

The Psychology of Radioactive Waste Disposal

Understanding and Dealing with People Issues

Continuing Education Lecture 3

7 – 8 am

Tuesday, February 7, 2012

**Midyear Meeting of
the Health Physics Society
Dallas, TX**

Presented by

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HPS Midyear Meeting

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<http://radiationcounseling.org/>

Agenda

- 7:00** **Welcome, Introductions, Review Agenda**
- 7:05** **Greatest challenge for Radioactive Waste – People issues**
- 7:10** **Radiation Fears and the Subconscious Mind**
- 7:25** **How We Make Decisions for Safety**
- 7:35** **Source of Radiation Fears**
- 7:45** **Fear in Our Culture**
- 7:50** **Future of Nuclear Energy**
- 8:00** **Summary, Questions, Evaluations**

The Psychology of Radioactive Waste Disposal - Understanding and Dealing with People Issues

Ray Johnson, MS, SE, PE, FHPS, CHP
Director, Radiation Safety Counseling Institute
radiationcounseling.org

Continuing Education Lecture
Presentation to the Health Physics Society Midyear Meeting
Dallas, TX February 7, 2012

What is the greatest challenge for radioactive waste disposal, technical issues or people issues? Why do regulators and the public demand such extraordinarily expensive practices for disposal of radioactive wastes? Why does the public seem to mistrust politicians, regulators, industry, and experts regarding such waste disposal? The answer to each of these questions has to do with fears of radiation. These fears arise from images or imagination of unacceptable consequences of exposure to radiation. The subconscious mind of a fearful person will create the most alarming images in order to assure protection of the person. People who are fearful of radiation (basically everyone is afraid under some circumstance) are not aware of images of terrible consequences which originate in the subconscious mind. They just know instinctively that radiation exposure is bad and should be avoided at all costs. Appeals to the conscious mind for rational decisions about the safety of radioactive waste disposal will not change the fearful person's feelings because their fears are from their subconscious mind. The imagination of the subconscious mind will win over the rational conscious mind every time.

A person with subconscious fears will also seek confirmation or justification for those fears. Thus, fearful persons are very open to information about alarming risks from radiation as promoted by the media and anti-nuclear activists. Information provided by radiation experts, which is contrary to the expectations of the subconscious mind of a fearful person, may be viewed with great suspicion and discounted. Efforts to provide a more balanced risk perspective may be heard as propaganda. Fearful people will also gravitate towards others expressing the same fears for confirmation and reinforcement of their fears. Groups will form with a common bond of radiation fears, although they may argue that their concerns are simply prudence for assurance of safety. People reacting to their subconscious fears may rationalize their perceptions with arguments that make no sense for logical, rational, analysis by the conscious mind and understanding by technical experts. People's views of radiation risks will not change without a change in their subconscious minds.

Radiation Fears and the Subconscious Mind

Ray Johnson, Director
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<http://radiationcounseling.org/>
September 19, 2011

While pursuing a continuing quest to better understand the nature of radiation fears, two books have come to my attention which seem to explain a lot. These are: “*The Power of the Subconscious Mind*,” Joseph Murphy, 2007 (reprint) and “*The Genie Within – Your Subconscious Mind, How it Works, and How to Use It*,” Harry W. Carpenter, 2009. I used insights drawn from these books in several presentations at professional conferences this past summer (copies can be downloaded):

- **Japan Nuclear Fears – Real and Perceived Dangers.** A 15-minute presentation to about 150 in a special session on Fukushima Public Information at the annual meeting of the Health Physics Society, West Palm Beach, FL. June 29, 2011. Included a handout of five pages.
- **The Psychology of Radiation Safety – How to Answer Questions.** A 15-minute presentation to about 200 at the annual meeting of the Health Physics Society, West Palm Beach, FL. June 29, 2011. Included a handout of five pages.
- **How We Formed Our Profession – the Psychology of Radiation Safety, It’s All About Fears.** A 30-minute invited presentation for over 150 at an American Academy of Health Physics Special Session, Health Physics Society Annual Meeting, West Palm Beach, FL, June 28, 2011. Included a handout of 9 pages.
- **Japan Nuclear Fears - Real and Perceived Dangers.** A 30-minute presentation to about 350 for a special session on the Japan Nuclear Incident at the annual meeting of the American Industrial Hygiene Association in Portland, OR. May 16, 2011. Included a handout of 12 pages.

To help understand the workings of the subconscious mind, we need to distinguish the functions of the conscious and subconscious. Our conscious mind functions rationally, thinks, reasons, and makes decisions and choices based on sensory input. This function occupies about 10% of our brain and serves as the captain of our ship, the giver of orders. Our conscious mind can only deal with one thing at a time. The subconscious mind makes up 90% of our brain and is the seat of our emotions and creativity. Our subconscious mind takes orders from the conscious mind without judgments. It is a multi-tasker which functions 24/7 operating the machine we call our body. Without our awareness, the subconscious mind regulates our heart, our breathing, the digestion of food, the healing of cells, etc. Better than any computer, our subconscious handles thousands of inputs simultaneously for our health and protection.

Fear is a natural response of our subconscious to protect us from danger. We have survived by paying attention to our fears and reacting accordingly. After hearing repeatedly the message “radiation is deadly” our conscious mind has transferred this message to our subconscious for our protection. Our subconscious mind hears that radiation is very dangerous and to assure our safety our subconscious attaches terrible feelings (fears) to radiation. By linking radiation with emotional trauma, a powerful negative association is formed to avoid this source of danger and a radiation phobia is born. Thus fear of radiation is no longer a rational conscious choice based on logical analysis, but a gut instinct (feeling). Our subconscious does not consult with our conscious mind before raising the alarm of fear. For protection our subconscious has to react before we can even think about it. Avoidance of radiation is now an automatic response.

Since fears of radiation come from our subconscious, efforts to speak to the rational thinking mind may not help. Giving out facts about radiation safety does not change the feelings. Fears of radiation are based on images of unacceptable consequences. All fears are the result of imagination of what will happen next. A person afraid of heights imagines getting near the edge and falling. Appeals to the conscious mind with explanations about reality and safety may not change these images and the basis of fear. The least helpful response is to say, “You do not have to be afraid.” Thus, trying to tell people that they do not need to fear radiation does not connect with their gut feelings and images of danger. The imagination of the subconscious mind will win over the rational conscious mind every time.

If we ask a person who is fearful of radiation, “Why are you afraid?” they do not know the answer which is in their subconscious. So they are likely to rationalize an answer that may not make any sense to a technical person. At this point, if a technical person attempts to correct errors of technology, the fearful person may become distrustful and even angry because their fears are not about facts, but feelings. Experts are wrong to think they can ease fears of radiation by simply “getting the facts out.” While facts are evaluated by the rational conscious mind, fears come from subconscious gut feelings, not logical analysis. The gut feeling of a fearful person will tell them that even though radiation injuries are very unlikely to occur, that is not an adequate justification for ignoring risks of possible future effects.

Radiation – To Fear or Not to Fear?

**Ray Johnson, Director
Radiation Safety Counseling Institute
<http://radiationcounseling.org/>
October 25, 2011**

Most everyone will admit that they are afraid of radiation, at least under some circumstances. Even career radiation safety professionals may find themselves in situations which raise concerns for radiation exposures. Notice I used the word “concerns.” Often men, in particular, will tell me that they are not afraid, but they may have concerns. Our society seems to encourage men not to be afraid. However, I suggest that the words “concern” and “fear” essentially mean the same thing.

Gavin De Becker tells us that fears are natural and OK. Fear is a gift for our protection as a natural response of our minds for safety. Our minds are always on the alert for danger. We have survived as a species by paying attention to our fears and reacting as needed for protection. Psychologists define fear as a response to a specific stimulus, such as pain or imminent danger. De Becker would call such responses a true fear as part of our defense mechanism. However, since radiation does not produce any physical sensation or stimulus, fear of radiation is not a true fear, based on something happening right now (real danger). Radiation fears are based on images of predicted unacceptable consequences (perceived danger) of radiation exposure.

Fears based on imagination of perceived dangers have to be learned. They are not a natural or instinctive fear, such as fear of snakes. Radiation fears are more of a worry or anxiety related to what we are told about radiation effects. Images of consequences may include cancer and death as conveyed by the media which typically reports radiation as “deadly radiation.” Unfortunately much of the fear inducing reports on radiation are based on mythology (something believed which is not technically true, based on false premises and misunderstanding). De Becker says that we worry about what has a low probability of happening, because if the probability is high, we take action. Worrying about radiation is a distraction from what is happening in favor of what we imagine might happen. Will Rogers reportedly said, “I have experienced a great many terrible things in my life, a few of which have actually happened.” Imagination can conjure powerful possibilities.

Media reports often link radiation with cancer. To give the media some leeway, we could say they are simply reporting what “everyone knows” namely, radiation is deadly. Such reports raise fears and as public concerns rise reporters respond with more fearsome stories of radiation, and the loop expands. Stories about cancer get our attention because cancer is a word which is black and frightening, and stirs bleak feelings. One writer describes cancer as a crab-like scavenger reaching its tentacles into the life of the soul as well as the body. It destroys the will as it gnaws away at the flesh. Therefore, it is easy to conclude we should avoid any prospects of cancer by the precautionary principle, “It is better to be safe than sorry.” Interestingly, while people worry about radiation causing cancer, more than half of all cancers might be prevented by lifestyle changes, such as exercise, weight control, and not smoking.

Fear of radiation itself may be a danger to us. Our thoughts of being harmed may actually be harming us. Fear, anxiety, stress, and worry kill through: high blood pressure, addictions, drugs, heart disease, weight loss or gain, depression, insomnia, suicides, abortions, and post traumatic

stress disorder. Psychological effects may be equally, if not more, damaging than physical health effects from radiation. In 1933 President Roosevelt said, "...the only thing we have to fear is fear itself, nameless, unreasoning, unjustified terror which paralyzes needed efforts to convert retreat into advance." Unreasoning fear may cause us to make increasingly foolish choices in daily decisions about risks.

Our Culture of Fear

Daniel Gardner says that we live in an interesting time where people commonly shrug off great risks, such as automobile travel, and yet live in great fear of typically trivial risks such as radiation. Part of the answer about why we live in a culture of fear is self interest. Fear sells. Fear makes money. Fear is a fantastic marketing tool. We cannot turn on the news or open a paper without seeing fear at work. The countless companies and consultants in the business of protecting the fearful from whatever they may fear know it only too well. The more fear, the better the sales. Activists and NGOs know that their influence with the media depends on telling the scariest stories possible. Gardner says the media, too, know the value of fear. The media are in the business of profit, and crowding in the information marketplace means the competition for eyes and ears is steadily intensifying. Inevitably and increasingly, the media turn to fear to protect shrinking market shares because a warning of mortal peril—"A story you can't afford to miss!"—is an excellent way to get someone's attention.

Fear wins elections, expands budgets, and sells news media. Fear is an excellent way to promote the interests of groups to boost memberships, and donations, and enhance political clout. We encounter these messages of fear daily. The opportunities for finding a fear, promoting it, and leveraging it to increase sales are only limited by imagination. Fear of death is a great promoter. Drug companies like to show how we have lost control of our lives and can regain control with a medication. There is money to be made by marketing fear. "Unreasoning fear" is bad for society, but great for marketers.

De Becker calls the promotion of fear by the media "electronic terrorism" and devotes a whole chapter to the newspeak of fear. Media stories are popular because we are good with stories and bad with numbers. A touching story is more memorable than the best analysis, even though anecdotes are not data and don't prove anything. Thoughts of risks are hard to turn off when fear is sprayed at us like tear gas from every TV—next up, another nightmare, next up, another tragedy, next up, another terrible thing from someone's imagination. Language, images, and graphics are carefully chosen to make each story seem urgent or significant. Viewers are left swimming in pictures of fear without a balanced perspective on the situation.

De Becker says that news should focus on what is known, instead news often focuses on what is not known and builds on speculation, supposition, rumor, gossip, projection, and conjecture. The role of the media is to promote what makes news – novelty, conflict, impact, and human interest. Dramatic stories, such as the Fukushima reactors, out sell the slow, routine, and massive toll taken by smoking, alcohol, and obesity. It seems like the definition of news is "bad news." Although we do not like to hear bad news, we have to pay attention in case it's coming our way. De Becker suggests that with fearful images filling our minds, qualifying words, such as "allegedly, unconfirmed, possibly, could, potentially, conceivably" drop from our consciousness, leaving us with a sense that danger is everywhere around us. Perhaps TV news should just begin by saying: "We are surprised that you made it through another day, here is what happened to those that didn't.

The media like to portray radiation as “deadly.” This implies that all will die if exposed to radiation and begs the question whether radiation is deadly in any amount. In truth, we are extremely resistant to harmful effects of radiation. Truth in advertising should say, “Today a person was exposed to highly survivable radiation.” However, after sixty years of bad news about radiation we are fertile soil for fear mongers. The “War on Terror” has done well to establish a culture of fear. Fear obscures reason, intensifies emotions, and makes it easier to mobilize public opinion. Consequently, Americans remain inordinately fearful of unlikely dangers, such as radiation.

References

- The Science of Fear –Why We Fear the Things We Shouldn’t and Put Ourselves in Greater Danger, Daniel Gardner, 2008
- The Gift of Fear – and Other Survival Skills that Protect Us from Violence, Gavin De Becker, 1997
- Fear Less – Real Truth About Risk, Safety, and Security in a time of Terrorism, Gavin De Becker, 2002
- The Culture of Fear –Why Americans are Afraid of the Wrong things. Barry Glassner, 2010
- Conquering Fear – Living Boldly in an Uncertain World, Harold Kushner, 2009
- Extreme Fear – Jeff Wise, 2009

How Do We Make Decisions for Radiation Safety?

Ray Johnson, Director
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<http://radiationcounseling.org>
January 25, 2012

The answers to this question are very complex. Despite my studies for 25 years with the Myers-Briggs Type Indicator (MBTI) trying to understand how people acquire information and make decisions, I still have much to learn. While the MBTI provides helpful insights on dominant data gathering preferences using our five senses or intuition and dominant decision making preferences using either logical thinking or feeling, decisions for safety involve all of these preferences at the same time. Our brains are programmed to protect us in many different ways. In this monthly Newsletter I would like to share some observations drawn from a recent book by David Ropeik, *“How Risky is it, Really? Why Our Fears Don’t Always Match the Facts.”* The McGraw Hill Companies, Inc. 2010 (Amazon - \$13.60). These observations will also build on materials presented in earlier Newsletters on September 19, 2011 *“The Power of the Subconscious Mind”* and on October 25, 2011 *“Radiation – to Fear or Not to Fear?”*

People make decisions for radiation safety based on how much they fear radiation. There is nothing wrong with fear which is a natural response of our minds for our safety. We have survived as a species by paying attention to our fears and reacting as needed for protection. While we may take time to think about dangers, most of our fears originate at a subconscious or instinctive level which reacts very rapidly as appropriate for protecting us from imminent danger, such as a striking snake. People have commonly believed that there are two separate systems involved in safety decisions: 1) reason and rational analysis of facts and 2) emotion, instinct, and gut reactions. Ropeik says these are not separate systems. We are not perfectly rational or completely emotional and instinctive. System 1 seems to be favored by technical specialists and may lead to more intelligent judgments, however, this approach is very slow and takes more effort. Also, we often do not have all the facts for making a good decision, the time for gathering the facts, or the knowledge to understand what the facts mean. On the other hand, the system often favored by non-technical people based on gut instincts and feelings is much faster and does not need all the facts before sounding an alarm for safety. Ropeik says we actually use both systems all the time and he says we are *Affective*. This means we make decisions using both our minds and heart. We decide based on facts and how we feel about the facts, as well as instincts, values, cultural views, personal experience, and life circumstances.

We are Programmed to Fear First and Think Second - Our first reactions to danger happen subconsciously in the part of our brain close to the top of the spinal cord called the amygdala. Sensory information speeds from our five senses through our spinal cord to a group of cells in the center of our brain called the thalamus. These cells act as a relay station between the midbrain which sits directly on top of the spinal cord (sensory pathway) and the larger cerebral cortex (where thinking occurs). The thalamus also shares a signal with the amygdala which resides closer than the cerebral cortex, so it responds quicker. The amygdala recognizes

signals of danger and immediately mobilizes automatic responses for protection. Ropeik calls these Fight, Flight, and Freeze responses. Before you are even consciously aware of danger, your body has already reacted without benefit of a slow rational analysis. If a snake is about to strike you, you do not want to take time to process the degree of danger. Somewhat later processing of information by the cerebral cortex may modify the fear response.

While the amygdala responds immediately to external indications of danger, it may also respond to memories of previous signs of danger. These memories of danger are implicit, meaning that you cannot consciously recall them, but the amygdala, whose goal is to protect us, will remember. As the amygdala responds it also enhances our ability to consciously recall explicit memories of danger. Thus, recall and reaction are speeded up when the same danger is encountered again.

Programmed Fears and Flaws for Dealing with Radiation - Some fears seem natural or common to most everyone, such as fear of the dark, snakes, spiders, heights, closed spaces, and being underwater. Other fears include public speaking, fear of intimacy, and fear of failure or social rejection. These fears are also about survival because we have learned to rely on others to protect us. Our sensory system and amygdala are constantly scanning for signs of danger and quickly leap to action at the first hint. The amygdala takes control immediately with a fear response which overrides conscious processes. While this may be appropriate for response to a striking snake, this process does not do well when considering issues such as safety of radiation. Our programmed fear response does not know what to do with radiation which is not programmed into our alert system. However, other parts of our subconscious brain have evolved to allow us to process information and make quick judgments for our protection.

Bounded Rationality - Ropeik describes *Bounded Rationality* as our approach to making decisions when we do not have all the data, time to acquire more data, or the intellectual ability to process the data. Ropeik shows that we are constantly making judgments without perfect knowledge, but doing the best that we can at the time. We process, sort, compare, categorize, and analyze information in relation to our immediate circumstances, experiences, and life factors, such as health, wealth, traditions, and lifestyles. With all these inputs we can come up with instant judgments. Such quick judgments are crucial to our survival. However, because they are based on limited information, these decisions may not always be best for us in the long run.

Mental Shortcuts - Some of the tools described by Ropeik for mental shortcuts to quick decision making include: the framing effect, categorization, loss aversion, anchoring and adjustment, awareness and recall, and optimism bias. Much of how we see a certain risk has to do with how it is framed or presented (in DC, this is called spin). We also tend to categorize perceived risks that seem similar and this could lead us to jump to conclusions based on small samples. This shortcut may also lead to problems with probabilities where we see patterns that seem suspicious (perceived cancer clusters lead to questions of causation when the clusters may be purely random chance). Because we are inclined to avert losses, we tend to hold onto stocks longer than we should when the value is going down. For our survival we are also very sensitive to factors which may cause a loss of health. The media is especially vocal on losses (dangers)

that may affect our health or that of our children. Anchoring is a process which influences the starting point or anchor for a decision. People tend to be more influenced by the first data presented. Recall has to do with whether the danger comes readily to mind. The greater our recall and awareness of a certain risk, the more concerned we become. Vivid, dramatic, or frightening events are recalled more quickly (where were you on 9/11/01?). The media plays a big part on our recall abilities according to how they report stories. For example, many people fear nuclear power plants because they believe the plants might blow up like an atomic bomb. Even after learning that this can't happen, images of Hiroshima, Nagasaki, Chernobyl, and Fukushima come so readily to mind that these images may override any rational judgment about risks from nuclear power.

Numeracy may also be an issue when people try to comprehend risks from radiation. Because many people have trouble with numbers, difficulties with trying to understand the data may lead people to rely on their affective mental shortcuts. People are also often optimistically biased that certain risks will not happen to them (such as health risks of being overweight, heart disease, stroke, diabetes, etc.). Certain ways of dying get more attention, such as cancer (the predominant fear for radiation). As people associate radiation with cancer, fears of radiation risks escalate far beyond the fears of much greater health risks listed above. The fact that "we are actually very resistant to harmful effects of radiation" gets lost.

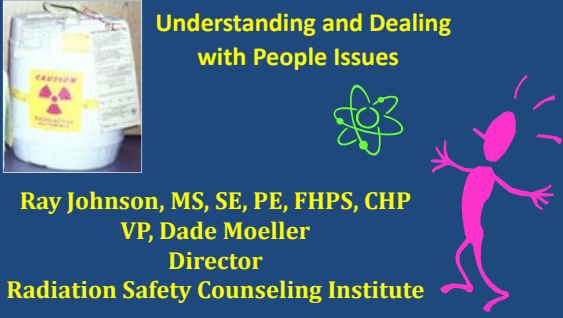
Ropeik says that risks have personality traits that help us instinctively judge their character, even before we consciously process the facts. The media have done a great job conditioning people's minds with the words "deadly radiation." Thus, today the word "radiation" alone takes on the personality trait of great risk independent of any actual facts.

The Role of Trust - Another factor in decisions for radiation safety is trust. Our survival may depend on knowing who to trust for our safety. Promises of absolute safety may lead to mistrust if something happens. Lack of trust increases fears. Organizations perceived as creating risks are not likely to be seen as trustworthy. The appearance of withholding information is a cause for mistrust and increased fears. Failing to take fears seriously, failing to be open, and failing to share the decision making process with affected people all lead to mistrust.

If any of the above discussion attracts your interest, you are encouraged to get the book by Ropeik who provides much more elegant perspectives than I could offer in this Newsletter.

The Psychology of Radioactive Waste Disposal


Understanding and Dealing with People Issues



Ray Johnson, MS, SE, PE, FHPS, CHP
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Greatest Waste Disposal Challenge?


- Technical Issues or People Issues ?
- Do we know what to do with rad waste ?
- Why do regulators and the public demand such extraordinary precautions ?
- Why does the public seem to mistrust us ?
- Why, "Not in My Back Yard" ?
- Answers - have to do with fears of radiation originating in the subconscious mind



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Our Conscious Mind

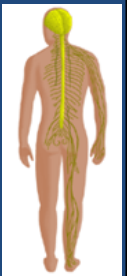
- Functions rationally, thinks, reasons, and makes decisions and choices based on sensory input
- Occupies about 10 % of our brain
- Source of knowing and awareness
- Serves as the captain of our ship, the giver of orders
- Can only deal with one thing at a time
- Processes information to make decisions using :
 - Thinking or Feeling



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Subconscious Mind


- The seat of our emotions / creativity.
 - Makes up 90 % of our brain
 - Nervous system / solar plexus
- Takes orders from the conscious mind without judgments
- A multi-tasker
- Functions 24 / 7 operating the machine we call our body.
 - Regulates our heart, our breathing, the digestion of food, the healing of cells, etc
- Handles thousands of inputs simultaneously for our health and protection



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Subconscious Fears


- Our subconscious is programmed to react instantly to danger - fear response
 - Before we have time to think - will it strike ?
- Fears arise from images of danger
- Subconscious mind creates alarming images to assure quick protection
- Actually our subconscious reacts even before our conscious mind is aware of the images



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What is Fear ?


- Psychologists define fear as a response to a specific stimulus
 - Such as pain or imminent danger
- Since radiation produces no sensation
 - Not a true fear based on imminent danger
 - Radiation fears are based on imagination
 - Manufactured fears based on images of consequences
- Many radiation fears are also based on mythology
 - Something believed which is not technically true
 - Based on false premises and misunderstanding



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Nothing Wrong with Fear


- 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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The Gift of Fear

- Fear is a gift for our protection
 - True fear is part of our defense mechanism
- Worries or anxieties are based on our memories or imagination
 - Worry is not a true fear, but a choice
- Many fears are learned
- Does anyone have a true fear of radiation?



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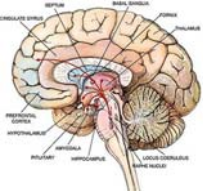
Two Systems for Safety Decisions

- Reason and rational analysis of facts
 - Favored by technical specialists
 - May lead to intelligent decisions
 - Slow and takes effort
 - Often we do not have all the facts, time to gather facts, or knowledge to understand them
- Emotion, instinct, and gut reactions
 - Much faster,
 - Does not need all the facts
- Actually we use both systems all the time
 - We use both our heads and our hearts

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Fear First – Think Second

- First fear reactions are subconscious
 - Occur near top of spinal cord - amygdala
- Sensory data speeds from five senses
 - Through spinal cord to center of brain -thalamus
 - Thalamus acts as relay between midbrain and larger cerebral cortex
- Amygdala is closer
 - Recognizes danger first
 - Mobilizes body for Fight, Flight, or Freeze
 - Before thinking occurs



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Amygdala Remembers Danger

- Amygdala responds to external signals
- Also responds to memories of danger
- These memories are implicit
 - Cannot consciously recall them
- Amygdala remembers
 - goal is for our protection
 - enhances recall of explicit memories
- Both recall and reaction are speeded up
 - When the same danger is encountered again



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Amygdala on Guard

- Sensory system and amygdala constantly scanning for signs of danger
- Quickly leaps to action at first hint
- Amygdala takes control immediately
 - Fear response
 - Overrides conscious thinking processes
- OK for striking snake
- Not good way to decide on radiation safety
- Amygdala not programmed for radiation
 - Our subconscious has learned other shortcuts to process information quickly

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Fears and Imagination

- All fears are based on imagination
- Fears summon powerful predictive forces
- Fear is about what might happen next
 - Not what is happening now
- Example – fear of heights
- If we tell that person, “You do not need to be afraid,” will that help them?
- Radiation fears are based on imagination of unacceptable consequences
 - Cancer and death



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Fears of Radiation are Involuntary

- Similar to fear of heights, spiders, snakes,
- Can we talk a person out of their fear of snakes?
 - by saying, “Its only a harmless garter snake”
- Can we change a person's fears of radiation?
 - By saying, “ You do not need to be afraid, its only like a chest x-ray”
- If we ask, “Why are you afraid?”
 - They do not know - unconscious mind
 - They will try to rationalize an answer



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Fear May Be the Greatest Danger from Radiation

- Fear, anxiety, stress, and worry kill through
 - high blood pressure
 - addictions, drugs
 - heart disease
 - weight loss or gain
 - depression, insomnia
 - suicides, abortions
 - post traumatic stress disorder



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What is Your Risk Response

- Bioterrorism is a serious health threat?
- Pesticides are a serious health threat?
- Driving with cell phones is a serious threat?
- Did you have all the facts needed for a fully informed, analytical, rational decision for any of these questions?
- We all make judgments and decisions without perfect knowledge

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Bounded Rationality

- We process, sort, compare, categorize, and analyze information, in relation to
 - Immediate circumstances
 - Experiences
 - Life factors, such as health, wealth, traditions, and lifestyles
- 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 run



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Mental Shortcuts

- How do we make decisions
 - When we do not have all the data
 - No time to acquire more data
 - No understanding to process the data
- We are constantly making judgments
 - Without perfect knowledge
 - Doing the best that we can




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Mental Shortcuts


- **Framing**
 - Much of how we perceive a risk has to do with how is presented
 - In DC this is called “spin”
- **Categorization**
 - We group risks that seem similar
 - May jump to conclusions based on small samples
 - Leads to problems with probabilities
 - Suspicious patterns (cancer clusters) can lead to conclusions on causation, which may be random chance



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Mental Shortcuts

- **Loss aversion**
 - Concerns for loss of health, rather than doing things for good health
 - Media are good at telling us what may affect our health or our children
- **Anchoring and adjustment**
 - Has to do with a starting point or anchor
 - We are influenced more by the first data



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Mental Shortcuts


- **Awareness and recall**
 - Does the danger come readily to mind?
 - Greater recall = greater concern
 - Dramatic events are recalled quicker
 - Media has big role in recall
- **People worry that nuclear plants could blow up**
 - Even after learning this is not possible
 - Images of Hiroshima, Chernobyl, Fukushima come so readily to mind they override rational judgment about risks of nuclear power



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Mental Shortcuts


- **Optimism bias**
 - People believe certain risks will not happen to them
 - Such as being overweight, heart disease, stroke, diabetes, alcoholism, smoking
 - Some ways of dying get more attention
 - Cancer
 - Fears of radiation risks rise above those listed
- **Numeracy**
 - People have trouble with numbers and rely on mental shortcuts



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Dealing with Fears of Radioactive Wastes


- Experts are wrong to think they can ease fears by simply “getting the facts out”
- While facts are evaluated rationally, fears come from our subconscious gut feelings, not based on logical analysis
- Our gut tell us that even though radiation injuries are very unlikely to occur,
 - that is not an adequate justification for ignoring the risk of possible effects.
- Judgments are commonly made on the basis of anecdotes and speculation



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Where Would We Be – Without Fear ?

- How many of us would be here today if people were not afraid of radiation ?
- Is our profession built on fears ?
- The words “Radiation Safety”
 - Imply risks and a need for caution or safety
- Protection for safety is to avoid what we fear
 - unacceptable consequences of radiation exposure
 - Consequences which we imagine




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Developments for Safety

- Motivated by fears
- Fears are basis for anti-nuclear sentiments, aversion to nuclear power, nuclear wastes, and nuclear bombs
- Fears have resulted in very conservative practices for radiation safety
- Precautionary principle
 - Caution in response to uncertainty

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Basis of Radiation Fears




- When did radiation become fearsome?
 - 1945 - Hiroshima / Nagasaki
 - 1979 - Three Mile Island
 - 1986 - Chernobyl
 - 2011 - Japan, Fukushima Daiichi Reactors
- Is there a good basis for radiation fears?
- Is radiation deadly? What is the evidence?
- How many people in the US have died from radiation exposures? Where? When?
- How much radiation does it take to cause effects? Death?

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Common Views Behind Radiation Fears


- Fearful images of consequences, such as cancer and death
- Dread and expectations of catastrophic consequences
- No way to know if you have been exposed
- If you know, it may be too late
- You do not know what will happen, but you know it will be bad
- Possible effects on children and future generations
- Possible long-term harm to property and property values
- You have no control and there is no escape



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Sources of Radiation Fears

- Perceptions of radiation risks
 - Related to images of unacceptable consequences
- Lack of information
 - Forces people to rely on
 - What they already know or believe about radiation
 - Use of imagination
 - Worst case images of disaster



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Fear of Radiation

- Psychological effects may be equally, if not more, damaging than physical health effects
- Fear is created by the unconscious mind as a protective mechanism
- Result of linking radiation with emotional trauma
 - Real life injuries - not likely
 - Portrayed by news, movies, TV shows
- Powerful negative association, unconscious mind says this is very dangerous and to avoid radiation, I will attach terrible feelings to radiation, to assure that I will be safe
- A radiophobia is born

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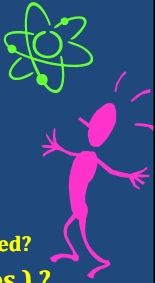
Radiation Phobia

Fears arise from the question, "What if..?"

- What if I am exposed to radiation?
- What if I get contaminated?
- What if my children are exposed?
- What if my property gets contaminated?

Basis of phobias (fears / images) ?

Ask **"What's so bad about that ?"**



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Dread of Radiation

- You cannot see it, smell it, or feel it
 - We rely on our five senses to warn us of danger
 - No one has ever had a direct experience of radiation
 - Like touching a hot pan or a live electric wire
- Many feel defenseless against radiation
- Many may conclude,
“If radiation is there, it is bad for you!!!”
 - Therefore, for many people no radiation is acceptable

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Two Word Risk Assessments

- Media avoids complex risk assessments with only 2 words
 - “Deadly Radiation”
 - Is there any other kind?
 - Is all radiation deadly?
 - Does the type or amount matter?
- Media has created and perpetuates a mindset against radiation
- Now part of everyone’s subconscious alert to danger
- Putting these two words together
 - Assumes - Cause and Effect



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Role of Fear in Our Lives

- Fear can be a constructive emotion. When we worry about a risk, we pay more attention to it. Fear keeps us alive and thriving.
- In 1933 Roosevelt said, “...the only thing we have to fear is fear itself, nameless, unreasoning, unjustified terror which paralyzes needed efforts to convert retreat into advance.”
- In fact, unreasoning fear may cause us to make increasingly foolish choices in daily decisions about risks.

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Why Do We Fear So Much?

- Why do we shrug off great risks and why have we become a culture of fear ?
- Part of the answer is self interest. Fear sells. Fear makes money. Fear is a fantastic marketing tool.
- We cannot turn on the news or open a paper without seeing fear at work.
- Activists and NGOs know that their influence with the media is to tell the scariest stories possible.
- Media also know that competition in the marketplace is related to promoting fears

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Basis of Radiation Fears


- Inability to see, feel, smell, or detect by our senses
 - Also true for many chemical toxins, mercury, PCBs, dioxin, asbestos
- Word association of nuclear weapons, nuclear energy, radioactive wastes
 - Radiation was actually cause of few deaths from bombs
- Causes cancer



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Stories Promote Fears


- We are good with stories and bad with numbers.
- The fact that 3,000 died on 9/11 does not carry the same feeling as watching the buildings collapse
- A touching story is more memorable than the best analysis.
 - However, anecdotes are not data, and don’t prove anything



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Worry

- We worry about what has a low probability of happening
 - If probability is high, we take action
- Worrying about radiation is a distraction from what is happening in favor of what you imagine might happen
 - Imagination can conjure powerful possibilities




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Results of Worry

- I've experienced a great many terrible things in my life, a few of which have actually happened.

Will Rogers



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How Nuclear Fears Perpetuate

- Confirmation bias – Once we have formed a view, we embrace information that supports that view while ignoring, rejecting, or harshly scrutinizing information that casts doubt on it. Once a belief is established, our brains will seek to confirm it.
- Seeking to confirm our beliefs seems natural, while it seems strange to look for evidence that contradicts our beliefs.
- Groups tend to hold more extreme beliefs than individuals. Confirmation bias further strengthens those beliefs, until everyone is convinced of mortal danger.
- Media reports what “everyone knows” radiation is deadly.

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We Are All Afraid of Something

- What are we afraid of ?
 - What we worry about – loss of family
 - Failure – loss of employment, loss of trust, or loss of credibility
 - Embarrassment – appearing stupid
 - Change - which may leave us out
 - Losing too much - money, status, security
 - Getting hurt – feelings or physical
 - Loss of relationships – loss of friends or loved ones
 - What we do not understand - how much do people generally understand about radiation ?



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Fear in Our Future

- Wins elections, expands budgets, sells news media,
- Fear is an excellent way to promote the interests of groups to boost memberships, donations, and enhance political clout.
- We encounter these messages of fear daily.
- The opportunities for finding a fear, promoting it, and leveraging it to increase sales are only limited by imagination.

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Marketing of Fear

- If people believe they can be protected by a pill (KI) they will buy out all stocks.
- Fear of death is a great promoter.
- Drug companies like to show how we have lost control of our lives and can regain control with a medication
- There is money to be made by marketing fear. “Unreasonable fear” is bad for society, but great for marketers.

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Hard to Turn off Thoughts of Risks

- Especially when fear is sprayed at us like tear gas from every TV
 - Next up, another nightmare
 - Next up, another tragedy
 - Next up, another terrible thing from someone's imagination
- Its too hard to be on constant duty
 - Its very stressful to live like this
- We have an opportunity to become less controlled by unwarranted fear
 - Turn off the news



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Role of the Media

- What makes news – novelty, conflict, impact, and human interest.
- The dramatic out sells the slow, routine, and massive toll taken by smoking, alcohol, and obesity.
- Definition of news is “bad news”.
- We do not like to hear bad news, but we want to hear about it in case its coming our way.



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Electronic Terrorism

- America against America
 - When our own TV news terrorizes us
- News should tell us:
 - What is happening
 - What has happened
- News should not make up stories about what “might” happen in some awful version of the future



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Electronic Terrorism

- Language, images, and graphics are carefully chosen to make each story seem urgent or significant
- Viewers are left swimming in pictures of FEAR
 - Without a balanced perspective on the situation
- News should focus on what is known
 - Instead news focuses on what is not known
 - Builds on speculation, supposition, rumor, gossip, projection, and conjecture

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TV News

- With fearful images filling our minds
 - Qualifying words: “allegedly, unconfirmed, possibly, could, potentially, conceivably” drop from our consciousness, leaving us with a sense that danger is everywhere around us
- TV news should just begin by saying:
 - We are surprised that you made it through another day
 - Here is what happened to those that didn't

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The Newspeak of Fear

- “Deadly”
 - “Deadly Radiation”
 - Is radiation “deadly” in any amount?
 - Deadly implies that all will die
- In truth, we are extremely resistant to harmful effects of radiation
 - Truth in advertising should say,
“Today a person was exposed to highly survivable radiation”

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Radiation and Cancer

- Reports on radiation raise fears, public concern rises, and reporters respond with more fear stories, and the loop expands.
- Everyone knows radiation causes cancer
- Cancer is a word which is black and frightening, it stirs bleak feelings, reporters experience those feelings and their perceptions are shaped by them.

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We Want to Avoid Cancer

- It's easy to conclude - "better to be safe than sorry."
- Cancer is a crab-like scavenger reaching its tentacles into the life of the soul as well as the body. It destroys the will as it gnaws away at the flesh.
- We worry about cancer when more than half of all cancers might be prevented by lifestyle changes, such as exercise, weight control, and not smoking.

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Future of Nuclear Energy – Public Sentiments

- Cannot rely on nuclear power
- Cannot guarantee safety, no option for radioactive wastes
- Need to revise plans for more nuclear
- Worried about children and grandchildren
- Nuclear accidents could take great toll of lives
- Other energy sources are safer - wind, solar



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Fears in Our Future

- After sixty years of bad news about radiation we are fertile soil for fear mongers.
- The "War on Terror" has done well to establish a culture of fear
- Fear obscures reason, intensifies emotions, and makes it easier to mobilize public opinion.
- Americans remain inordinately fearful of unlikely dangers, such as radiation



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Why Will People Issues Be So Difficult ?

- Would it be better if people were more rational?
- Are we stressed by emotional issues ?
- Is fear a factor in dealing with radioactive wastes?
- How many of us have had training in dealing with feelings ?
- How well do we understand feelings ?
- How much of our lives are affected by feelings that we do not understand ?



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Fear Comes from Subconscious

- Our subconscious mind (gut feeling) is the source of fears
- Our subconscious mind does not consult with our conscious mind (rational thinking) before raising the alarm of fear
- Speaking to the rational thinking mind does not reach the subconscious (gut feeling)
- Giving facts may not change the feelings

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Most Believe Radiation is Dangerous

- Gut feeling based on what they have heard
- Continuous repetition of messages about radiation dangers have instilled an aversion to radiation at a subconscious level (gut feeling level)
- The role of our subconscious mind is to protect us from danger, before we can even think about it.
- Thus, avoidance of radiation is now an automatic response

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Views on Radioactive Waste

- Historically we have thought
 - If we could present better information,
 - People's views may be changed
- Is it working ?
- Those who believe radiation is bad will seek confirmation,
 - Others with same views
 - Suspicious of what does not support these views



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Summary

- Challenge for radioactive waste - fears
 - Radiation fears are based on images in the subconscious mind
 - Automatic response for protection
- Appeals to conscious mind for rational decisions will not change fearful person's feelings
- Imagination by the subconscious mind will win every time
- Answers to radioactive waste may be a better understanding of people issues and fears



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Conclusions

- Hopefully this review of nuclear fears has provided a useful perspective.
- Most likely nuclear fears will be active long after the technical issues are resolved.
- Dealing with fears of radioactive wastes will be a long and difficult process



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