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# Reinvigorating a Technical Countering Weapons of Mass Destruction Distance Learning Graduate Certificate Program

Dr. James Petrosky, Dr. Gaiven Varshney, Dr. Jeremy Slagley  
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*Current Countering Weapons of Mass Destruction (CWMD) demands can be divided broadly into policy and science. The science of chemical, biological, and radiological/nuclear weapons informs the limits of development, production, employment, operation, detection, risk characterization, human and material protection, and medical intervention. In short, the science of weapons of mass destruction (WMD) should precede and inform the development of policy. It is to this end that the Air Force Institute of Technology (AFIT) CWMD program was re-established, providing a technical educational option for practitioners to understand the science behind a very technically challenging subject.*

## THE PAST

Graduate educational programs can focus on either science or policy. Since the AFIT graduate school is focused on technology-based education, it was only fitting that AFIT developed and operated the science-based graduate certificate program in CWMD for nearly a decade. The initial program was developed for United States Air Force (USAF) scientists that had a background in a technical field but were assigned to organizations that required integration of chemical, biological, and nuclear protection. In its later years, however, the program was primarily supported by Army functional area (FA) 52 counterproliferation officers. Due to low enrollments the program was sunset

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in 2018.

## THE PRESENT

In 2020, with a renewed interest in CWMD operations, the Department of Homeland Security (DHS) CWMD office sought to establish a technical CWMD expertise development program and turned to AFIT to re-establish the technical CWMD certificate program. Following substantial coordination and assurance from DHS that program funding was in place, AFIT began planning and coordination to re-establish the CWMD certificate program. During the COVID lockdown in 2020, AFIT restarted the program through the recently established Nuclear Expertise for Advancing Technologies (NEAT) Center<sup>1</sup> and recruited and enrolled students from the Air Force, Army, and Lawrence Livermore National Laboratory (LLNL) for the October 2020 start. In September 2021, the first 30 students were awarded their graduate



Dr. Gaiven Varshney (co-chair and CHEM 597 instructor) and Dr. Anna Bucy (CWMD administrative assistant) prepare the first 30 graduate certificates for mailing.

certificates in CWMD.

The AFIT CWMD program is shared by the Departments of Engineering Physics and Systems Engineering & Management. The program is housed in the NEAT Center, headed by Dr. James Petrosky. The NEAT Center is a technical partner and a bridge for developing technical talents and human capital for mission partners focused on protecting the US. NEAT is engaged in research, education, and publication that enhances Defense, Air Force, and Department of Energy organizational cross-knowledge. The education strategy offers a

broad portfolio of courses and programs oriented toward technical nuclear subjects, including technically oriented nuclear forensics graduate courses and research that develops national level expertise of interest for key mission partners. The close ties between education and research and national security efforts are clear, making AFIT a primary institute for innovation and relevance.

Several changes were necessary for the program reestablishment to broaden the student population. These included adding material on biological effects and physiology, which is of increased interest due to the current pandemic. Additionally, there was an effort to rebuild the program with a consistent format and structure, following AFIT's extremely popular Nuclear Weapons Effects, Policy, and Proliferation (NWEPP)<sup>2</sup> graduate certificate program. This structure has proven to provide the best flexibility for students who must balance their primary duties with distance learning education, while providing interactions between faculty and students at the graduate level. Content changes also included some reorganization of materials to provide similar approaches to common materials, such as application of mathematical models for prediction of outcomes and using common software such as Excel<sup>TM</sup>.

The program maintained the focus on basic and applied sciences behind each of the CWMD topic areas but brought new subject matter related to consequence management to the forefront. The substantial faculty experiences on the broad applications of CWMD, both military and civilian, represent over 100 years of biowarfare, chemical and nuclear weapons, and physiological response technical expertise. This experience led to the assembly of valuable and applicable course materials, and many real time conversations during webinars and office hours. Together, these resulted in many relevant lectures, and discussions related to students' current work areas. The students ranged from PhDs to new Lieutenants, and from CWMD researchers to CWMD responders.

The Biological Weapons Effects and Technology course materials were especially relevant against a backdrop of an international pandemic. Many students commented on the specific relevance and daily applicability of the course materials,

for both scientific studies and development of policy. The course covered technical aspects related to infectious disease epidemiology, biological agent production methods and history of use, and characteristics of bio-pathogens that lend to weaponization.

The Chemical Weapons Materials, Effects, and Technology course included an intense organic chemistry review and a basis for the complex methods for creating chemical weapons. The course then covered how chemical weapons are employed, the process by which chemical weapons can cause harm, the technical issues associated with detection and decontamination of chemical weapons, and the selection criteria for choosing a chemical weapons route.

Dr. Petrosky, (NENG597 instructor) presents a webinar related to shielding methods.

The Nuclear Weapon and Radiological Effects course included an understanding of radiation and how it is transported through various environments. The course presented students with various web available references to determine exposures and shielding effects in order to survive a radiological incident or attack. The course was completely re-written to focus on domestic radiological events with some historical context. This change made this course uniquely different from other “targeting” oriented nuclear courses at AFIT.

The Physiological Effects of CBRN course (which is expected to be the final course in the certificate) explored human physiology relevant to WMDs, covering major organ systems anatomy and physiology. The students selected a particular agent and conducted a focused study on it using the previous course materials as support. This course engaged students via individual and team projects in order to apply the course materials and establish networks

among students.

The project-based approach in the final course in the certificate supported the goals of integrating the science, having knowledge of the current literature, and informing policy decisions. These goals are a unique aspect of the AFIT CWMD program. Unlike training, graduate education requires students to analyze and evaluate the information in order to make assessments and decisions. This is enhanced by faculty led student projects and evaluation and feedback on the topic. Students’ innovative ideas emerge and are rigorously examined and the scientific process is applied multiple times to hone skills.

## THE FUTURE

Thanks to the Department of Homeland Security CWMD office’s continued support, AFIT has expanded offerings of the CWMD program into 2022. The program will be able to offer multiple offerings of courses and substantially increased enrollment. This expansion will allow AFIT to reach more organizations and bring in a broader group of students. This expansion is no small measure, as our experience with having students from outside of the DoD, including DHS, NNSA, and LLNL, substantially enriches the course interactions and led to an improved program. The current expansion includes students from Air Force, Army, Navy, NNSA, LLNL, and FBI; all part of the national CWMD team.

Additionally, we are seeking changes to course content to include more information on the “countering” aspect of WMDs and including this into the project work and discussions. We are seeking ways to include this in a consistent way across all courses. Lastly, we are looking to build “step up” course materials to provide students with natural science and math skills, and problem-solving techniques before starting the program. These are being done to ensure student success and enhance learning as many students have not used these skills for some time. Lastly, based upon the huge student and organizational interest, we are seeking to reestablish the CWMD Master of Science (MS) distance learning graduate degree program, which will include the CWMD certificate courses. If your organization may be able to sponsor this program, contact us at [CWMD@afit.edu](mailto:CWMD@afit.edu).

## THE CWMD GRADUATE CERTIFICATE PROGRAM

The CWMD graduate certificate program is hosted by AFIT's NEAT Center, within the AFIT Graduate School of Engineering and Management. The program is shared by AFIT's departments of Engineering Physics and Systems Engineering and Management. The CWMD program includes four courses delivered via distance learning modality. The courses all include remote asynchronous content delivered via CANVAS learning management system, and weekly synchronous webinars. Each course represents four graduate quarter credit hours (a total of 16 credits for the certificate) and these credits can be used in certain approved master's programs as transfer credits. The intent is for the program to be completed by non-traditional students part-time in one year.



### CWMD Certificate Courses

- BIOL 597 Biological Weapons Effects and Technology
- CHEM 597 Chemical Weapons Materials, Effects, and Technology
- NENG 597 Nuclear Weapon and Radiological Effects
- CWMD 596 Physiological Effects of CBRN

### Admission requirements:

- A Bachelor's degree in a science, engineering, or medical related field (Physics, Biology, Chemistry, Nuclear Engineering, Industrial Hygiene Environmental Science, Physiology, or Epidemiology)
- College algebra required and calculus is desired with a grade of C or better.
- A cumulative undergraduate GPA of 3.0 (on a 4.0 scale).
- US Citizenship

Waivers to the above criteria may be granted on a case-by-case basis. Therefore, those who do not meet the above criteria are encouraged to apply.

More information is available at: <https://www.afit.edu/EN/programs.cfm?a=view&D=21> or contact us by email: [CWMD@afit.edu](mailto:CWMD@afit.edu).

### Notes

1. Nuclear Expertise for Advancing Technologies Center – focused on building and enhancing careers on DoD technical subjects.
2. The Nuclear Weapons Effects, Policy and Proliferation graduate certificate program includes 3 weekly lessons followed by a live webinar.