear and radiological incidents and terrorist acts (SLO 1, 2, 3)
» Discuss national framework of emergency response with EPA, FEMA, FBI, DOE, DOE, State and Local authorities (SLO 1,2, 3)
» Illustrate the medical management of radiation casualties (SLO 1, 2, 3)
» Characterize the psychosocial effects of radiological/nuclear incidents (SLO 1, 2, 3)
» Describe the protection action guides (PAGs) and public communication (SLO 1, 2, 3)
» Illustrate the late-phase recovery objectives and key societal issues (SLO 1, 2, 3)
» Describe the training and qualifications for radiological disaster support (SLO 1, 2, 3)
» Demonstrate emergency response planning and use of critical resources (SLO 1, 2, 3)

RPT 312 Environmental Radioactivity (5 Credits)

CATALOG DESCRIPTION

This course is intended to teach students the sources of natural and technologically enhanced radioactivity in the environment. Basic environmental transport methods and software will be explored and applied to determine dose to a worker and a member of the public based on a composite of real-world situations, in a hypothetical setting, that have historically occurred in the health physics industry.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

RPT 302 or instructor permission.

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

Merril Eisenbud, Thomas Gesell, "Environmental Radioactivity from Natural, Industrial, and Military Sources", 1997, ISBN: 978-0-12-235154-9

GENERAL TEACHING METHODS

Lectures, discussions, assignments, class project

COURSE LEARNING OUTCOMES (CBC SLO)

- Describe atmospheric properties, deposition and resuspension (SLO 1, 2, 3)
- Explain the transport pathways and exposure to humans (SLO 1, 2, 3)
- Demonstrate the use of atmospheric modeling software for surface and groundwater transport (SLO 1, 2, 4)
- Evaluate differences in Norm and Tenorm (SLO 1,2, 3)
- Explain releases from light water reactors, reactor accidents and weapons testing (SLO 1, 2, 3)
- Discuss the history of radium and use of uranium and thorium in consumer products (SLO 1, 2, 3)
- Employ the air dispersion model and associated calculations (SLO 1, 2, 3)
- Illustate uses of other software applications, such as Hotspot, EPA Comply, AER Mod (SLO 1, 2, 4)

RPT 399 Health Physics Seminar I (1 Credit)

** RPT 499: Health Physics Seminar II (1 Credit) in similar modality.*

CATALOG DESCRIPTION

This course is intended to cover a broad spectrum of topics in contemporary health physics (e.g., state and federal regulations, waste disposal, emergency response, dosimetry, IAEA activities, nuclear nonproliferation, radiation oncology, etc.) delivered by field experts. Additionally, the students will increase their knowledge of employment opportunities and learn basic skills, such as resume writing and interview techniques.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

Acceptance into the BASHP program.

CREDITS AND HOURS

1 Credit (11 hours lecture)

TEXT(S) AND MATERIALS

None

GENERAL TEACHING METHODS

Lectures, demonstrations, discussions, assignments

COURSE LEARNING OUTCOMES (CBC SLO)

» Discuss contemporary issues in health physics on a variety of topics (SLO 1, 2, 3)
» Demonstrate awareness of employment opportunities within the field (SLO 4, 5)
» Employ communication skills in presentation and interviewing techniques (SLO 3, 4)

RPT 401 External Dosimetry (5 Credits)

CATALOG DESCRIPTION

This course is intended to teach students external radiation protection, point kernel techniques, shielding calculations including NCRP 147, and external dosimetry measurement techniques. Students will develop skills by learning how to use industry shielding software and available resources, such as ORNL's Radiological Toolbox.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

RPT 302 or instructor permission

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

Thomas E. Johnson, “Introduction to Health Physics”, 2017, ISBN: 978-0-07-183527-5

NCRP Report Number 147: Structural Shielding Design for Medical X-Ray Imaging Facilities; 2004.

MicroShield by Grove Software

GENERAL TEACHING METHODS

Lectures, demonstrations, discussions, assignments, presentations

COURSE LEARNING OUTCOMES (CBC SLO)

» Calculate radiation exposure in air and material from various source geometries using point kernel techniques (SLO 1, 2, 3, 4)
» Calculate gamma shielding requirements for various source configurations using industry software such as MicroShield (SLO 1, 2, 3, 4)
» Determine the proper materials for radiation shielding in a medical facility (SLO 1, 2, 3)

» Demonstrate use of commercial software, such as MicroShield (SLO 1, 2, 3, 4)
» Evaluate a complex shielding configuration (SLO 1, 2, 3, 4)
» Demonstrate application of available resources, such as BNL's National Nuclear Data Center and ORNL's Radiological Toolbox (SLO 1, 2, 4)

RPT 402 Internal Dosimetry (5 Credits)

CATALOG DESCRIPTION

This course is intended to teach students internal radiation protection based on international recommendations that include ICRP, NCRP and journal publications. Furthermore, the course will include discussion and applications of MIRD methods for calculating internal dose. Students will develop skills by learning how to use industry dosimetry software, such as IMBA and ORNL's Radiological Toolbox.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

RPT 302 or instructor permission

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

Thomas E. Johnson, "Introduction to Health Physics", 2017, ISBN: 978-0-07-183527-5

ICRP publications

RADAR publications

GENERAL TEACHING METHODS

Lectures, demonstrations, discussions, assignments, presentations

COURSE LEARNING OUTCOMES (CBC SLO)

» Assess the evolution of ICRP recommendations and major differences as it relates to internal dosimetry (SLO 1, 2, 3)
» Calculate internal radiation exposure for an inhalation intake using ICRP 2, ICRP 30, and ICRP 66 using first principles (SLO 1, 2, 3, 4)
» Derive DACs and ALIs based on permissible levels and appropriate dose coefficients (SLO 1, 2, 3, 4)
» Evaluate internal radiation safety methods that include engineering and administrative controls and respiratory protection (SLO 1, 2, 3)
» Calculate internal dose to patients from radiopharmaceutical administration using MIRD methods (SLO 1, 2, 3, 4)
» Demonstrate use of commercial software for calculating internal dose (SLO 1, 2, 3, 4)
» Analyze and present a case study of an individual internal contamination event (SLO 1, 2, 3, 4)

RPT 403 Radiation Biology (5 Credits)

CATALOG DESCRIPTION

This course is intended to teach students molecular mechanisms of radiation interaction, cell survival curves, cellular radiosensitivity, dose fractionation, acute radiation syndrome, medical countermeasures, radiation carcinogenesis, teratogenesis, and radiation protection. Students will develop skills by learning how to use applicable sections of the ORNL's Radiological Toolbox.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

RPT 302 or instructor permission

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

Eric J. Hall, "Radiobiology for the Radiologist", 2019, ISBN: 9781496335418

GENERAL TEACHING METHODS

Lectures, demonstrations, discussions, assignments, presentations

COURSE LEARNING OUTCOMES (CBC SLO)

- Describe molecular mechanisms of radiation interaction (SLO 1, 2, 3)
- Derive the cell survival curve and how it was generated (SLO 1, 2, 3)
- Explain the cellular mitosis cycle and stages of radiosensitivity (SLO 1, 2, 3)
- Determine the effects on the hematopoietic and gastro-intestinal system following a significant radiation exposure (SLO 1, 2, 3)
- Evaluate medical countermeasures and when they are used following a significant acute radiation event (SLO 1, 2, 3)
- Differentiate embryo stages of development and its radiosensitivity (SLO 1, 2, 3)
- Evaluate and present on one topic of radiation biology that illustrates contemporary understanding of the topic (SLO 1, 2, 3, 4)

RPT 404/405 Radiation Detection and Measurement with Lab (A total of 5 Credits)

CATALOG DESCRIPTION

This course is intended to teach students the basic physics principles and applications of radiation detecting instruments, with laboratory exercises. The course emphasizes techniques and instrumentation for nuclear radiation detection and measurements as they relate to health physics (radiation safety) and nuclear physics. Laboratory exercises implement classroom knowledge through experience with various counting systems.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

RPT 302 or instructor permission

CREDITS AND HOURS

5 Credits (44 hours lecture and 22 hours lab)

TEXT(S) AND MATERIALS

Glenn F. Knoll, “Radiation Detection and Measurement”, 2010, ISBN: 978-0-470-13148-0

Nicholas Tsoulfanidis and Sheldon Landsberger, “Measurement & Detection of Radiation”, 2015, ISBN: 978-1-4822-1549-6

GENERAL TEACHING METHODS

Lectures, demonstrations, discussions, laboratory exercises

COURSE LEARNING OUTCOMES (CBC SLO)

» Explain radioactivity, radiation interactions, and counting statistics (SLO 1, 2, 4)
» Describe the general properties of radiation detectors (SLO 1, 2, 3)
» Demonstrate pulse processing, shaping and pulse functions (SLO 1, 2, 3, 4)
» Explain and demonstrate the multichannel pulse analysis (SLO 1, 2, 4)
» Determine the proper materials for radiation shielding in a medical facility (SLO 1, 2, 3)
» Demonstrate use gas-filled detectors (SLO 1, 2, 3, 4)
» Demonstrate use of scintillation detectors (SLO 1, 2, 3, 4)
» Evaluate methods for radiation spectroscopy (SLO 1, 2, 3)
» Demonstrate use of semiconductor detectors (SLO 1, 2, 3, 4)
» Demonstrate use of neutron detectors (SLO 1, 2, 3, 4)

RPT 411 Medical Health Physics (5 Credits)

CATALOG DESCRIPTION

This course is intended to provide students an introduction to the field of Medical Health Physics. Topics in this course will include the diagnostic and therapeutic use of x-rays and nuclear medicine, radiation protection and regulation, radiation accidents, waste management and disposal.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

RPT 302 or instructor permission.

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

Michael G. Stabin, “Radiation Protection and Dosimetry: An Introduction to Health Physics”, 2007, ISBN: 978-0-387-49982-6

GENERAL TEACHING METHODS

Lectures, demonstrations, discussions, assignments

COURSE LEARNING OUTCOMES (CBC SLO)

» Evaluate the sources of radiation in the medical environment (SLO 1, 2, 4)
» Discuss the methods used in diagnostic x-rays (SLO 1, 2, 3)
» Examine the use of nuclear medicine in diagnostic x-rays (SLO 1, 2, 4)
» Explain the methods used in x-ray and gamma radiation for therapeutic use (SLO 1, 2, 3)

» Demonstrate radiation protection use in diagnostic and therapy applications (SLO 1, 2, 4)
» Evaluate radiation accidents in the medical industry (SLO 1, 2, 3)
» Describe waste management and disposal (SLO 1, 2, 4)

RPT 412 Nuclear and Regulatory Regulations Framework (5 Credits)

CATALOG DESCRIPTION

This course is intended to teach students the formation of the nuclear and regulatory environment in the United States and the role of Independent Domestic and International Consensus Standards.

PREREQUISITE OR BY PLACEMENT SCORE (AS APPROPRIATE)

Acceptance into the Nuclear Technology Health Physics BAS program.

CREDITS AND HOURS

5 Credits (55 hours lecture)

TEXT(S) AND MATERIALS

Thomas E. Johnson, "Introduction to Health Physics", 2017, ISBN: 978-0-07-183527-5

Relevant Statutes issued by Congress to the EPA

GENERAL TEACHING METHODS

Lectures, discussions, assignments

COURSE LEARNING OUTCOMES (CBC SLO)

» Describe the federal regulatory agencies and their role(s) (SLO 1, 2, 3)
» Summarize regulatory development and the Federal Register (SLO 1, 2, 3)
» Evaluate the differences between NRC and DOE regulations (SLO 1, 2, 3)
» Discuss the role of the ICRP, NCRP and National Academy of Sciences (SLO 1,2, 3)
» Compare the Federal Guidance Reports, ICRU, DOT and IATA (SLO 1, 2, 3)
» Discuss regulations for the environment (SLO 1, 2, 3)
» Appraise the licensing of Nuclear Power Plants and other NRC licensing (SLO 1, 2, 3)
» Discuss role of NRC and agreement states (SLO 1, 2, 3)
» Explain additional rules governing radiation waste (SLO 1, 2, 3)

APPENDIX II. SAMPLE ACADEMIC PLAN

ACADEMIC PLANNING WORKSHEET

Name: Full-time Student Date:

Degree or Certificate : BAS in Health Physics Estimated Completion Quarter/Year:

Quarter #1

FA - W - SP - SU Year: 2020

Course & Number	Credits
RPT 301/RadPhys I (K)	5
RPT 411/MedHP (M)	5
MATH& 151	5
Total Credits	15

Quarter #2

FA - W - SP - SU Year: 2021

Course & Number	Credits
RPT 302/RadPhys II (K)	5
RPT 310/NucForen (S)	5
MATH& 152	5
Total Credits	15

Quarter #3

FA - W - SP - SU Year: 2021

Course & Number	Credits
RPT 311/RadEmerg/Resp (D)	5
RPT 403/RadBio (B)	5
RPT 399/Seminar I (M)	1
Social/Behavioral Elec	5
Total Credits	16

Quarter #4

FA - W - SP - SU Year:

Course & Number	Credits
Total Credits	

Quarter #5

FA - W - SP - SU Year: 2021

Course & Number	Credits
RPT 401/ExtDose (B)	5
RPT 412/NucRegs (D)	5
PHIL 305	5
Total Credits	15

Quarter #6

FA - W - SP - SU Year: 2022

Course & Number	Credits
RPT 402/IntDose (M)	5
RPT 312/EnviroRad (D)	5
ENVS 310	5
Total Credits	15

Quarter #7

FA - W - SP - SU Year: 2022

Course & Number	Credits
RPT 404/RadDetect (M)	4
RPT 405/RadLab (M)	1
RPT 499/Seminar II (M)	1
Social/Behavioral Elec	5
Total Credits	11

Quarter #8

FA - W - SP - SU Year:

Course & Number	Credits
Total Credits	

Quarter #9

FA - W - SP - SU Year:

Course & Number	Credits
Total Credits	

Quarter #10

FA - W - SP - SU Year:

Course & Number	Credits
Total Credits	

Quarter #11

FA - W - SP - SU Year:

Course & Number	Credits
Total Credits	

Quarter #12

FA - W - SP - SU Year:

Course & Number	Credits
Total Credits	

ACADEMIC PLANNING WORKSHEET

Name: Part-time Student 1 Date:

Degree or Certificate : BAS in Health Physics Estimated Completion Quarter/Year:

Quarter #1

FA - W - SP - SU Year: 2020

Course & Number	Credits
RPT 301/RadPhys I (K)	5
MATH& 151	5
Total Credits	10

Quarter #2

FA - W - SP - SU Year: 2021

Course & Number	Credits
RPT 302/RadPhys II (K)	5
MATH& 152	5
Total Credits	10

Quarter #3

FA - W - SP - SU Year: 2021

Course & Number	Credits
RPT 311/RadEmerg/Resp (D)	5
RPT 403/RadBio (B)	5
RPT 399/Seminar I (M)	1
Total Credits	11

Quarter #4

FA - W - SP - SU Year: 2021

Course & Number	Credits
PHIL 305	5
Social/Behavioral Elec	5
Total Credits	10

Quarter #5

FA - W - SP - SU Year: 2021

Course & Number	Credits
RPT 401/ExtDose (B)	5
RPT 411/MedHP (M)	5
Total Credits	10

Quarter #6

FA - W - SP - SU Year: 2022

Course & Number	Credits
RPT 402/IntDose (M)	5
RPT 310/NucForen (S)	5
Total Credits	10

Quarter #7

FA - W - SP - SU Year: 2022

Course & Number	Credits
RPT 404/RadDetect (M)	4
RPT 405/RadLab (M)	1
RPT 499/Seminar II (M)	1
Total Credits	6

Quarter #8

FA - W - SP - SU Year: 2022

Course & Number	Credits
ENVS 310	5
Social/Behavioral Elec	5
Total Credits	10

Quarter #9

FA - W - SP - SU Year: 2022

Course & Number	Credits
RPT 412/NucRegs (D)	5
Total Credits	5

Quarter #10

FA - W - SP - SU Year: 2023

Course & Number	Credits
RPT 312/EnviroRad (D)	5
Total Credits	5

Quarter #11

FA - W - SP - SU Year:

Course & Number	Credits
Total Credits	

Quarter #12

FA - W - SP - SU Year:

Course & Number	Credits
Total Credits	

ACADEMIC PLANNING WORKSHEET

Name: Part-time Student 2 Date:

Degree or Certificate : BAS in Health Physics Estimated Completion Quarter/Year:

Quarter #1

FA - W - SP - SU Year: 2020

Course & Number	Credits
RPT 301/RadPhys I (K)	5
MATH& 151	5
Total Credits	10

Quarter #2

FA - W - SP - SU Year: 2021

Course & Number	Credits
RPT 302/RadPhys II (K)	5
MATH& 152	5
Total Credits	10

Quarter #3

FA - W - SP - SU Year: 2021

Course & Number	Credits
RPT 311/RadEmerg/Resp (D)	5
RPT 399/Seminar I (M)	1
Total Credits	6

Quarter #4

FA - W - SP - SU Year: 2021

Course & Number	Credits
PHIL 305	5
Social/Behavioral Elec	5
Total Credits	10

Quarter #5

FA - W - SP - SU Year: 2021

Course & Number	Credits
RPT 401/ExtDose (B)	5
Total Credits	5

Quarter #6

FA - W - SP - SU Year: 2022

Course & Number	Credits
RPT 402/IntDose (M)	5
Total Credits	5

Quarter #7

FA - W - SP - SU Year: 2022

Course & Number	Credits
RPT 404/RadDetect (M)	4
RPT 405/RadLab (M)	1
Total Credits	5

Quarter #8

FA - W - SP - SU Year: 2022

Course & Number	Credits
ENVS 310	5
Total Credits	5

Quarter #9

FA - W - SP - SU Year: 2022

Course & Number	Credits
RPT 411/MedHP (M)	5
Total Credits	5

Quarter #10

FA - W - SP - SU Year: 2023

Course & Number	Credits
RPT 310/NucForen (S)	5
Total Credits	5

Quarter #11

FA - W - SP - SU Year: 2023

Course & Number	Credits
RPT 403/RadBio (B)	5
RPT 499/Seminar II (M)	1
Total Credits	6

Quarter #12

FA - W - SP - SU Year: 2023

Course & Number	Credits
Social/Behavioral Elec	5
Total Credits	5

ACADEMIC PLANNING WORKSHEET

Name: Part-time Student 2 (continued) Date:

Degree or Certificate : BAS in Health Physics Estimated Completion Quarter/Year:

Quarter #13

FA - W - SP - SU Year: 2023

Course & Number	Credits
RPT 412/NucRegs (D)	5
Total Credits	5

Quarter #14

FA - W - SP - SU Year: 42021

Course & Number	Credits
RPT 312/EnviroRad (D)	5
Total Credits	5

APPENDIX III. LETTER OF SUPPORT

November 13, 2019
Subject: Industry Support Letter

To Whom It May Concern:

The Hanford site, which is managed by the Department of Energy, is supported by multiple contractors that employ Health Physicists for covering radiological work activities. Health Physicists make up the professional staff that develop and oversee program implementation at the Hanford site. Last year, the professional staff determined there was a lack of qualified applicants to fill the void left behind by the aging workforce. In addition, it was identified that employees in the field of radiological control had a significant desire in continuing education. Due to this demand, and the lack of a local institution offering a bachelor's degree in Health Physics, the need for a local program was identified.

Over the past year, several Hanford contractors have worked closely with Columbia Basin College in pursuit of establishing a bachelor's degree program in the local area. Columbia Basin College is an optimal choice since it currently offers a 1 year certificate and associates degree in the field of nuclear technology. Furthermore, Columbia Basin College has already established an educational pipeline in providing STEM education to the local community. A large portion of recent Associates Degree graduates expressed a desire to continue into a BAS program, illustrating the community desire for supporting the BAS program.

The BAS program was designed with rigor for the future possibility of ABET accreditation. We, as the Hanford industry professionals and future professors, are committed to ensuring the success of this program. We are encouraged by Columbia Basin College's proposal and are happy to support its development.

Sincerely,

Stephanie Doll, Ph.D.

David Hearnsberger, Ph.D.

Brett Rosenberg, Ph.D.

Michael Stabin

Michael Stabin, Ph.D.

Kevin Konzen, Ph.D.

APPENDIX IV. EXTERNAL EXPERTS REVIEW REPORTS

College Name:	Columbia Basin College	**BAS Degree Title:**	BAS in Health Physics
Reviewer Name/ Team Name:	Thomas Johnson	**Institutional or Professional Affiliation:**	Professor, Colorado State University
Professional License or Qualification, if any:	CHP, NRRPT, CLSO	**Relationship to Program, if any:**	None
Please evaluate the following Specific Elements			
a) Concept and overview	Is the overall concept of the degree program relevant and appropriate to current employer demands as well as to accepted academic standards? Will the program lead to job placement?		
	Comment: Yes, the program is relevant, and the use of adjunct faculty employed by firms that are actively seeking graduates will ensure the program is focused and relevant. Additionally, the faculty will probably be recruiting students directly from the program.		
b) Degree Learning Outcomes	Do the degree learning outcomes demonstrate appropriate baccalaureate degree rigor?		
	Comment: Yes, I am a bit concerned that only Physics for non-science majors is required. However, the calculus requirements are excellent. RPT 301 and 302 may be more difficult to teach without a more rigorous physics background. The outcomes match the ABET requirements and will ensure an excellent program.		
c) Curriculum Alignment	Does the curriculum align with the program's Statement of Needs Document?		
	Comment: Yes, it aligns with the needs of the employers as well as the ABET requirements.		
d) Academic Relevance and Rigor	Do the core and elective courses align with employer needs and demands? Are the upper level courses, in particular, relevant to industry? Do the upper level courses demonstrate standard academic rigor for baccalaureate degrees?		

	Comment: Yes, I was surprised and pleased to see the number and variety of classes offered. The classes are relevant to all health physics employers and would make a firm foundation for application to graduate school.
e) General Education Requirements	Are the general educations requirements suitable for a baccalaureate level program? Do the general education courses meet breadth and depth requirements?
	Comment: The public speaking class will be very helpful, as will the writing class. An additional technical writing class should be considered as either an elective or requirement. Most employers as well as graduate programs note that technical writing skills tend to be weak in undergraduate programs.
f) Preparation for Graduate Program Acceptance	Do the degree concept, learning outcomes and curriculum prepare graduates to enter and undertake suitable graduate degree programs?
	Comment: Yes, the program appears adequate to prepare students for graduate school. Consider adding a technical writing class.
g) Faculty	Do program faculty qualifications appear adequate to teach and continuously improve the curriculum?
	Comment: The faculty appear excellent, however, I am concerned about the workload on the adjunct faculty, especially Drs. Stabin (5 classes), Hearsenberger (3 classes), Rosenberg (2 classes) and Konzen (2 classes). All are very well qualified to teach the classes. My concern is that they are teaching a lot of classes in addition to their full time jobs. If their workload at their full time jobs increases, or they need to travel extensively, are there provisions in place to replace them or provide substitutes? The program relies very heavily on these adjunct faculty. Would there be a full time person that could be available to step in should one of the adjunct professors be unable to teach for a semester?
h) Resources	Does the college demonstrate adequate resources to sustain and advance the program, including those necessary to support student and library services as well as facilities?
	Comment: The resources and the equipment appear adequate to meet the needs of the program, but funding for sources may be low, as well as equipment. The program will be relying on the

	DOE for equipment donations, and sometimes donations do not materialize. Additionally, it is not clear that Washington has fully agreed to equipment sharing, and I am uncertain if there is a formal agreement in place. I would suggest that the Cf-252 source (which will require replacement every few years) be replaced with a PuBe or similar neutron source. While the Cf-252 is far superior for calibrations, a PuBe (or AmBe) source will not need to be replaced for the life of the program, and the licensing and controls are not as onerous. It was not clear if the lab could be permanently set up and dedicated to the classes. Moving and setting up radiation detection equipment can cause early failure, so a dedicated room is desirable. I did not notice a LSC, which is a key piece of equipment in almost all facilities. Please consider the purchase of an LSC. The long term budget should include saving a bit each year towards the replacement of all equipment, including the DOE donated equipment. With a plan in place, the equipment can be kept up to date. Software, especially, and the computers that support eh equipment, will need to be replaced on a regular basis (~5 years) and tend to be very expensive.
i) Membership and Advisory Committee	Has the program received approval from an Advisory Committee? Has the program responded appropriately to it Advisory Committee's recommendations?
	Comment: Appears to be a well-qualified group.
j) Overall assessment and recommendations	Please summarize your overall assessment of the program.
	Comment: Overall, I think the enrollment in the part time program will exceed expectations. The faculty is outstanding, but I am concerned about the faculty workload, and the long term equipment funding. I believe the program will have no difficulty with ABET accreditation.

College Name:	Columbia Basin College	**BAS Degree Title:**	Bachelor of Applied Science in Health Physics
Reviewer Name/ Team Name:	Jerry E. Kurtz Jr.	**Institutional or Professional Affiliation:**	Washington River Protection Solutions
Professional License or Qualification, if any:	Diplomate, American Academy of Health Physics, Associate Safety Professional, National Registry of Radiation Protection Technologists	**Relationship to Program, if any:**	Industry employer/sponsor
Please evaluate the following Specific Elements			
k) Concept and overview	Is the overall concept of the degree program relevant and appropriate to current employer demands as well as to accepted academic standards? Will the program lead to job placement?		
	Comment I employ almost 400 persons in this field. With the aging workforce, more and more are leaving the occupation. Efforts to recruit and hire yield little in results. If I do find someone, I spend upwards of $20,000 to move them here and they usually do not stay beyond their obligated time. The tri-cities does not offer the lifestyle that most young people, which move from outside the area, want. With a shortage in the entire industry, they can easily find employment elsewhere. Additionally, the work is not as glamorous as doing research, which many believe that is typical of the work. The few colleges that offer programs in this field are not located where the work is. So the students get a clearly academic view of the work. Locating a program in the area where the work is 1) Gives us a pool of students that are from the area and probably want to stay, 2) Gives me as a manager, a way to grow my current staff, 3) Gives the program access to highly qualified instructors that know the actual industry and not just the books.		

	The Hanford Site has work until at least 2064 if all goes well. It does not always go well. So, yes, it is relevant and appropriate to what I need. I need a pipeline to improve skills of my current staff, train new people in the field to meet my staffing needs, and is academically challenging to students.
l) Degree Learning Outcomes	Do the degree learning outcomes demonstrate appropriate baccalaureate degree rigor?
	Comment Yes they do. This program is based on the best industry standards for this work and current top programs. With that being said, is the CBC student population ready for this rigor? There were some discussions where some CBC facility were not sure the typical student could master these difficult standards. I agree, that the school systems are not really putting out graduates ready to pursue STEM job careers, even with all the hype around STEM.
m) Curriculum Alignment	Does the curriculum align with the program's Statement of Needs Document?
	Comment Yes it does.
n) Academic Relevance and Rigor	Do the core and elective courses align with employer needs and demands? Are the upper level courses, in particular, relevant to industry? Do the upper level courses demonstrate standard academic rigor for baccalaureate degrees?
	Comment Yes. They were carefully selected to be rigorous and applicable to the work.
o) General Education Requirements	Are the general educations requirements suitable for a baccalaureate level program? Do the general education courses meet breadth and depth requirements?
	Comment Yes. This is where the most work was put in. It required a re-thinking of relation of general to upper level courses to ensure student is prepared.

p) Preparation for Graduate Program Acceptance	Do the degree concept, learning outcomes and curriculum prepare graduates to enter and undertake suitable graduate degree programs?
	Comment Yes, They should to get access to any graduate degree program and do well if they master these outcomes. The difficulty is in the political infighting that happens between schools. But technically, they would be prepared.
q) Faculty	Do program faculty qualifications appear adequate to teach and continuously improve the curriculum?
	Comment This is where this program stands out. We have access to a vast array of highly qualified instructors across the spectra of the curriculum. You will not find this in most programs like this. Other programs are usually supported by one professor with grad students filling the gaps.
r) Resources	Does the college demonstrate adequate resources to sustain and advance the program, including those necessary to support student and library services as well as facilities?
	Comment Yes and no. Facilities, for the most part, are outstanding. My one concern is in the area of office hours for students. With the use of adjunct faculty, we run into the problem of being available for the student during off-class hours. The lab facilities need some work to set them up for optimal learning.
s) Membership and Advisory Committee	Has the program received approval from an Advisory Committee? Has the program responded appropriately to it Advisory Committee's recommendations?
	Comment Have no idea. But one comment on the advisory committee is that the proposed only contains those who are intimately involved in the program. Need to have member(s) from the actual employers. If you are intimately involved in a process, sometimes you cannot see what is right in front of you.
	Please summarize your overall assessment of the program.

t) Overall assessment and recommendations	**Comment** This will not only give me the tools to carry on work at Hanford for the foreseeable future but it will establish CBC as a preeminent school in this field. This program gives our area a real STEM choice, beyond, engineering. One that pays well, requires critical thinking, is interesting.