

# REPORT DOCUMENTATION PAGE

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# **Active Denial Technology (ADT) Risk Communication**

**Brent Voorhees**  
**Radio Frequency Bioeffects Branch**  
**Bioeffects Division**  
**Airman Systems Directorate**  
**711th Human Performance Wing**



# How ADT Works



- Energy beam heats surface of skin
- Most energy is deposited within the first  $1/64^{\text{th}}$  inch of the skin
- This region is where sensory nerve endings are located



# Basic Questions To Answer



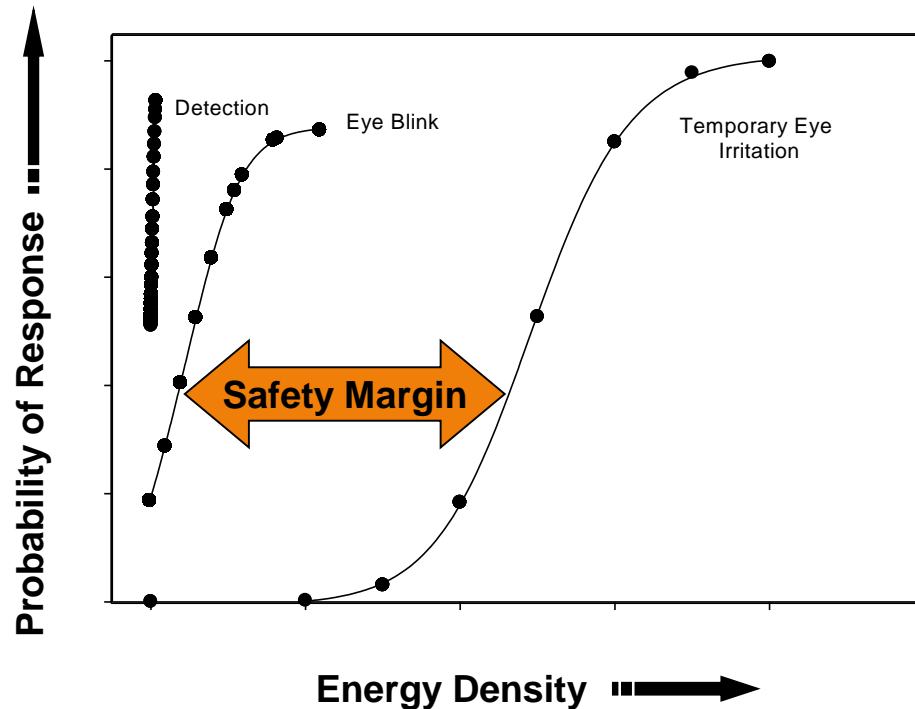
- **Will exposure cause:**
  - **Eye damage?**
  - **Skin damage?**
  - **Cancer?**
- **Will exposure affect reproduction?**
- **Do real world conditions change**
  - **Effectiveness?**
  - **Safety?**



# Will Exposure Cause Eye Damage?



- Animal studies show complete protection occurs due to rapid reflex actions
- Rapid reflex responses including eye blink, head turn, and eye shading all provide protection
- Blink reflex =  $\frac{1}{4}$  second
- Blink reflex protects eye



Humans Have Similar Protective Mechanisms

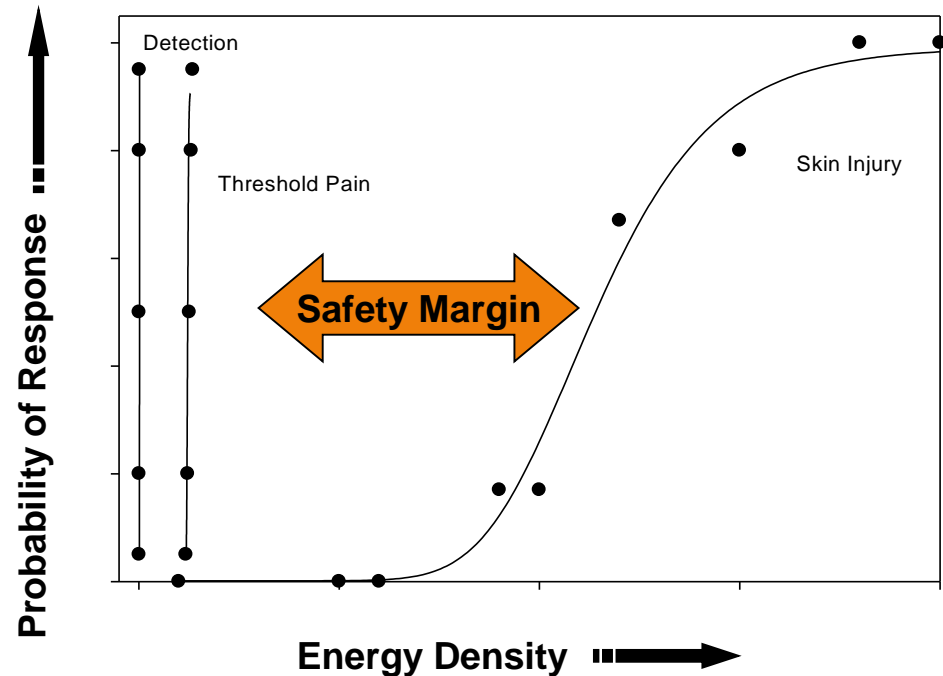
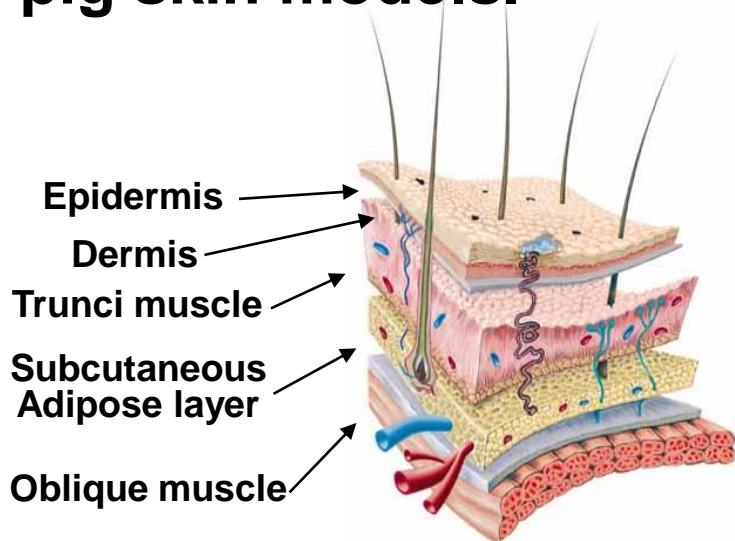


# Will Exposure Cause Skin Damage?



**There is a considerable safety margin before skin damage occurs**

**Thermal dose response curves have been developed for rat and pig skin models.**





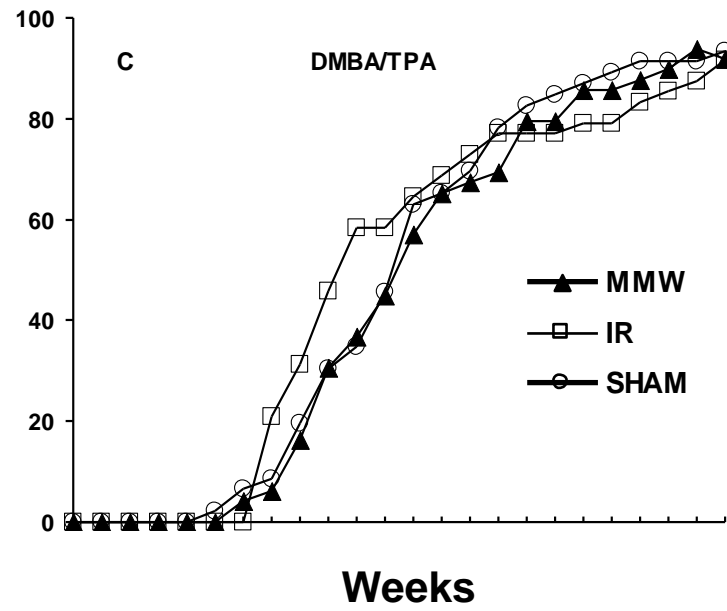
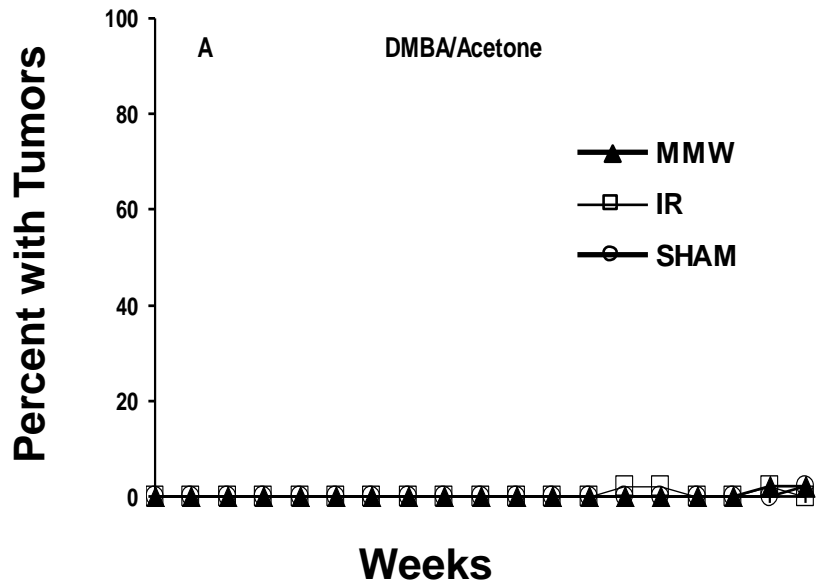
# Will Exposure Cause Cancer?



**No development of skin cancer after ADT exposure**

**Promotion**

**Co-Promotion**



*Results published in Carcinogenesis – Mason et al., 2001*



# Will Exposure Effect Reproduction?



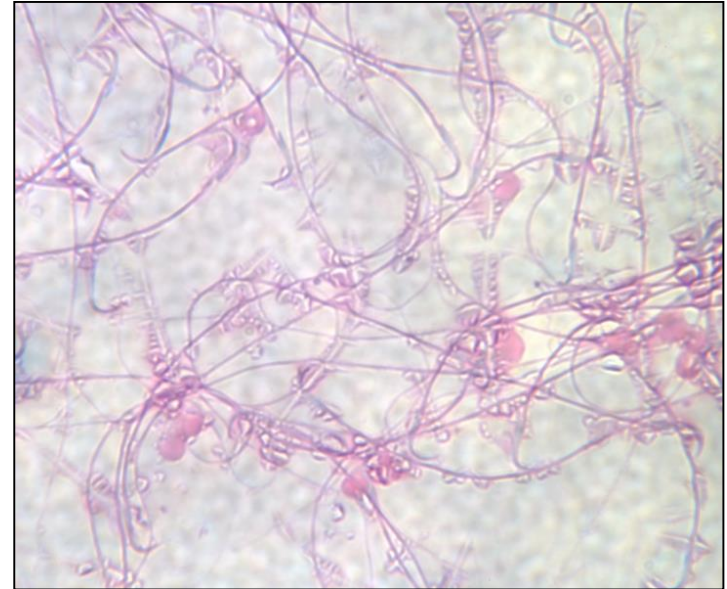
- **Energy from beam penetrates 1/64<sup>th</sup> inch into skin**
- **Male and female reproductive tissues are positioned much deeper than 1/64<sup>th</sup> inch depth**
- **No scientific reason to assume there would be an effect**
- **For ADS use acceptability reasons, male reproductive capability was assessed**
  - **Structures are less protected than female reproductive organs**
- **Also for acceptability reasons, the risk of birth defects was assessed**
  - **No adverse effects were found**



# Will Exposure Effect Male Reproductive Capability?



- **No effect of MMW (or IR) exposure on:**
  - **Sperm motility**
  - **Weight of male reproductive structures**
  - **Sperm production**
  - **Sperm transit time**



**There is no scientific evidence that suggests ADT exposure will have any effect on male reproductive capability.**



# Have there been any injuries?



**From over 13,000 exposures, there have been two (2) reported injuries which required medical attention, and eleven (11) which did not require medical attention.**

**The two which required medical attention were both mishaps; the subjects were accidentally exposed to significantly more than the planned maximum dose:**

- January 1999: an incorrect setup of laboratory equipment. Injury was a quarter-sized blister (second degree burn) and resulted in an outpatient treatment.
- April 2007: a training exercise at Moody AFB, GA, due to procedural shortcomings; corrections included Operator Training and Software. The Airman received second degree burns from a dose estimated to have been at least ~3x maximum. The individual was held overnight after treatment, returned to active duty in two weeks and made a full recovery.

**The eleven which have not required medical attention were on subjects who were exposed properly:**

- All were small (~5mm) blisters, which self-resolved

**Combined, the research shows that there is only a 1/10<sup>th</sup> of 1% chance of injury associated with exposures to Active Denial systems.**

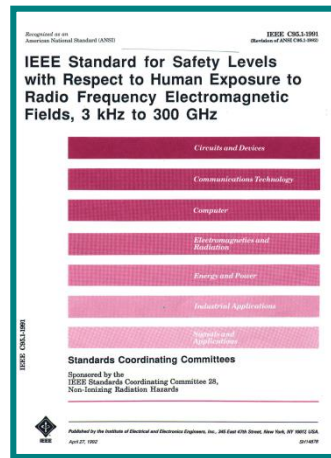


# Long Term Effects

- ADS research on-going and has been for 20 years
- 50+ years research at other radio frequencies
  - No cumulative effect (IEEE C95.1-2005)
- No known long term effects
- We have no data beyond our 20 years of research



WORLD HEALTH ORGANIZATION  
COLLABORATING CENTER





# Bioeffects Summary



- **We know the stimulus**
- **We can predict skin temperature increases & reactions**
- **We know the safety margin for thermal injuries**
- **We know the safety margin for eye damage**
- **ADT exposure does not promote or co-promote cancer**
- **ADT exposure does not effect male reproduction**
- **ADT does not cause birth defects**
- **ADT can be used safely**
- **Warfighters can employ ADT systems effectively & safely**

**ADS Proved Safe & Effective During MUAs**



# Exposure



- **Maximum exposure parameters**
  - **Power Density X Shot Duration = 12 Joules/cm<sup>2</sup>**
- **Stop targeting when:**
  - **Subject raises hands over their head**
  - **Signifies volunteer wants to remove themselves from engagement**





# Participants



- **Must be 18 years old or older**
- **No eyewear restrictions**
- **Disqualification criteria**
  - **Pregnancy: Hazards of test range terrain**
- **Volunteer Statement required signed following in-brief**
- **Pre and post exposure medical screening via survey during in- and out-processing**
- **Follow-up exams when deemed necessary by Medical Advisor**





# When to See the Medic



- **Expected effects**
  - **Pain, tenderness, tingling, skin redness, small blisters**
  - **All observed effects and injuries have been minor**
  - **Rapid recovery, no aftereffects**
- **When to see the medic**
  - **Skin discomfort >15 min**
  - **Any complaint of dryness, irritation of the eye that does not resolve within a few minutes**
  - **Reddening of skin, blisters (no matter how small), tenderness, or tingling that does not resolve within 72 hours**
  - **Whenever you have any questions or concerns**



# Questions