

SECTION II. INTRODUCTION

Instructional technique: LE
Method of Instruction: Conference (CO)
Instructor to Student Ratio is: 1: audience
Time of Instruction: 0.3 hours
Media: Viewgraphs

Motivator Show VGT 1: Tier I: Depleted Uranium General Awareness

Note: Instructor must paraphrase or read this statement and stress the importance of this lesson.

Depleted uranium (DU) is a dense, slightly radioactive metal used by the US and other forces in munitions and armor and in other applications. DU has properties similar to more familiar heavy metals such as lead and tungsten. Under very limited conditions, soldiers could inhale or ingest DU "dust" and/or sustain DU fragment injuries that could result in DU intakes at levels exceeding US safety standards. Exercising precautions outlined in this training will protect you against DU and other heavy metals.

Operation Desert Storm saw the first widespread battlefield use of DU in both anti-armor kinetic-energy penetrators, and in encased DU armor used to bolster the survivability of M1A1 tanks. Used in both its offensive and defensive roles, DU proved to be far superior to any other alternatives employed by friendly or threat forces. By war's end, Iraq had lost more than 4,000 tanks and armored vehicles, while not a single US tank, and fewer than half a dozen APCs, were lost to hostile fire. That kind of effectiveness obviously did not go unnoticed, making it likely that potential adversaries will acquire and use DU munitions and armor in future conflicts.

It is important that soldiers recognize the sharp distinction between the acute, possibly lethal nuclear, biological, or chemical (NBC) exposure hazard and the far less serious risk of exposures to DU. When you are operating in an NBC environment, take the appropriate NBC protective measures. NBC exposures are extremely deadly and can kill or incapacitate unprotected individuals and units in seconds or hours. The protective measures described in this TSP, however, apply to DU, which is essentially an "industrial hygiene" or safety hazard.

Terminal Learning Objective	<p>Note: Inform the students of the following Terminal Learning Objective requirements.</p> <p>At the completion of this lesson, you [the student] will:</p> <p>Action: At the completion of this lesson, you will be able to respond safely and effectively to depleted uranium (DU) on the battlefield and initiate additional protective measures. You will also be able to recognize the special cases when these additional protective measures are necessary in order to keep exposures below US safety standards and as low as reasonably achievable.</p> <p>Conditions: In a simulated combat situation where DU munitions or weapons systems that could contain DU are in use or could be used: protective mask, gloves, and first aid supplies.</p> <p>Standards: Without reference: Show VGT 2: Learning Objectives At the completion of this lesson, you will 1) be able to respond safely and effectively to depleted uranium (DU) on the battlefield and 2) initiate additional protective measures. Show VGT 3: Learning Objectives, cont. You will also be able to recognize the special cases when these additional protective measures are necessary in order to keep exposures below US safety standards and as low as reasonably achievable.</p>
Safety Requirements	None
Risk Assessment Level	Low
Environmental Considerations	None
Evaluation	None. While an evaluation is not a part of this TSP, after receiving this instruction, the students will be able to pass CT 031-503-1017.
Instructional Lead-In	After introducing the training video by showing VGTs 1, 2, and 3, show the video.

SECTION III. PRESENTATION

NOTE TO INSTRUCTOR

Show the video now. The video covers all of the enabling learning objectives.

A. ENABLING LEARNING OBJECTIVE 1

ACTION:	Describe depleted uranium (DU).
CONDITIONS:	In a training environment.
STANDARDS:	Without reference, describe DU to include these elements: 1) heavy metal, 2) produced by refining and processing natural uranium, 3) 40% less radioactive than natural uranium.

Method of Instruction: Conference
 Instructor to Student Ratio: 1: audience
 Time of Instruction: NA
 Media: Video

- A. Uranium is a heavy metal that is a part of our natural environment and is found in the air, water, and soil throughout the world. In the US, uranium is found in amounts large enough to be mined in New Mexico, Colorado, Wyoming, Utah, and Arizona.
- B. Fifty years of intensive research on uranium have shown that natural uranium's health effects are comparable to those of other heavy metals such as lead and tungsten.
- (1) Like other heavy metals, uranium is also present naturally in our bodies in trace amounts. (NOTE TO INSTRUCTOR: see FAQ 1 for additional information on this topic)
 - (2) However, as with all heavy metals, internalizing large amounts of uranium could affect your health. With uranium, the primary organ affected is the kidney.
- C. Depleted uranium (DU) is a dense, slightly radioactive metal used by the US and other armed forces in munitions, armor, and other applications.
- (1) DU is a metal derived from the processing of uranium ore. DU remains chemically identical to natural uranium; however, it is 40% less radioactive after processing. The primary concern from a health perspective is uranium's chemical rather than radiological properties. (NOTE TO INSTRUCTOR: see FAQ 2 for additional information on this topic)
 - (2) You could receive a dose (or intake) of DU that potentially exceeds US safety standards if you are in, on, or near an armored combat vehicle at the time it is struck by DU munitions, or a DU-armored vehicle where the encased DU armor is struck and ruptured by hostile fire (DU or non-DU). However, this does not mean that you will suffer any adverse health effects. In fact, adverse health effects may only occur for intakes that greatly exceeded the US safety standard. (NOTE TO INSTRUCTOR: see FAQ 7 for additional information on this topic)
 - (3) US safety standards for DU internalization are set at a level WELL BELOW that at which actual health effects are considered likely to occur. To date, no health effects attributable to DU exposures or intakes have been observed in Gulf War veterans, even those with the most serious exposures.

B. ENABLING LEARNING OBJECTIVE 2

ACTION:	Identify military uses of DU.
CONDITIONS:	In a training environment.
STANDARDS:	Without reference, identify all of the following uses of DU: 1) armor-piercing munitions, and 2) armor plating.

Method of Instruction: Conference
 Instructor to Student Ratio: 1: audience
 Time of Instruction: NA
 Media: Video

D. General military uses of DU.

- (3) The US military uses DU in armor-piercing kinetic energy (solid-shot, non-explosive) munitions and in armor encased in regular steel armor in M1A1/A2 tanks. DU munitions might also be found in storage conexes, on ammunition carriers or transports, uploaded on attack aircraft (USAF A-10 Thunderbolt II or Marine AV-8B Harriers), or on transport vehicles. DU is also used as counterweights in guided missiles and aircraft; however, ground troops are unlikely to encounter it in those forms.
- (4) DU is an ideal material for armor-piercing munitions because it is extremely dense, giving better accuracy and superior penetration at extended ranges. DU munitions have a unique "self-sharpening" characteristic: while tungsten and similar metals tend to mushroom upon impact with thick armor, DU actually becomes more pointed as fragments break off. This facilitates armor penetration. These characteristics give US forces an unmatched ability to engage enemy forces at longer ranges and with greater effect. In addition, DU used in tank armor can defeat most currently fielded, non-DU anti-tank munitions, providing a crucial enhancement in the survivability of our tanks and their crews.

E. DU penetrators.

- (1) DU rounds are kinetic energy munitions. Kinetic energy munitions are solid, non-explosive rounds that rely on high muzzle velocity and "hitting power" to punch through heavy armor. Armor-piercing penetrators do not explode when they hit a target, but rather punch a hole in it, much like the bullets from your M16 going through an aluminum can. Obviously, this requires a metal with the density and strength to withstand the tremendous force of impact without breaking up or bouncing off.
- (2) Because of regulations governing gunnery ranges, US forces do not use DU rounds for training. DU munitions are fired at selected test and evaluation ranges. Only in areas where hostilities are imminent or a very high readiness is required do US forces operate combat vehicles uploaded with DU munitions.
- (3) Most DU rounds are discarding SABOTs, so-called because the dart-like penetrator—the long, thin metal rod that flies downrange—is fitted with an oversized non-metallic SABOT or collar. The SABOT falls away once the DU rod exits the muzzle.

F. Weapon systems that use DU penetrators.

- (1) M2/3 series Bradley Fighting Vehicle Bushmaster cannon and the GAU-12 Gatling gun on the Marine AV-8 Harrier fire the 25mm DU round.

- (2) The M1 and M60 series tanks fire the 105mm DU munition.
- (3) The M1A1 and M1A2 Abrams Tanks fire the 120mm DU munition.
- (4) The Air Force uses a 30mm DU round in the GAU-8 Gatling gun on the A-10 Thunderbolt II. In combat, the A-10 normally fires a mixture of DU and high-explosive rounds.
- (5) The Navy uses the 20mm DU munition in the Phalanx Close-In Weapons System.

G. DU armor.

The same dense qualities that allow DU to penetrate other metals also mean that other metals cannot easily penetrate DU. Therefore, the M1A1/A2 Abrams (Heavy Armor) tanks employ steel-encased DU for increased armor protection. It is impossible to come into contact with the DU in these tanks unless the armor has been damaged. We identify tank turrets containing DU armor with a "U" at the end of the four-digit turret serial number.

C. ENABLING LEARNING OBJECTIVE 3

ACTION:	Identify protective measures required for handling intact DU armor and unfired DU munitions.
CONDITIONS:	In a training environment.
STANDARDS:	Without reference, state there are no additional protective measures required for handling intact DU armor and unfired DU munitions.

Method of Instruction: Conference
Instructor to Student Ratio: 1: audience
Time of Instruction: NA
Media: Video

- H. There are NO additional protective measures required for unfired DU munitions, beyond those standard for all munitions.
- I. There are NO additional protective measures required for intact DU armor, beyond those standard for all armor packages.
- J. Both unfired DU munitions and intact DU armor emit very low levels of radiation that are well below the US safety standards. This radiation can be detected using the AN/VDR-2 or the AN/PDR-77 radiac meter.

D. ENABLING LEARNING OBJECTIVE 4

ACTION:	Identify situations in which DU could present a hazard.
CONDITIONS	In a training environment.
STANDARDS	Without reference, state/identify the following situations: 1) when in, on, or near an armored combat vehicle at the time it is struck, 2) when decontaminating the crew compartment of a damaged armored vehicle, 3) when routinely entering vehicles with penetrated DU armor or that have been struck by DU munitions, 4) when finding penetrators or parts of penetrators, and 5) when near actively burning fires that involve DU.

Method of Instruction: Conference
 Instructor to Student Ratio: 1: audience
 Time of Instruction: NA
 Media: Video

- K. You could receive a dose (or intake) of DU that exceeds US safety standards if you are in, on, or near an armored combat vehicle at the time it is struck by DU munitions, or an M1A1/A2 Heavy Armor tank when it is struck and breached by any munition (DU or non-DU). When a DU round hits and penetrates armor (especially DU armor), fragments, oxides, and particles are formed. This DU could be taken into the body through inhalation, ingestion, or wound contamination or as embedded fragments. DU particles settle out of the air soon after a munitions strike, greatly reducing the risk of DU intake by inhalation.
- L. DU could present a hazard during decontamination of the crew compartment. Crew movements associated with the process of decontamination could resuspend the DU particles. The crew compartment of the vehicle will need to be decontaminated if:
- (5) munitions penetrate the crew compartment or
 - (6) DU munitions have burned inside the vehicle.
- M. A third situation in which DU could present a hazard is if you routinely enter vehicles with penetrated DU armor or vehicles that have been struck by DU munitions. Personnel who routinely enter and spend many hours each day in vehicles penetrated by DU munitions or with penetrated DU armor require special training and wear protective clothing. This is to keep exposures to these personnel below US safety standards and as low as reasonably achievable. (NOTE TO INSTRUCTOR: see FAQ 3 for additional information on this topic). These personnel include:
- (1) Maintenance personnel
 - (2) Explosive ordnance disposal personnel
 - (3) Vehicle recovery personnel
- N. A fourth situation in which DU could present a hazard is if you find penetrators or parts of penetrators. ELO#7 will cover how to identify penetrators.
- O. A final situation in which DU could present a hazard is if you are near (within 50 meters of) actively burning fires involving DU. If DU rounds are in a burning vehicle or otherwise exposed to an active fire, they form particles that can become carried by the smoke or settle in and around the vehicle.

E. ENABLING LEARNING OBJECTIVE 5

ACTION:	State the actions to be taken when in, on, or near an armored combat vehicle at the time of impact by munitions.
CONDITIONS:	In a training environment, given a simulated battlefield situation in which the soldier is in, on, or near a vehicle at the time of impact.
STANDARDS:	Without reference, state/identify: 1) conduct combat life-saving, 2) continue operations, if possible, 3) notify chain of command, and 4) if the crew compartment has been breached, decontaminate the inside of the vehicle.

Method of Instruction: Conference
 Instructor to Student Ratio: 1: audience
 Time of Instruction: NA
 Media: Video

If you are in, on, or near an armored combat vehicle at the time of impact by munitions, take appropriate actions such as conducting combat life-saving and continuing operations if possible. Notify chain of command that you were in, on, or near a vehicle when it was struck. When METT-TC allows, decontaminate the inside of the vehicle if the crew compartment was breached by any munition. The following information should be recorded in the unit journal: that the vehicle crew compartment was breached; what personnel were in, on, or near the vehicle; and where the strike happened.

F. ENABLING LEARNING OBJECTIVE 6

ACTION:	State the protective measures to be taken when decontaminating the crew compartment of a damaged armored vehicle.
CONDITIONS:	In a training environment, given a simulated situation in which the soldier is performing decontamination of the crew compartment of a damaged armored vehicle.
STANDARDS:	Without reference, state: 1) wear respiratory protection, 2) cover exposed skin, 3) dust off your uniform, and 4) observe standard field hygiene procedures.

Method of Instruction: Conference
 Instructor to Student Ratio: 1: audience
 Time of Instruction: NA
 Media: Video

- P. If any munitions penetrate the crew compartment of an armored vehicle, you will eventually decontaminate the inside of the vehicle to remove all possible hazards. Such hazards could include DU contamination as well as burned plastics; petroleum, oil and lubricant (POL) products; and tungsten contamination. When METT-TC permits, decontaminate the crew compartment of the vehicle IAW procedures in FM 3-5.
- Q. In the process of decontaminating the crew compartment of a damaged vehicle, you could resuspend DU contamination as well as burned plastics, POL products, and tungsten contamination that had previously settled inside. While performing these actions:
- (7) Wear some respiratory protection (such as a dust mask, protective mask, or other approved respirator).
 - (8) Cover exposed skin, including rolling down your sleeves and wearing gloves. An increase in MOPP is not required.
 - (9) After you leave the vehicle and before removing your protective mask, dust off your uniform.
 - (10) Always observe standard field hygiene procedures, including washing your hands.

G. ENABLING LEARNING OBJECTIVE 7

ACTION:	State the actions to take when finding penetrators or parts of penetrators.
CONDITIONS:	In a training environment, given a situation in which the soldier finds a penetrator.
STANDARDS:	Without reference, state: 1) leave the penetrator alone, and 2) notify the chain of command of its location.

Method of Instruction: Conference
 Instructor to Student Ratio: 1: audience
 Time of Instruction: NA
 Media: Video

- A. If a penetrator hits a hard target, it could be deformed and/or reduced in size and could be difficult to recognize. A fired or spent penetrator that does not impact a hard target could maintain its original shape or lose the nose cone and/or tail fin. Because a tungsten penetrator could appear very similar to a DU penetrator, assume all penetrators you find are made from DU. The only way to positively identify that a penetrator is made from DU is to use an AN/VDR-2 or an AN/PDR-77 radiac meter.
- B. If you find a penetrator or parts of a penetrator:
- (1) As with all battlefield debris, leave the penetrator alone.
 - (2) Notify chain of command of its location.

H. ENABLING LEARNING OBJECTIVE 8

ACTION:	State the actions to take when near actively burning fires that involve DU munitions.
CONDITIONS:	In a training environment.
STANDARDS:	Without reference, state stay at least 50 meters away from the actively burning fire if METT-TC permits.

Method of Instruction: Conference
Instructor to Student Ratio: 1: audience
Time of Instruction: NA
Media: Video

If METT-TC permits, stay at least 50 meters from actively burning fires involving DU. Assume all armored combat vehicles and ammunition supply vehicles contain DU munitions.

I. ENABLING LEARNING OBJECTIVE 9

ACTION:	State first aid procedures for injuries involving DU.
CONDITIONS:	In a training environment, given a simulated casualty who has been injured in a vehicle that has been damaged by DU or in a vehicle with DU armor that has been damaged.
STANDARDS:	Without reference, state: 1) administer first aid IAW Soldier's Manual of Common Tasks, and 2) notify chain of command.

Method of Instruction: Conference
 Instructor to Student Ratio: 1: audience
 Time of Instruction: NA
 Media: Video

R. If you encounter a soldier who could have injuries involving DU:

- (11) Conduct rescue and administer first aid IAW the Soldier's Manual of Common Tasks. The presence of DU does not change the procedures for first aid or rescuing the injured.
- (12) The presence of DU on a wounded soldier poses no threat to those administering first aid.
- (13) Notify chain of command that the person could have injuries involving DU, because additional medical tests could be required.

SECTION IV. SUMMARY

Instructional technique: LE
Method of Instruction: Conference (CO)
Instructor to Student Ratio is: 1: audience
Time of Instruction: 0.3 hours
Media: Viewgraphs

Review /
Summarize Lesson

Show VGT 4: In Summary

Note: The instructor must summarize this lesson and the video using the summary slides.

Depleted uranium (DU) is

- | |
|---|
| A) a heavy metal,
B) produced by refining and processing natural uranium, and
C) 40% less radioactive than natural uranium. |
|---|

Show VGT 5: In Summary, cont.

No additional protective measures are required for handling intact DU armor and unfired DU munitions.

Show VGT 6: In Summary, cont.

DU could present a hazard in the following situations:

- A) when in, on, or near an armored combat vehicle at the time it is struck,
- B) when decontaminating the crew compartment of a damaged armored vehicle,

Show VGT 7: In Summary, cont.

DU could present a hazard in the following situations:

- C) when routinely entering vehicles with penetrated DU armor or that have been struck by DU munitions,
- D) when finding penetrators or parts of penetrators, and
- E) when near actively burning fires that involve DU.

Show VGT 8: In Summary, cont.

When in, on, or near an armored combat vehicle at the time of impact by munitions,

- A) conduct combat life-saving;
- B) continue operations, if possible;
- C) notify chain of command; and
- D) if the crew compartment has been breached by any munitions, decontaminate the inside of the vehicle.

Show VGT 9: In Summary, cont.

When decontaminating the crew compartment of a damaged armored vehicle, take the following protective measures:

- A) wear respiratory protection,
- B) cover exposed skin,
- C) dust off your uniform, and
- D) observe standard field hygiene.

Show VGT 10: In Summary, cont.

When finding a penetrator or parts of a penetrator, leave the penetrator alone and notify the chain of command of its location.

When near actively burning fires that involve DU munitions, stay at least 50 meters away if METT-TC permits.

Show VGT 11: In Summary, cont.

When finding a soldier who could have injuries involving DU:

- A) Conduct rescue and administer first aid IAW the Soldier's Manual of Common Tasks.
 - B) Notify the chain of command that the person could have injuries involving DU.
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Check on Learning**Show VGT 12: Check on Learning****Note:** The instructor must ask the students the following questions to make sure they understand the lesson.

- Q. What should you do if you encounter a soldier with injuries involving DU?
- A) Conduct rescue and administer first aid IAW SMCT, and
 - B) notify chain of command that the person may have injuries involving DU.
- Q. Identify three situations in which DU could be a hazard.
- A) When finding penetrators or parts of penetrators,
 - B) when decontaminating a breached armored vehicle crew compartment, and
 - C) when near actively burning fires that involve DU.
- Q. What additional protective measures are required for unfired DU munitions?
- None.
- Q. What should you do if you find a penetrator?
- A) Leave it alone, and
 - B) notify chain of command of its location.
- Q. What protective measures should you take if required to decontaminate the crew compartment of an armored vehicle that has been breached by an armor-piercing munition?
- A) Put on protective mask, and
 - B) cover exposed skin.
- Q. What should you do if you encounter an armored vehicle or ammo transport vehicle that is actively burning?
- Stay at least 50 meters away from it if METT-TC permits.
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Frequently Asked Questions

Show VGT 13: Questions

Note: The instructor must allow the students the opportunity to ask questions about the training. Below are frequently asked questions and the appropriate responses to them.

FAQ 1: Do I have uranium in my body now?

- A. Yes, uranium is a part of our natural environment. It is found in many things on the earth, including our food and water. Like many other elements, radioactive and otherwise, it is a natural part of our bodies. For example, carbon-14, used in carbon dating, is a radioactive element found in all organic living things. Hydrogen-3, called tritium, is found in nature as a part of all things that contain hydrogen (which is just about everything, including our bodies!). Like other natural elements in our bodies (iron, potassium, and other elements and minerals), uranium is also found in measurable quantities in our waste products (urine and stools).

FAQ 2: What is the difference between DU and natural uranium?

- A. DU is obtained from natural uranium ore, which is found throughout the world. In the United States, it is mined in New Mexico, Colorado, Wyoming, Utah, and Arizona. Uranium ore contains, by weight, 99.28% U-238, 0.71% U-235, and 0.0058% U-234. This means that the part of the ore that is mostly DU, U-238, makes up the largest part of uranium ore, while the part that is most useful for nuclear fuel and nuclear weapons, U-235, is only a very small part of the actual ore. To build nuclear weapons or make fuel rods, uranium ore is run through a complex enrichment process that removes most of the U-235 and U-234. The uranium that is left over from this process is mostly U-238 and is called DU. DU is 40% less radioactive than uranium.

FAQ 3: Why do some soldiers wear protective equipment and I don't need to?

- A. Maintenance, explosive ordnance disposal, and vehicle recovery personnel wear protective suits because they are required to routinely enter and spend many hours each day in vehicles damaged by DU penetrators or in vehicles with damaged DU armor.

FAQ 4: I saw the old DU training film and it made DU out to be a lot more dangerous. Why is the training being changed?

- A. The new training reflects the most current medical, scientific, and operational data regarding DU.

FAQ 5: What other forces are using DU?

- A. France, Great Britain, and Russia use DU in munitions and armor plating. Many other nations are looking to use DU in their arsenals.

FAQ 6: Just how much radiation might I receive handling unfired DU munitions or riding in a vehicle with DU armor?

- A. The radiation you receive during normal handling of munitions or riding in our vehicles is very low. The radiation levels in our Bradley Fighting Vehicle and our tanks (Abrams Heavy, Abrams, and the M60s) have been extensively measured. The levels are so low that you can remain in these vehicles 24 hours a day 365 days a year and not exceed the annual US safety standard for workers for exposure to ionizing radiation. The worker exposure standard is 5 rems (5cGy) per year. The radiation from our vehicles cannot cause radiation sickness because the levels are so low. You should not, in general, pick up bare penetrators. But, if you pick up a bare DU penetrator with your bare hands, the dose rate to the skin of your hands is such that you would