

# Management of Depleted Uranium Casualties

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# Depleted Uranium

- Introduction to Depleted Uranium (DU)
- Radiological Effects of DU
- Toxicological Effects of DU
- DU Casualty Management Policy
- DU Bioassay Policy
- Risk Management of DU Wounded Patients
- References

## Depleted Uranium-Not New Substance

- Chemically same as natural uranium, 40% less radioactive
  - Internalize natural uranium
  - Eat, drink, breathe it daily
- One of many substances found in everyday life and on the battlefield

## Properties of Depleted Uranium

- **Toxicological - primary concern**
  - Heavy metal like lead, tungsten and nickel
  - Kidney/Liver are the target organs
- **Radiological- is a low level radioactive material**
  - Alpha and beta
  - Low intensity gamma

## OSHA Permissible Exposure Limits (PEL)

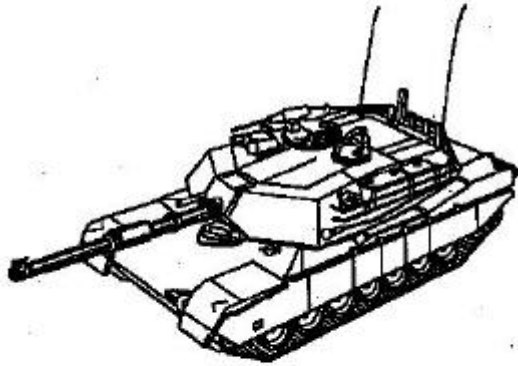
<b>Element</b>	<b>Soluble (mg/m<sup>3</sup>)</b>	<b>Insoluble (mg/m<sup>3</sup>)</b>
<b>Lead</b>	0.05	0.05
<b>Cobalt</b>	0.10	0.10
<b>Uranium</b>	0.05	0.25
<b>Nickel</b>	1.00	1.00
<b>Tungsten</b>	1.00	1.00
<b>* mg/m<sup>3</sup> is 1/1000 of a gram per cubic meter of air.</b>		

## Uranium in the Body from Natural Sources

<u>Source</u>	<u>Amount*</u>
Daily Intake - Food and Liquids	1.9 ug/day
Daily Intake - Inhalation	0.007 ug/day
Total Uranium in the Body	90 ug
Uranium in Urine	0.05-0.5 ug/day
Uranium in Feces	1.4-1.8 ug/day
* 1ug is equal to one millionth of a gram	

# Military Uses

M1A1H Abrams Armor

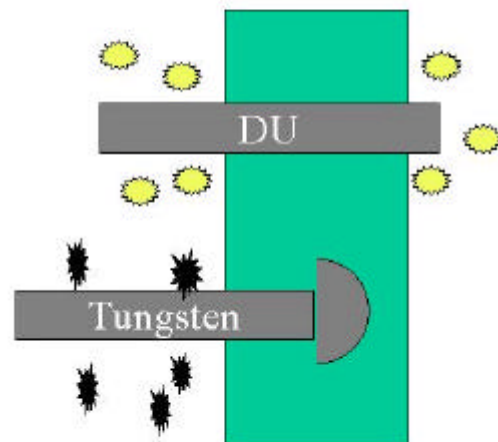


Anti-Armor Munitions



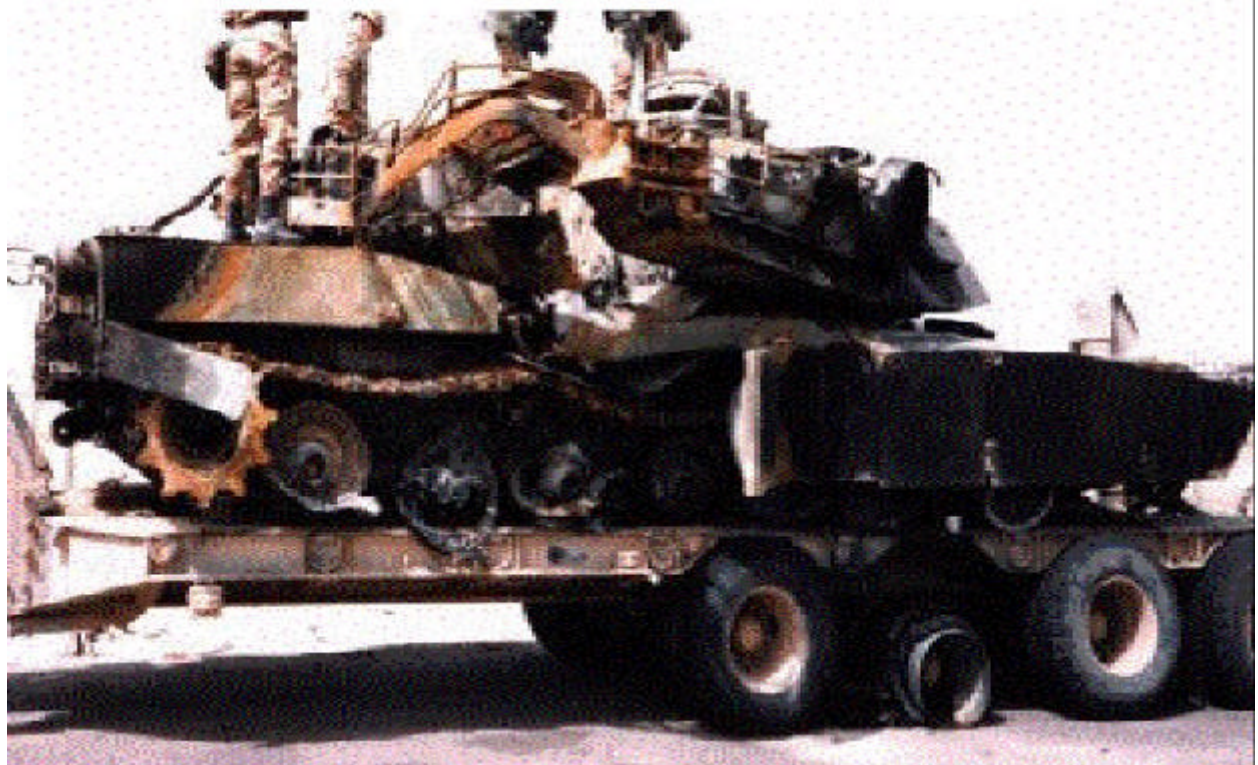
## Properties of Depleted Uranium

- High Density
- Self sharpening as it penetrates armor
- Pyrophoric - small particles ignite and burn at high temperatures





## Friendly Fire Incidents



## **Retained Depleted Uranium**

- Friendly fire incidents result in soldiers with retained DU fragments
  - Could not be readily removed surgically
  - First time
- Office of the Army Surgeon General initiated this effort in 1992. Requested an assessment by the Armed Forces Radiobiology Research Inst. (AFRRI)

## **Actions Taken**

- Armed Forces Radiobiology Research Inst. (AFRRI) initial assessment, 1992:
  - No change in fragment removal policies
  - Research and monitoring recommended
- Department of Veterans Affairs - personnel surveillance
- Research initiated in 1993 at AFRRI and the Inhalation Toxicology Research Institute

## **Summary of AFRRI and VA**

- Results to date indicate
  - Only change to current fragment removal policies: large fragments (over 1 cm) should be removed unless medically contraindicated
  - Depleted uranium health effects are comparable to other heavy metals (lead, tungsten, nickel)
- Studies will be published in the open, peer-reviewed literature

## **Identification of DU Patients**

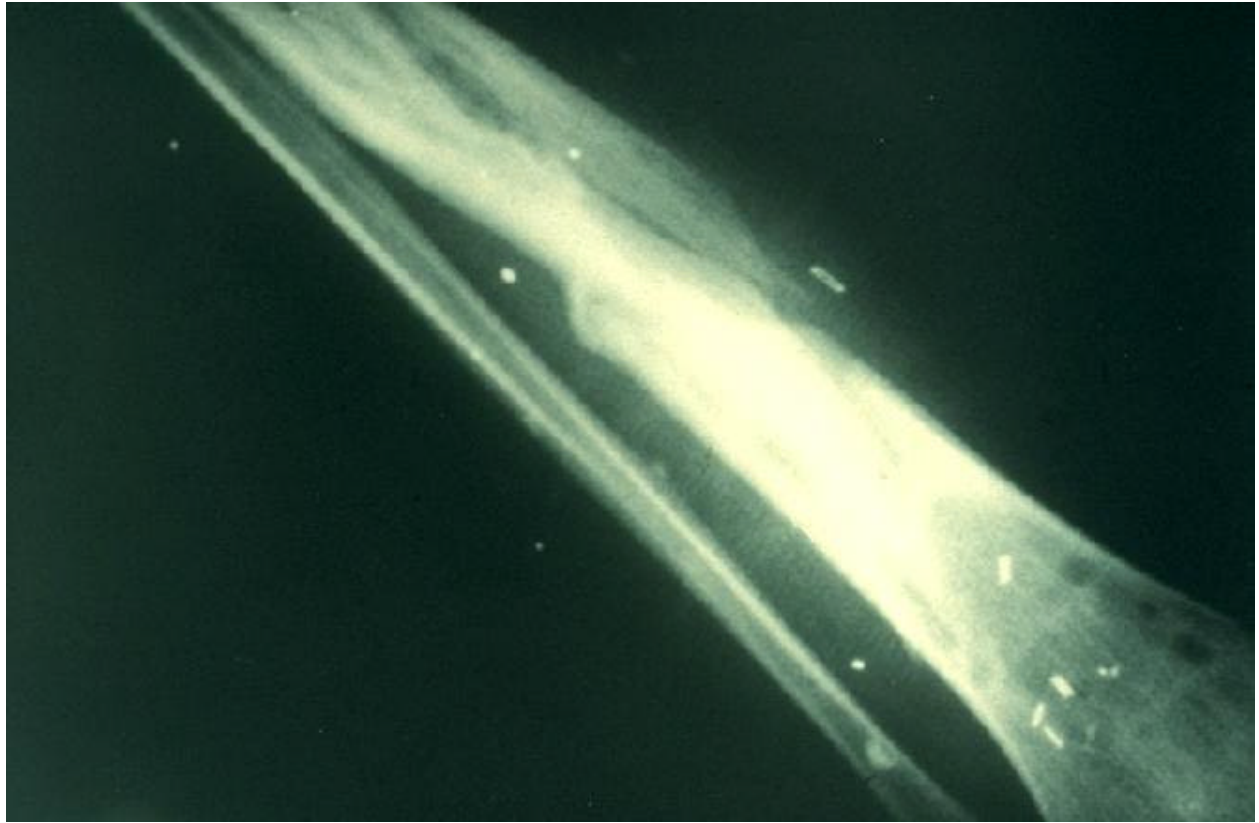
- HX of vehicle struck by KE munition
- HX of vehicle struck by “friendly fire”
- HX of burning fragments “ \*sparkler\* ”
- HX of DU exposure on field medical card

## **Identification of DU Patients**

- **If DU contamination suspected:**
  - **Annotate Field Medical Card**
    - **“SUSPECTED DEPLETED URANIUM (DU) EXPOSURE”**
    - **Briefly describe exposure scenario (Block 19)**

## **Identification of DU Patients**

- **RADIAC Meter** - positive over wounds or fragments
- **Urine Bioassay** - most sensitive test for internalization of depleted uranium
- **XRAYS** - high density, highly visible





## **Clinical Treatment of DU Patients**

- Wounded patients pose **NO Threat** to medical personnel
- **DO NOT DELAY TREATMENT!**
- “Universal Precautions” - surgical gloves, masks and throw-away gowns offer adequate protection to medical personnel

## Clinical Treatment of DU Patients

- Debridement should follow standard surgical techniques
- Radiation meters may aid in management of wounds
- **DO NOT DELAY TREATMENT** to obtain radiation monitoring equipment!

## **Clinical Treatment of DU** **Patients**

- Remove embedded DU fragments using standard surgical criteria
- Large fragments ( $>1\text{cm}$ ) should be removed unless the medical risk is too great

## **Clinical Treatment of DU Patients**

- **Monitor Hepatic and Renal Function**
  - **BUN, Creatinine, Creatinine clearance, beta-2 microglobulin, urine Uranium**
  - **standard liver function tests: AST, ALT, GGT, Bilirubin, PT, PTT**

## **Clinical Treatment of DU** **Patients**

- **Urine Uranium Bioassay:**
  - Perform in all patients with suspected DU exposure
- **Chelation therapy not indicated**

## **Urine Uranium Bioassay**

- **Baseline urine specimen:**
  - Start collection immediately after injury
  - Terminate @ 24 hours after exposure incident
- **Initial DU urine specimen:**
  - Start collection @24 hours after exposure incident
  - Terminate @ 24 hours
- **Follow up urine specimen:**
  - Collect a 24 hr urine @ 7-10 days post exposure

## **Urine Uranium Bioassay**

- Urine Uranium bioassay specimens should be forwarded to AMEDD-specified DOD clinical laboratories
- Spot urine collections should be performed if tactical/logistical issues prevent the collection of 24 hour specimens

## **Risk Assessment**

- Department of Veterans Affairs has followed 15(?) patients who have retained DU fragments in their bodies for over 7 years.
- Highest Uranium Urine = 30-40 mcg/L
- No evidence of renal, liver, reproductive abnormalities has been detected in this group of patients



## **Summary**

- Depleted Uranium - not a radiation threat!
- Heavy Metal Toxicity is the major concern
- Health Care Providers are not at risk
- Clinical Management is the same as other wounded patients
- Suspected exposures should have urine uranium bioassay performed

## **References**

- Message, 141130Z Oct 93, DASG-PSP HQDA, Subject: Medical Management of Unusual Depleted Uranium Exposures.
- North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) 2068, “Emergency War Surgery,” 1988.
- Army Regulation (AR) 40-5, 15 October 1990, Preventive Medicine.

## **References**

- Draft AR 40-400, Patient Administration
- 1st Endorsement, MCHO-CL-W (ECMD/9 Jan 96), 23 Jan 98, Subject: Request for Guidance on the Medical Management of Unusual Depleted Uranium Exposures.
- Tech Guide 211, “Radiobioassay, Collection, Labeling and Shipping Requirements, US Army Center for Health Promotion and Preventive Medicine (USACHPPM), May 1996.