



Serving Safety Leaders: Cardinal Health’s Innovative Authorized User Program

Cardinal Health
 Best Certification Program
 October 2024



Company Background



Company-at-a-Glance	
Headquarters	Dublin, Ohio
Year Founded	1971
Revenue	\$205.0 billion for fiscal year 2023
Employees	Approximately 46,500
Global Scale	Headquartered in Columbus, Ohio, Cardinal Health has one of the largest dedicated distribution networks in the world with manufacturing, sales and/or distribution sites in 30 countries across the globe.
Customers/Output, etc.	Cardinal Health supports customers across the entire healthcare continuum. Cardinal Health is known as a leading healthcare logistics company. With healthcare changing, and the shift to value-based care, Cardinal Health understands the pressures their customers are facing to reduce the cost of care and drive patient outcomes. To best support customers, Cardinal Health has built on their foundation in meaningful ways well beyond logistics to include a broad range of product, business, and patient solutions.
Industry	Healthcare
Stock Symbol	CAH
Website	www.cardinalhealth.com



Budget and Timeframe

Budget and Timeframe	
Overall budget	\$0.00
Number of (HR, Learning, Talent) employees involved with the implementation?	3
Number of Operations or Subject Matter Expert employees involved with the implementation?	3
Number of contractors involved with implementation	0
Timeframe to implement	12 months
Start date of the program	9/26/2022

Business Conditions and Business Needs

Cardinal Health, headquartered in Dublin, Ohio, Cardinal Health, Inc. (NYSE: CAH), is a distributor of pharmaceuticals, a global manufacturer and distributor of medical and laboratory products, and a provider of performance and data solutions for healthcare facilities. The organization is a crucial link between the clinical and operational sides of healthcare, delivering end-to-end solutions and data-driven insights that advance healthcare and improve lives every day. Cardinal Health serves nearly 90% of U.S. hospitals, more than 60,000 pharmacies, and more than 10,000 specialty physician offices and clinics.

Cardinal Health’s Nuclear and Precision Health Solutions (NPHS) business unit produces radiopharmaceutical drugs which require personal protection from radiation exposure. The U.S. NRC (United States National Radiation Commission) regulates all employers who handle radioactive materials and requires that all pharmacies have a designated individual on each shift, who has completed special training on radiation safety and received an authorized user (AU) certification by completing a U.S. NRC approved AU Program. The organization complies with NRC requirements for Authorized User (Authorized Individual) and Authorized Nuclear Pharmacists (ANP). Defined by the Center for Disease Control and Prevention (CDC), nuclear medicine uses radioactive material inside the body to see how organs or tissue are functioning (for diagnosis) or to target and destroy damaged or diseased organs or tissue (for treatment). Images of the body show



where and how the tracer is absorbed. Although we all are exposed to ionizing radiation every day from the natural environment, added exposures like those from nuclear medicine procedures can slightly increase the risk of developing cancer later in life.

Cardinal Health currently has 163 sites that operate with radioactive materials. Within the Nuclear Pharmacy and Precision Health business, there are 30 PET manufacturing sites, 130 nuclear pharmacies, and 3 Theranostic Center of Excellence sites. PET sites employ, on average, 5-10 people per workday, while the nuclear pharmacies operate with an average of 10-50 people, depending on pharmacy size, for a workday. Additionally, Cardinal Health has a Center for Theranostics Advancement. The Center for Theranostic Advancement operates with an average of 20- 50 people.

Both the PET sites and the nuclear pharmacies are second and third shift operations. Staffing hours and risks associated with handling radioactive materials have contributed to a high rate of turnover. Turnover rates reached a pinnacle point at 18.9%, with the majority of turnover occurring within the first 3 years of employment. This put pressure on the business to staff an Authorized User at every site during operating hours. For example, if an Authorized User is needed to provide back-up at a PET site in Texas, the business may need to search nationally to find a stand-in Authorized User for seamless business operability.

Historically, PET Manufacturing employees completed an internally developed Authorized User program, which included a two-week virtual classroom session and coaching support. Learning and development partnered with the business to significantly redesign and implement the current PET Authorized User Program that met business needs and closed gaps. For example, the new design offers on-demand flexibility, minimized the need for Authorized User back-up coordination and travel, and increased completion rate.

Pharmacists employed in the NPHS nuclear pharmacies attended external Authorized User programs to become an Authorized Nuclear Pharmacist (ANP). The average cost for an external Authorized User program is upwards of \$5,000 per person (could be as high as \$10,000) and requires 200 hours of didactic and 500 hours of hands-on training completed over an average 6 weeks.

The entire nuclear medicine industry is shifting from only using radiopharmaceuticals for diagnosis to developing radiopharmaceuticals that can be used for diagnosis and complimentary radiopharmaceuticals used for therapy. Hot cells are critical equipment used in the production of radiopharmaceuticals.



Prior to installation, the Theranostic Center had to implement a customized version of the PET Authorized User Program. It was imperative that activities align with operations to ensure employees know how to work safely with specific radioactive materials used in their production. The Authorized User must understand requirements specific to those radioactive materials intended to keep the employees safe.

All businesses shared an AU Program goal to eliminate or reduce travel expenses, minimize overtime costs, and prevent workplace burnout. Most critical, an operational delay could impact the patient due to receive a potentially life-saving radiopharmaceutical drug. PET, Pharmacy, and Theranostics AU Programs achieve those shared goals, enable uninterrupted operation, and provide participants with the competence and resources necessary to keep employees safe.

For the program design to be effective, the business decided to implement a formal coaching program. Historically, the Health Physics team supported the Authorized Users with learning and resources.

The program lacked defined expectations, standards, resources, and tools for preceptor support. Each site delivered classroom content and exams in their preferred order and style creating an inconsistent experience. The certification rate was 62% for PET participants.

NPHS Leadership requested an analysis to close the gap. To achieve a higher certification rate, the focus became program structure with on-demand flexibility, increased program effectiveness, and standardization for participants and preceptors to share the same experience and expectations.

Authorized Nuclear Pharmacists (ANP) required the same didactic and hands-on training hours and achieved this in an external program. There are 130 sites that require an Authorized User on site to operate or manufacture when radiation is present. It was determined that the ANP AU program needed to be designed and developed for internal delivery. To meet regulatory requirements, it required additional time, energy, and money. Examples of such are scheduling, travel and expenses, registration fees, time away from work, and learning in a non-Cardinal Health environment.



Overview

The Authorized User (AU) is responsible for the radiation safety of all employees at both PET Manufacturing and Nuclear Pharmacy sites. The site cannot operate without at least one certified Authorized User on site.

Per the NRC, a person named as an Authorized User on an NRC license is responsible for ensuring that radioactive materials are handled and used safely and in accordance with NRC regulations and the terms and conditions of the NRC license. (10 CFR 35) To certify as an Authorized User (AU), an employee must complete 200 hours of didactic and 500 hours of hands-on training. This is known as the AU Program or Authorized User Program at Cardinal Health.

The Cardinal Health Learning team partnered with NPHS Health Physics and PET subject-matter experts to revamp the existing PET AU Program. The hybrid certification program structure includes a foundational elearning course, digital activity guides for practice and discussion with a preceptor, digital assessment, and qualification for each topic. The program is On-Demand beginning with an automated registration process. Assessment retakes are controlled to ensure remediation discussions occur between preceptor and participant. The PET AU Program launched in September 2022 and has since achieved the flexibility and pass rate meeting business expectations.

Building on PET Manufacturing's success, a new internal Cardinal Health Pharmacy AU Program launched in August 2023. Following the same structure, the Pharmacy AU Program included radiopharmaceuticals, radiochemistry, and radiopharmaceutical application. In addition to Participant Guides, separate Preceptor Guides were developed as an improvement opportunity. With the internal program in full momentum, the Pharmacy AU Program has achieved a direct cost savings in the amount of \$6,300 plus travel per person, received positive feedback, and met business expectations. While the Pharmacy program is required for Authorized Nuclear Pharmacists (ANP), it also serves as a voluntary, comprehensive professional development program for Nuclear Pharmacy Technicians which historically was cost-prohibited.



Design of the Program

While 200 hours of didactic training and 500 hours of hands-on training are required, the regulation does not prescribe program design, including structure and delivery. The NRC prescribes required topics, but internally, Cardinal Health was able to customize the learning materials for relevancy to the NPHS Authorized User role and stay in compliance with regulations. This resulted in a more impactful, relevant, and retainable learning experience.

At the time of redesign, the didactic portion of the PET AU program consisted of over 50 individual modules along with three comprehensive paper-based exams. With 500 hours of hands-on training required, there was a disconnect between the didactic portion of the training and application to the participant's role.

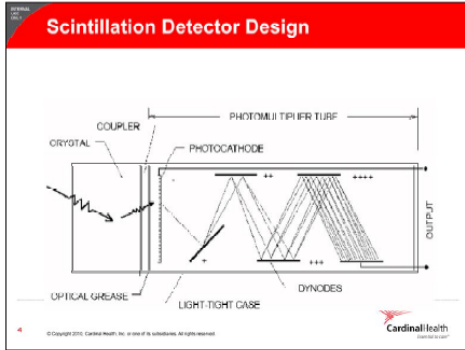
The redesign strategy included converting long modules and courses into smaller sections by topic. The curriculum was divided into seven sections which contained a total of 30 topics. Each topic was laser focused on the what, the why, and the how, ensuring that the connection was made between the lesson and its applicability in day-to-day practice.

Sections included a foundational elearning course, hands-on activity, a brief topic assessment, and qualification. Targets included improving learning retention for theory and strengthening practical content application of radiation safety at the respective site.

Foundational elearning modules were designed to provide knowledge by topic and prepare for the Preceptor-supported Participant Activity using a coinciding Participant Activity Guide.



Previous Content



The squiggly arrow on the left side of the diagram represents an incoming photon. It interacts with the NaI scintillator crystal in the probe, which excites an atom in the crystal. The atom almost immediately de-excites, resulting in the emission of a short burst of light. The walls of the area around the crystal (except at the coupler) are mirrored so that they reflect the light towards the coupler. The coupler is a lens which directs the light towards the photocathode. Optical grease is used to as an interface between the crystal and the coupler.

At the photocathode, the light is of a specific wavelength so that the photoelectric effect causes the release of an electron from the photocathode. The first dynode is positively charged, and each successive dynode is more positively charged than the previous so that incoming electrons have more energy (remember from Module 1 the stronger the charge difference, the more force is exerted between charges, so the faster the electrons move). The first electron hits the first dynode, releasing a cascade of electrons, and each of these release a cascade upon hitting each successive dynode. At the output, there is a total multiplication of electrons of about 10^6 (the total can vary from detector to detector). With this many electrons, the electronics at the output reads the electrons as current as they move along wires to "replenish" electrons at each of the dynodes.

Again, the entire process is housed in a light tight casing to ensure extraneous light does not enter the photomultiplier tube.

New content

Scintillation detectors

Menu

Scintillation detector

The scintillation detector consists of two parts:

Scintillation material Photomultiplier tube

3 of 12

◀ PREV NEXT ▶

Scintillation detectors

Menu

What is scintillation?

Scintillation is a flash of light produced in a transparent material by the passage of a particle of radiation.

4 of 12

◀ PREV NEXT ▶

Scintillation detectors

Menu

Characteristics of scintillation materials

Although there are no materials that meet all criteria below, the perfect scintillator material would have the following characteristics:

- Convert gamma photon energy of radiation to light with high efficiency
- Short reset time
- Light output proportional to energy deposited
- Easy to manufacture in all shapes and sizes
- Transparent to wavelength of own emission
- Index of refraction for good coupling to photomultiplier tube

5 of 12

◀ PREV NEXT ▶



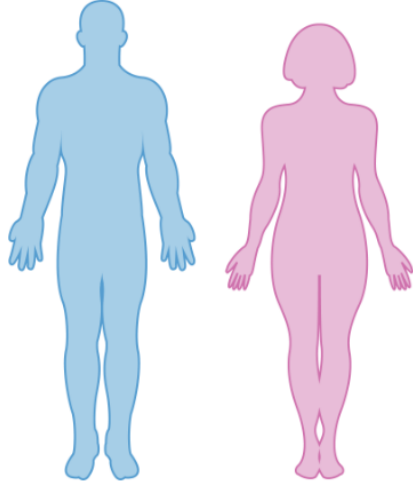
Radiation Biology Review: Study groups and low dose studies

Menu Exit

What does this mean in PET?

Even though radiation is all around us and the low dose studies show outcomes of very low probabilities of risk, it is still crucial to be vigilant around radiation.

Remember, radiation safety at your site is a top priority.

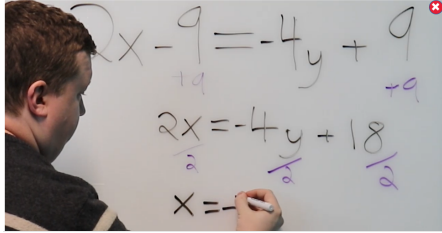


Example of elearning content from Radiation Biology Review: Study groups and low dose studies. “What does this mean in PET?” slides were used consistently throughout modules to focus the content through the lens of the future AU’s role.



For example, the program requires a demonstration of math involving the concepts of radiation-based physics such as half-life and decay. In the previous format, learners were asked to solve these complex equations without foundational learning and a strong background in math or physics. In addition, the program lacked connectivity between math and the AU role, thus it resulted in a high rate of program failure.


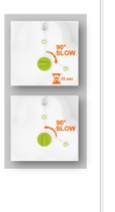
To address obstacles, supporting resources were designed to create a stronger connection between math, the AU role, and radiation safety. For example, high-level math-based concepts are introduced in a foundational elearning module. Each equation was aligned to a video demonstrating how to solve the math problem and connects math with application and safety.



Math Module Elearning Course	Health Physics Supporting Video
<p>Math Review</p> <p>Logarithms</p> <p>How does this apply to my site? This math applies to shielding and half-life.</p> <p>A logarithm is the inverse function to exponentiation.</p> <p>That means the logarithm of a given number x is the exponent to which another fixed number, the base b, must be raised, to produce that number x.</p> <p>Here is an example:</p> <p>$2^3 = 8$</p> <p>3 is the logarithm of 8 to base 2, or $3 = \log_2(8)$.</p> <p>Typically $\log(x)$ with no base notation signifies a base of 10. Another very common logarithm is $\ln(x)$, which is a logarithm with a base of e. The number e (2.71828) will be seen later as it is extremely important when calculating how radioactive materials decay.</p> <p>View Video Example</p>	<p>Math Review</p> 

Upon completion of the short elearning course, participants complete an in-person activity with the preceptor where the concepts are reinforced through practice. Participant Guides were designed with multiple activities per topic. Examples are preceptor-observed activities, participant practice, and participant-preceptor discussion.

<p>Authorized User Program Ge-68/Ga-68 Generator Participant Activity Guide</p> 	<p>Activity</p> <p>A Ge-68/Ga-68 generator enables convenient on-site production of Ga-68 via extraction.</p> <p>Let's get started.</p> <p>Discuss the following with your preceptor or pharmacy manager:</p> <p>Discuss</p> <ul style="list-style-type: none"> • Patient safety <ul style="list-style-type: none"> ◦ What is the most significant radioactive derived risk when receiving Ga-68 radiopharmaceuticals? ◦ What is the action limit and frequency of this test? ◦ Why does this test take so long to perform? • Compare and contrast Ge-68/Ga-68 radionuclide generators with Mo-99/Tc-99m generators. <ul style="list-style-type: none"> ◦ Comparisons ◦ Contrasts • What steps must be taken prior to an initial elution or an elution following an extended in-growth period (time between elutions)? <p>• Complete the following table:</p> <table border="1"> <thead> <tr> <th>Radionuclide</th> <th>Ge-68</th> <th>Ga-68</th> </tr> </thead> <tbody> <tr> <td>Half-life</td> <td></td> <td></td> </tr> <tr> <td>Emission (type)</td> <td></td> <td></td> </tr> <tr> <td>Emission (energy)</td> <td></td> <td></td> </tr> <tr> <td>Decay Product</td> <td></td> <td></td> </tr> <tr> <td>Source Isotope</td> <td></td> <td></td> </tr> </tbody> </table>	Radionuclide	Ge-68	Ga-68	Half-life			Emission (type)			Emission (energy)			Decay Product			Source Isotope			<p>Observe/Perform</p> <ul style="list-style-type: none"> ◦ It is important to observe, practice and be familiar with eluting the Ge-68/Ga-68 generator, if a generator is not used at your facility, you may visit a facility with one to observe or perform this activity virtually (i.e., verbally with your preceptor). <p>Activity: Elution Procedure</p> <ul style="list-style-type: none"> ◦ Observe another individual perform an elution. ◦ Perform an elution procedure following trainer's instructions. ◦ Demonstrate proficiency by eluting the generator with trainer's observation. <p>Elution Summary</p> <p>Connect a sterile needle to the other end of the tubing using a male-to-male Luer lock adapter. Avoid hard bending or pinching of the line.</p> <p>Turn the green button by 90° to the loading position and wait for at least 30 seconds.</p> <p>Then, turn back the button by 90° to its initial position.</p> <p>Remove the cap from the needle and quickly pierce vertically right in the center of the septum of a shielded sterile evacuated vial.</p> <p>Wait for at least 3 minutes for the elution process to take place (a fixed volume of 1.1 mL is eluted) and for the line to be drained by air.</p> <p>Measure eluted activity with a calibrated dose calibrator to determine the yield.</p> <p>Remove the needle from the vial and replace the cap.</p> 
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To complete a topic, participants must achieve 80% or higher score and move on to the next topic. This format repeats until the program is completed. Preceptor standards were also established as part of the PET AU Program redesign and improvement project.

With a successful PET AU Program, a decision was made to replace the need for external Pharmacy AU Program offerings with a similar learning design including brief foundational elearning courses, Participant Guide practice activities, and short assessments. Pharmacists have six additional topics but share the exact program elements as the PET AU Program. An opportunity for improvement, Preceptor Activity Guides were developed to provide answers and guidance for those precepting with participants. Authored by the Health Physics team, the guides provide effective preceptor resource support while ensuring certification standardization and consistency across all sites.

Delivery of the Program

The communication strategy and plan proved essential to the program's success given the national rollout. It was important to give this program a large platform for pre-launch. NPHS hosts an annual National Field Meeting at the start of each fiscal year. All people leaders attend from PET Manufacturing, Pharmacy, and Sales. Although different years, both programs were launched during this multi-day function.

People leaders had an opportunity to have their questions addressed before the participants joined the program. Upon sharing an overview, participant and preceptor roles and expectations were shared and people leaders made a commitment to maintaining the integrity of the program.

NPHS Authorized User Programs were designed for availability on-demand. Along with the AU curriculum, performance support portals were created utilizing SharePoint to provide supporting training materials and on the job performance support customized to each business. For example, Authorized Nuclear Pharmacist participants have additional learning requirements thus requiring differentiation in materials and support resources.



The AU programs rely on the use of performance support to help preceptors and participants. Here is a snapshot of the Pharmacy AU/ANP Program portal home page.

Pharmacy AU/ANP Program

Program Overview

Who is the Pharmacy AU/ANP Program intended for?
 The Pharmacy AU/ANP Program is designed to provide a pathway to obtain the required 200 didactic hours to become a pharmacy authorized user.

Why is the AU/ANP role important?
 Regulatory agencies require an Authorized User (AU) to be on site during operating hours. The AU is responsible for the radiation safety of the employees at the pharmacy. Becoming an AU is a great way to promote career growth and development.

What does the program consist of?
 The Pharmacy AU/ANP Program is housed in mySpark and consists of seven key sections. Each section contains short, focused eLearning modules, activities and assessments. The participant will work independently on the modules. The preceptor and/or site staff should assist with the activities to reinforce the content and provide practice opportunities. Once familiar with the content in the module and the activity, the participant is required to take a short assessment. Each assessment requires a minimum passing score of 80%. If the assessment is not successfully completed after two attempts, the participant must work with their preceptor to arrange additional retakes.

[View Program Information and Structure](#)

How long does it take to complete the program?
 The program is designed to move at a pace that meets both the needs of the participant and the demands of the facility. It is recommended that the participant finish within 6 months of their program start date. Participants must be enrolled in the course for a minimum of 6 weeks.

Didactic Training: 230 hours equivalent to ~6 weeks

How do I register for the program?
 First, talk to your preceptor and/or site supervisor on your individual completion goals. When ready, click the button below and complete the form to register.

[Register Here](#)

Supplements and Resources
 Use the resources below as support.
 Be sure to download the [Exam Equation Sheet](#). It contains valuable reference material that you will be able to use while taking the exams.

ANP AU Program Resources See all

Name	Modified	Modified By
Math Review Videos and Materi...	July 17, 2023	Whitton, Stephanie
Enrollment Information	July 17, 2023	Whitton, Stephanie

Preceptor Overview

What is the role of the Preceptor?
 The preceptor is to support learning, answer questions, and aid in the development of the participant. It is important to be a mentor for the duration of the program and beyond.

Preceptors must be aware of where the participant is in the program and be prepared to support them through activities, exercises, and practice problems.

Preceptors:
 Each activity is available in the Preceptor Resources section. It is recommended that you familiarize yourself with the role that you will play in each activity and be prepared to support your participant in their success.

[Preceptor Resources](#)

NRC.gov
 www.nrc.gov
 Nuclear Regulatory Commission

Both participants and preceptors have on-demand access to the program overview and structure, its purpose, requirements to certify, expectations, and supporting resources. There is also a performance support page dedicated for preceptors to fully understand their responsibilities and expectations while having quick access to Preceptor Activity Guides and automated forms. Forms include the AU program application and exam reset request.



Here is a snapshot of the Pharmacy AU/ANP Program portal resources page for preceptors.

Pharmacy AU/ANP Program Preceptor Resources

Your role as a preceptor

Success of the Pharmacy AU/ANP Program requires cooperation and commitment of all invested parties – the Learner, Preceptor, Pharmacy Staff and Leadership, and Q&R.

As Preceptor, you provide the front-line support for success of the Learner and the overall AU program. Q&R serves in a capacity to provide air support, but you are on the ground as the first line support for the Learner.

Be receptive of the Learner's needs or struggles during the course. Be their advocate to ensure they are positioned for success. If Preceptors suspect shortfalls that might prevent Learners from successfully completing the course, work with the pharmacy manager and RSO to make reasonable adjustments and accommodations as needed. Also, please contact Q&R for guidance if those efforts still fall short.

The Preceptor must maintain communication with Learner and their supervisor throughout the duration of the AU training.

Key areas of focus for Preceptors

- Familiarize yourself with the [Pharmacy AU/ANP Portal](#)
- Pharmacy AU/ANP Program > [Pharmacy AU/ANP Program Preceptor Activity Guides](#)
- Coordinate with pharmacy scheduler a tentative work schedule for both you and Learner that facilitates successful AU training.
- Connect with the AU Learner BEFORE commencing the course
- Keep Q&R-Health Physics contact information readily available for future reference
- Upon participant completion of the program, reach out to Q&R for AU certificate information.

Safety and the AU Role

We are all responsible for radiation safety in the workplace. The role of AU is a critical part of that which is why we must ensure they are properly trained and competent in the handling and decision-making for safe use of RAM for their own safety, those working around them, and the general public.

AU training covers 200 hours of didactic education for the Learner. Plan on accommodating the Learner for the duration of the training.

Although the training is self-paced, don't expect it to take just 1 – 2 weeks. It may take 6 weeks or more.

Who can be a Preceptor?

Foremost, the preceptor must be onsite at the AU Learner's location. AU Learners need an active, involved, and responsive preceptor to facilitate their AU education.

Preceptor prerequisites:

- Pharmacy AU/ANP
- Familiar with all aspects of pharmacy operations, including cyclotron operation
- Availability throughout the Learner's AU training
- Preferably have some previous training experience

Preceptor Resources

[Activity Resources](#) [Exam Resources](#) [Scheduling Resources](#)

[Request an Exam Retake](#)

After a preceptor registers a participant, an automated confirmation email includes the link to the first overview elearning course. Upon activation, the remaining curriculum features automatic assignment.

For each section, participants access the learning management system to complete a foundational elearning course and work with an assigned preceptor to complete Participant Activity Guide learning activities. To ensure consistency and accuracy, preceptors refer to a Preceptor Activity Guide version that includes answer keys. This guide is also used should remediation be necessary. Remediation discussions occur once participants have exceeded two assessment attempts.



The preceptor submits this form to the Learning team which allows for two more assessment attempts. This new automated process resets assessments within 24 hours, a significant reduction in cycle time that took 2-3 weeks for paper-based assessments.

Upon AU Program completion, the Health Physics team receives notification that a participant has fulfilled all learning requirements with passing scores. The Health Physics team receives an automated bi-weekly PET AU and Pharmacy AU/ANP Program training completion report from the Learning Management System. Completion represents 200 didactic hours as required by the NRC. Upon receipt, Health Physics validates that participants have completed all training requirements. The certified Authorized User must be added to a RAM (Radioactive Materials) license.

Radioisotope forms are necessary to add an AU to the RAM license. To achieve official Authorized User status, the Health Physics team completes and submits a form.

Upon confirmation that the NRC added the Authorized User to the Cardinal Health RAM license, the Health Physics sends the site the official RAM license for display in the facilities. Additionally, the Health Physics team notifies the participant that they can now perform the role, responsibilities, and duties of a certified, licensed Authorized User.



Measurable Benefits

The U.S. NRC (United States National Radiation Commission) regulates all employers who handle radioactive materials and requires that operating sites have a designated individual on each shift, who has completed special training on radiation safety and received an authorized user (AU) certification by completing a U.S. authorized user program. The Authorized User (AU) is responsible for the radiation safety of all employees.

PET manufacturing, pharmacies, and the Theranostic Centers cannot operate without at least one certified Authorized User on site due to operational handling of radioactive materials. It is critical to ensure an Authorized User is always available during operating hours. Should the designated Authorized User be away from site, another certified Authorized User from another location must provide onsite coverage. Thus, the importance of a 100% certification rate is paramount, ensuring staffing capabilities for uninterrupted operations. There were several reasons that motivated the business to redesign and automate the PET AU Program and launch the new Pharmacy AU Program. The key drivers were to achieve anticipated cost savings, provide an opportunity to offer a customized, on-demand program meeting NRC regulations, and to meet Cardinal Health operational staffing needs.

Cardinal Health's NPHS business ROI and impact includes radiation safety for all employees, number of staffed certified Authorized Users, indirect cost savings such as time and cost avoidance, direct cost savings, and zero regulation infractions.

Looking back to the previous program, the PET manufacturing sites saw a slight increase in participation, with 44 AU Program participants in 2020 and 46 participants in 2021. The average completion rate missed the 100% certification target with a 38% average program completion rate. Seventy-six customized assessments took an average of one hour per exam and the program required three exams overall. The Health Physics team spent an average of one hour manually grading each exam. For example, there were 46 participants in the 2021 program. Therefore, Health Physics spent 138 hours, almost a month, over 3.5 work weeks to manually grade exams.

With the conversion of paper to digital assessments, the new PET AU Program automatically randomizes and grades the 30 shorter assessments. Although the number of assessments increased, due to automated grading, it resulted in a time savings of 138 manual grading hours.



Since the inception of the new program in September 2022, 76 PET participants certified as a PET Authorized Users at 100% completion rate within 6-week average completion time. A PET AU Program participant survey indicated that 100% of participants believed the content was relevant to their role as an Authorized User. Additionally, 100% agreed or strongly agreed that program enrollment was easy, and the program was easy to navigate using the PET AU Portal's supporting tools and resources. The survey also indicated that 91% believed activities within the Participant Activity Guides served as a connection between foundational training and application in the Authorized User role providing closure to the content-application disconnection gap. As of March 2024, the business realized a \$402,800 cost avoidance.

With the internal program in full momentum, the Pharmacy AU Program has achieved a direct cost savings in the amount of \$6,600 plus travel per person, received positive feedback, and met business expectations. As of March 2024, the business realized a direct savings of \$105,600.

While the Pharmacy program is required for Authorized Nuclear Pharmacists (ANP), it also serves as a voluntary, comprehensive professional development program for Nuclear Pharmacy Technicians which historically was cost prohibitive. As of March 2024, based on \$5,300 per certification, the business realized \$127,200 in value/cost avoidance for the nuclear technicians completing the program. To date, there are 99 enrolled, 16 AU certified pharmacists, and 24 AU certified Nuclear Pharmacy Technicians.

With certified Authorized Users available at all sites, there have been zero interruptions in operability and drug delivery. In addition to PET and Pharmacy, Cardinal Health's Theranostic Center of Excellence focuses on diagnostic and therapeutic health solutions. In June 2023, Theranostics launched Pharmacy's AU Program for their Authorized Users to also certify internally. As of March 2024, Theranostics had 24 Participants enrolled with 14 certifications resulting in a \$92,400 cost savings for the business.



Return on Investment (ROI) Table (as of January 2024)

Cardinal Health Authorized User Program		NPHS Business ROI		
Program Launch	Business	#Certified Authorized Users	Cost Avoidance (value)	Direct Cost Savings
September 2022	PET Manufacturing PET Techs (\$5,300 tuition per person)	76	\$402,800	
August 2023	Pharmacy Pharmacists (\$6,600 tuition per person)	16		\$105,600
	Nuclear Pharmacy Techs (\$5,300 tuition per person)	24	\$127,200	
May 2023	Theranostics Pharmacists (\$6,600 tuition per person)	14		\$92,400
TOTAL		130	\$530,000	\$198,000

As of March 2024, the Cardinal Health Nuclear Health and Precision Solutions business realized a direct program cost savings of **\$198,000** for all three programs and savings in cost avoidance(value) of **\$530,000**. Due to NRC regulatory requirements, the Cardinal Health Authorized User programs continue and are projected to have significant savings over the years ahead.



Overall

As of March 2024, Cardinal Health's on-demand, redesigned PET AU Program and brand-new Pharmacy AU Program have graduated 130 certified Authorized Users whose primary responsibility is ensuring 163 sites safely operate with radioactive materials. Cardinal Health NPHS sites include 30 PET manufacturing sites, 130 nuclear pharmacies and 3 Theranostics centers.

Amongst key lessons learned, PET AU completion rates significantly increased, achieving 100% completion rate, with the new design of a short elearning course for foundational knowledge, preceptor-supported Participant Activity Guides, and brief assessments relevant to the specific subject. In addition, by implementing a new PET AU Portal, preceptors and participants have on-demand access to program information, application, exam reset request form, and preceptors have a segment dedicated to their role.

The new Pharmacy AU Program mirrored the PET AU Program with additions. Additional topics were added relevant to pharmacists. Adopting the Participant Activity Guide template, this project led to an improvement for both AU Programs. Preceptors must be AU certified to precept and support participants. To solve, Preceptor Activity Guides were designed like the Participant Guides and with standardized answer keys with guidance and/or specific answers.

Successfully launched as part of the Pharmacy AU Program, Preceptor Activity Guides were developed for preceptors. Preceptors responded positively to this resource and ensured all participants consistently received accurate knowledge, key discussion points, and feedback from observations. A Cardinal Health Senior Vice President commented that the redesigned engaging AU program puts math in perspective, therefore bringing role realization that radiation safety is the Authorized User's focus.

Another key lesson learned was the importance of meaningful activities that are customizable to the assigned site. In conducting a recent exam reset analysis for both PET and Pharmacy, we were able to quickly determine which assessments needed a review for potential improvements to the assessment or learning objects, and/or if additional supporting resources were needed. Shielding was a primary example. Upon review, it was improved by redesigning the math statements and formulas, organizing in a way that someone with little math background could successfully complete the problem.



The future plans for AU program review and improvements include continued partnership with the Health Physics team, Pharmacy, PET, and Theranostics business partners.

Areas under consideration are an annual exam reset analysis, participant, and preceptor surveys, providing additional preceptor program support, and an annual curriculum review.



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