

## **How Do We Make Decisions for Radiation Safety ?**

Ray Johnson, MS, SE, PE, FHPS, CHP  
Director, Radiation Safety Counseling Institute  
Consultant, Dade Moeller Training Academy  
ray@radiationcounseling.org

Health Physics Society Annual Meeting, Sacramento CA  
Session THAM-E.10, Thursday - 7/26/2012

How often do we evaluate risks as part of a process for decisions on radiation safety? Most of us make decisions based on the requirements of regulations (public and worker dose limits), the requirements of our radioactive materials license, or the requirements of our radiation safety plan. In particular, our radiation safety plan usually spells out how we will implement the principles of ALARA. Our normal goal is to reduce radiation exposures to as low as we can reasonably achieve, without regard to the risks. We know in theory that we are reducing risks by reducing exposures, but how much do we really know factually about risks, especially at low doses and low dose rates? As specialists in radiation safety we follow the theory of the linear non-threshold model for understanding the relationship of radiation dose and effects. However, we also know that this model gets fuzzy below a cumulative dose of 100 to 150 millisieverts (10 to 15 rem).

How much do workers or the public really know about radiation risks. For lack of knowing technically, I suggest that radiation professionals, concerned workers, and the public alike make decisions for radiation safety based on gut instinct. These are the urgings of our subconscious mind intended for our protection. Our subconscious is programmed to detect sources of danger and react automatically to protect us. For protection our minds create images of unacceptable consequences to be avoided. Unfortunately the automatic reactions programmed into our subconscious to avoid imminent dangers of snakes, spiders, heights, dark places, and submersion, etc. are not usually appropriate for dealing with dangers of radiation. Risks of radiation injury are usually not imminent, but matters of future random chance. Because we have primarily only heard bad things about radiation for the past 50 years, many people have now included radiation aversion into their automatic subconscious reactions to avoid danger. This may help explain why we find so many people inherently afraid of radiation and making decisions for safety based on an automatic response of their subconscious minds and not on factual understanding of radiation risks.

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Radiationcounseling.org

### How Many of You Work with Radiation ?

- Is your source of radiation safe ?
  - What does Safe mean ?
- How do you know that ?
- What data or understanding did you bring to your decision ?
- How long did you take to answer ?

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### How Do We Make Safety Decisions?

- What information do we rely upon ?
- What observations ?
- What experience ?
- What others have told us ?
- How do we evaluate this information ?

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### Do you have all the facts needed for a fully informed, analytical, rational decision ?

- How much do you rely on information provided by others ?
- How do you judge trustworthy data ?
- Who do you respect as a resource ?
- How would you defend your decision ?

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### Public Decisions for Safety ?

- Many of you were able to answer the question about radiation safety because you already have knowledge and experience ?
- How would you answer the question without direct knowledge or experience ?
- What information would you rely upon ?
- What source would you trust ?
- What would you conclude about radiation safety ?
- How long would it take to decide ?

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### Two Systems for Safety Decisions

1. Conscious - Reason and rational analysis of facts -
  - Favored by technical specialists
  - May lead to intelligent decisions, but, **very slow** and takes effort
  - In an emergency, we often do not have all the facts, time to gather facts, or knowledge to understand them
2. Subconscious - Emotion, instinct, and gut reactions, **very fast**,
  - Does not need all the facts, relies on memory, impressions
  - **Origin of most decisions, especially for safety**

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## How Do We Make Decisions for Radiation Safety ?

### Role of Our Conscious Mind < 1%

- **Slow**, deliberate, rational, thinks, reasons, and makes decisions and choices based on sensory input
- Source of knowing and awareness
- Serves as the captain of our ship, the giver of orders
- Processes information to make decisions
- Can only deal with one thing at a time

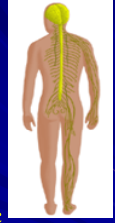


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### Subconscious Mind > 99.999%

- The seat of our emotions / creativity.
- Takes orders from the conscious mind without judgments
- A **Very Fast**, super computer
- Functions 24 / 7 operating the machine we call our body
  - Regulates our heart, our breathing, digestion of food, healing of cells, etc
- Handles thousands of inputs simultaneously for our health and protection
- Programmed to fear / react instantly to danger



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### Role of the Subconscious Mind

- The subconscious reacts automatically to messages from the conscious mind
- Most health effects could be controlled by the subconscious mind
- The subconscious does not judge good or bad
  - Carries out expectations of the conscious mind
- Placebo effect and healing
- What happens to retirees?
- What happens when a spouse dies?
- What will happen in Japan ?

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### Subconscious – Source of Fears

- Fear is a natural response for safety
- We survive by paying attention to fears
  - Reacting as needed for protection
- Some fears we think about before acting
- Others result in automatic subconscious reactions
  - Can we take the time to think about the danger of a snake ?



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### Fears of Radiation are Involuntary

- Instinctive fears: of heights, snakes, spiders, closed spaces, submersion, public speaking,
- Repeated message “Deadly Radiation”
  - Transferred to subconscious mind for protection
  - Radiation is now an instinctive source of fear
  - Fear of radiation – not a conscious choice
- Subconscious reacts automatically to radiation without consulting the conscious mind
- Decision to “RUN” is now automatic



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### How We Make Quick Decisions

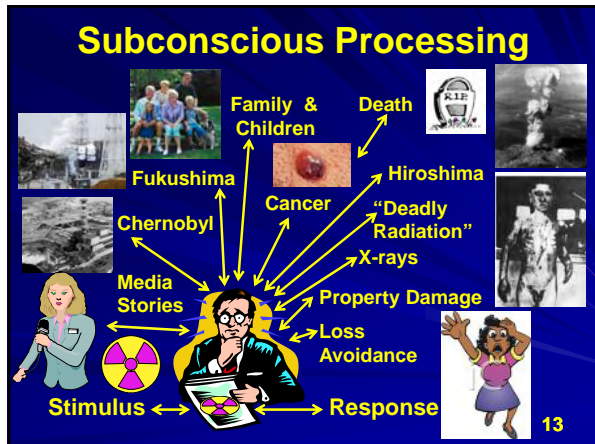
- We process, sort, compare, categorize, and analyze information, in relation to
  - Immediate circumstances - radiation
  - Experiences – what have we heard ?
  - Loss aversion – need to be safe
- With all these inputs we come up with instant judgments
  - Quick judgments are crucial to survival
- Based on limited information
  - May not be best in the long term
  - Is running away the best answer ?



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# How Do We Make Decisions for Radiation Safety ?



## Is it OK to be Afraid ?

■ What will you think of doing when the first responders are running ?

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## Summary

- Our subconscious mind makes instant decisions for safety (loss aversion) based on memory, impressions, and images
  - Predicts danger before it happens, when
    - Not enough data, no time to gather data, no knowledge for interpreting the data
- “Deadly Radiation” is now the basis for instinctive, involuntary fears, like snakes
- May not be best process for radiation decisions

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## Questions ?

[ray@radiationcounseling.org](mailto:ray@radiationcounseling.org)

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