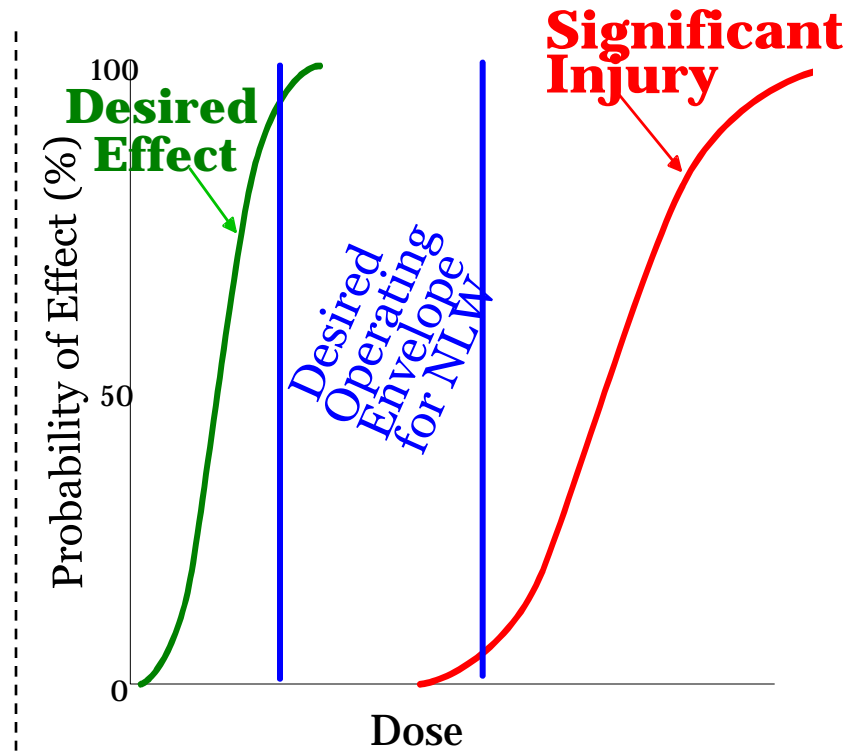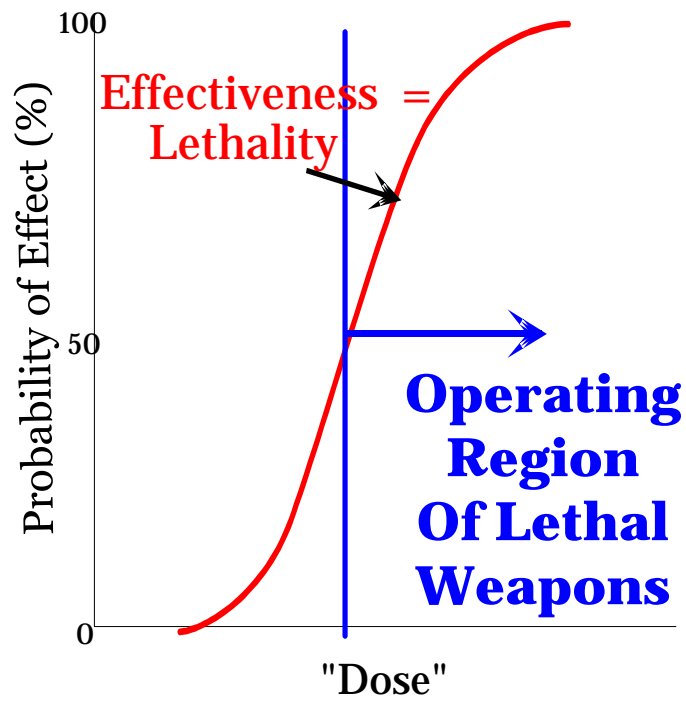Dr. Jennifer Preston
Dr. Mary Williams

- Background of Non-Lethal Weapons (NLWs)

- Risk of Significant Injury Calculation

- Challenges incorporating use in the field

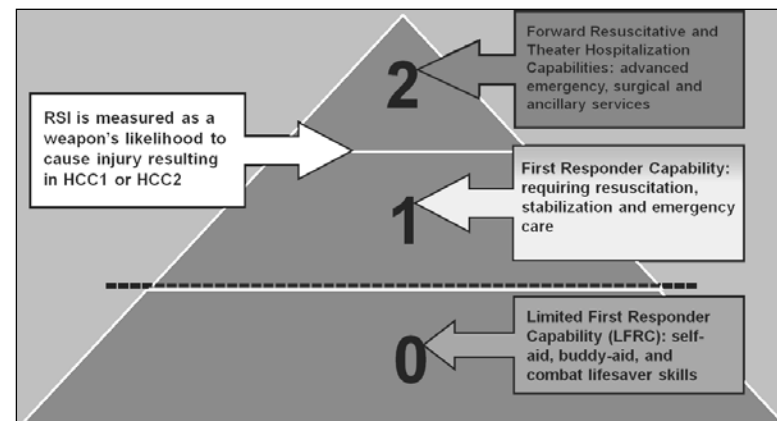- Adding NLWs to Soldier's load

"Weapons, devices and munitions that are ***explicitly designed*** and primarily employed to ***incapacitate targeted personnel or materiel***, while ***minimizing fatalities***, permanent injury to personnel, and undesired damage to property in the target area or environment. Non-lethal weapons are ***intended to have reversible effects*** on personnel and materiel."

- Counter-Personnel
  - Designed to Move, Deny, Disable or Suppress
- Counter-Materiel
  - Designed to Stop or Disable Vehicles, Vessels, and Aircraft; Deny Access; and Divert Aircraft

Left chart:
- Y-axis: Probability of Effect (%), marked 0, 50, 100
- X-axis: "Dose"
- Red curve labeled: Effectiveness = Lethality
- Blue text: Operating Region Of Lethal Weapons

Right chart:
- Y-axis: Probability of Effect (%), marked 0, 50, 100
- X-axis: Dose
- Green curve labeled: Desired Effect
- Red curve labeled: Significant Injury
- Blue text: Desired Operating Envelope for NLW
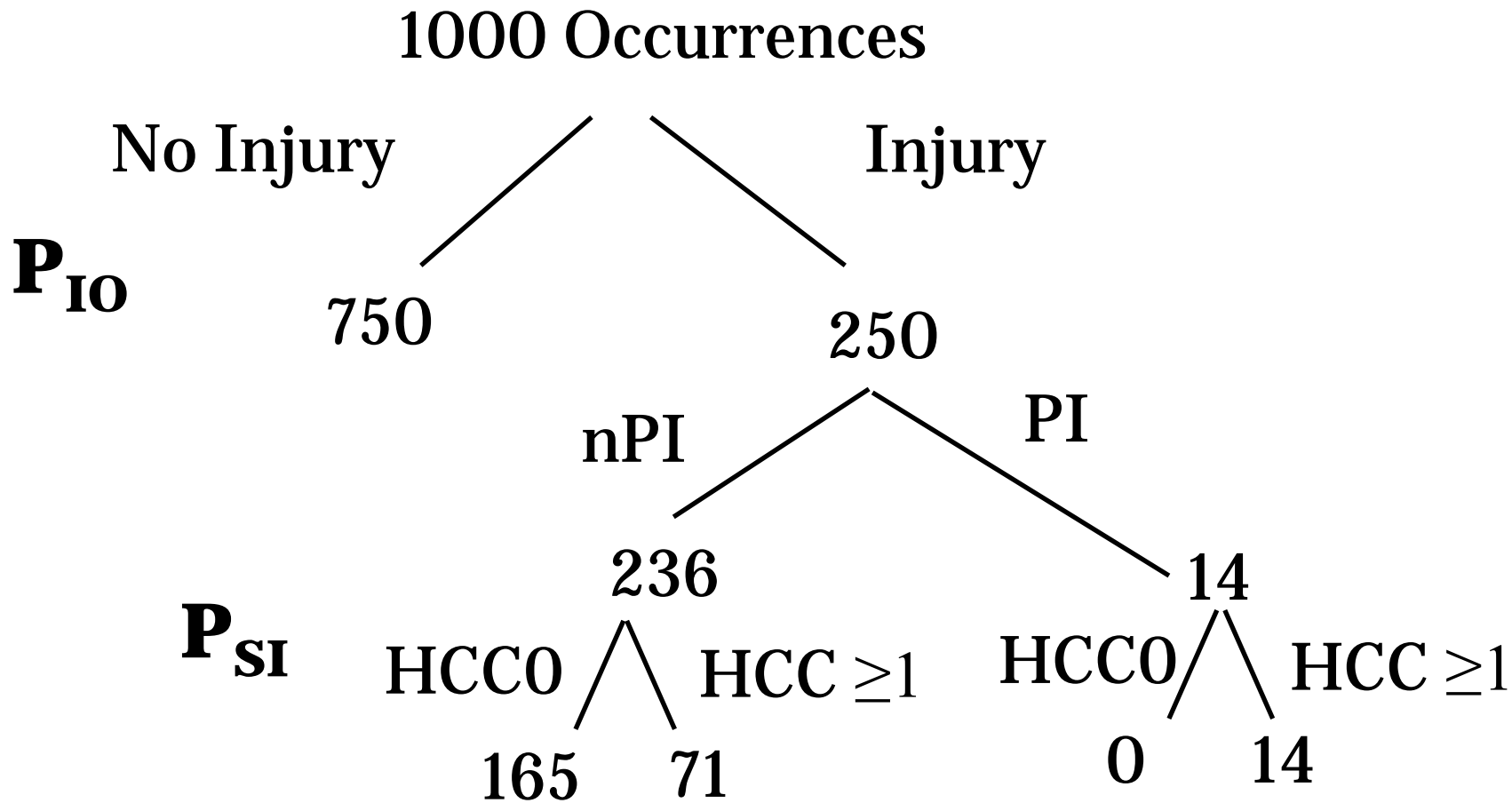
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- RSI is the probability that a NLW system will cause a significant injury when used as intended.

- **<u>Reversibility</u>**: The ability to return the target to its pre-engagement functionality. It is usually measured by the time and level of effort required for recovery of the target. *(DoDI 3200.19)*

- DODI 3200.19, "Significant" injuries include:

    a) any injury requiring Health Care Capability indices 1 or 2

    b) permanent injuries

    c) death

$$P_{RSI,\,Injury} = P_{IO} * P_{SI}$$

- P_{IO} is probability that injury will occur given the nature, location, and intensity of the insult

- P_{SI} is probability that injury will be significant (HCC1+ or permanent) given that type and severity of injury occurs

1000 Occurrences

No Injury   Injury

P_{IO}

750   250

nPI   PI

236   14

P_{SI} HCC0   HCC ≥ 1 HCC0   HCC ≥ 1

165   71   0   14

RSI = (250/1000)*((71+14)/250) = .085 or 8.5%

M&S Capability	Type	Status	V & V	Accreditation
Auditory 4.0	Auditory	Completed	• Human subjects	FY13: PM NLS & MCOTEA
PREMO	Optical	Completed	• Human subjects	FY13: PM NLS & MCOTEA
BBHAZ & LHAZ	Optical	Completed	N/A	FY13: PM NLS & MCOTEA
RTD	Optical	Completed	• Literature resources	FY13: PM NLS & MCOTEA
ATBM	Blunt Impact	Adding FEMs	• Literature resources, animals and human subjects	FY12: 12 ERMM (ATEC) FY13: PM NLS & MCOTEA
BURNSIM 3.0.3	Thermal	Completed	• Literature resources – skin burn depth	FY13: PM NLS & MCOTEA
Skin Penetration	Blunt Impact	Completed	• Animal models	FY12: 12 ERMM (ATEC) FY13: PM NLS & MCOTEA
INJURY 8.2	Blast	Completed	• Am Inst of Bio Sciences	FY13: PM NLS & MCOTEA
Underwater Acoustics	Auditory	Completed	• Human subjects • Harbor acoustics	None

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- Public Acceptability
- CONOPs / TTPs
- Understanding of associated RSI
- Belief that it would add weight to the already overburdened Soldier
- Training on NLW

- **An intent of NLW is to reduce collateral effects**
  - **Minimize the damage to a building or vehicle**
  - **Minimize the injury potential for bystanders**

- **Potential to provide more capabilities by including NLW ammunition**

- **Possible to have multi-use NLW, for example a laser dazzler**

- Some NLWs have long ranges and could be used to support the purpose of the mission from a distance

- Design of NLW is to determine intent allowing for less armor as the Soldier would be able to stay further away

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Questions?