Is Telling the Truth the Answer to Effective Radiation Risk Communication?

A Continuing Education Lecture (CEL)

Health Physics Society Midyear Meeting
Norfolk, Virginia

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by

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Is Telling the Truth the Answer to Effective Radiation Risk Communication?

(CEL Presentation at the HPS Midyear, Norfolk, VA – Feb. 4, 2015)

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A well known health physicist once told me, while shaking his finger in my face, “The answer to risk communication is simple, just tell people the truth!” I responded to say, “I believe in telling the truth, however, my studies show that truth has different meanings to different people.” This HP then left in great disgust saying, “I can see that we are diametrically opposed.” My studies of nearly 4,000 radiation safety specialists with the Myers Briggs Type Indicator (MBTI a trademark of Consulting Psychologists Press) show that for the majority of HPs truth is what can be defended by logical rational analysis and corroborated by peers. However, for the majority of the general public truth may be what is best for people taking into account the circumstances, feelings, and emotions. These two views of the truth can be very different and both groups will honestly believe they are right and will swear they are telling the truth in a courtroom.

The question to consider today is whether telling the “technical” truth about radiation is working? Have public sentiments against radiation mellowed over the decades since the advent of nuclear weapons?

I believe most will agree that the public is as concerned about radiation safety today as they were decades ago. After all we now have proof that nuclear technology can go wrong (Three Mile Island, Chernobyl, and now Fukushima Dai-ichi). Apparently the truth we are telling people about radiation risks is not generally accepted. This begs the question, “How do people determine the truth?” Insights on this question have been presented in a series of HPS News articles in 2012-2013. I have attempted to describe how people make decisions on truth for radiation safety based on processing information as normal functions of the subconscious mind. Our subconscious mind is wired to constantly search for signs of danger. However, since radiation does not give us any physical sensation, we have to rely on imagination to determine our safety. Our subconscious mind has been programmed by education and the media to automatically associate all radiation with “deadly radiation.” Thus, the associations by normal subconscious functions for safety will likely lead to decisions based on images of unacceptable consequences of radiation exposures. This class will explore many questions on effective risk communications, such as: What is the truth? How does truth relate to beliefs, faith, and ethics? What is lying? How do we process data to determine the truth? How does randomness affect our lives? How does radiation mythology affect people’s views. What are possible answers to effective radiation risk communication?
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- BS - Civil Engineering, University of Vermont (1961)  
- MS - Sanitary Engineering, Massachusetts Institute of Technology (MIT) (1963)  
- PSE - Professional Sanitary Engineer Degree, MIT and Harvard University (1963)  
- PE – Licensed Professional Engineer, Vermont (1965 – present)  
- CHP – Certified Health Physicist, American Board of Health Physics (1983–present)  
- Johns Hopkins Fellow, Organizational Systems and Communications (1984–1985)  
- FHPS - Fellow of the Health Physics Society and Past President (2000)  
- Past President, American Academy of Health Physics (2013)  
- Commissioned Stephen Minister – Counselor, United Methodist Church (2003–present)

Experience

2010 – pres.  Director , Radiation Safety Counseling Institute. Workshops, training, and counseling for individuals, companies, universities, or government agencies with concerns or questions about radiation and x-ray safety. Specialist in helping people understand radiation, what is safe, risk communication, worker counseling, psychology of radiation safety, and dealing with fears of radiation and nuclear terrorism for homeland security.

2007 – pres.  VP, Training Programs and consultant to Dade Moeller Radiation Safety Academy, training and consulting in x-ray and radiation safety, safety program audits, radiation instruments, and regulatory requirements.

1984 - 2007  Director, Radiation Safety Academy. Providing x-ray and radiation safety training, audits, and consulting to industry (nuclear gauges and x-ray), universities, research facilities, and professional organizations.

1988 - 2006  Manager and Contractor to National Institutes of Health (NIH) for radiation safety audits of 3,500 research laboratories and 2,500 instrument calibrations a year, along with environmental monitoring, hot lab and analytic lab operations, and inspections of three accelerators and over 100 x-ray machines.

1990 - 2005  President of Key Technology, Inc. a manufacturer and primary laboratory for radon analysis with over 1,500,000 measurements since 1985. Primary instructor at Rutgers University for radon, radon measurements, radiation risks, radiation instruments, and radon risk communication courses (1990-1998).

1986 - 1988  Laboratory Director, RSO, Inc. Directed analytical programs and Quality Assurance for samples from NIH, Aberdeen Proving Ground, radiopharmaceutical companies, and the nuclear industry.


Health Physics and Professional Activities


Publications


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In 1985 I was invited to give a presentation on radiation risk communication at a conference of the American Chemical Society. Before my presentation, the moderator (a well known health physicist) approached me and said, “So, you are going to tell us the answer to radiation risk communication?” I replied, “I do not pretend to have all of the answers, but I hope to offer some helpful insights.” Hearing this he responded, while shaking his finger in my face for emphasis, “The answer to public communications is simple, just tell people the truth!” I replied to say, “I agree that telling the truth is very important, however, my studies with the Meyers-Briggs Type Indicator (MBTI – trademark of Consulting Psychologists Press) show that truth has a different meaning to different people. After hearing a brief explanation of insights from the MBTI, he left in great disgust saying, “I can see that we are diametrically opposed.” Apparently “truth” had a special meaning for this person and he was not willing to hear other views.

My MBTI studies with over 4,000 specialists in radiation safety show that, for the majority of these people, truth is what can be defended by logical analysis based on fundamental laws and principles and corroborated by peers according to the scientific method for determining the technical truth. However, for the majority of the general public, truth is determined by what is best for people taking into account the circumstances, feelings, empathy, values, appreciation, and caring. These two approaches to determining the truth may lead to very different conclusions. While these two views of the truth can be poles apart, both groups will honestly believe they are right and will swear they are telling the truth.

Is Telling the Truth Working?
In light of these MBTI insights, the question now is whether telling the “technical truth” about radiation is working for proponents of radiation safety? Have extreme public fears of radiation been abated by attempts to provide better technical information? Have public sentiments against radiation mellowed over the decades since the advent of nuclear weapons and nuclear power? I believe most will agree that the public is as concerned about radiation safety today as decades
ago. After all, we now have proof that nuclear technology can go wrong (Three Mile Island, Chernobyl, and now Fukushima Dai-ichi). Apparently, the technical truth which specialists in radiation safety have been telling the public is not generally accepted. This leads to the question, “If telling the technical truth is NOT the answer, should we forego telling the truth?” What is the answer for public communications? Can we ever hope the public will achieve a balanced understanding of radiation risks closer to the technical understanding of experts?

What is the Truth?
Before we can answer the question about telling the truth, we first have to define the meaning of “truth.” There are several theories about what determines the truth. Scientists typically believe truth is determined by logical patterns of reasoning. Mathematicians believe truth is provable within an axiomatic system. Most accept that truth is that which is in accord with fact or reality or fidelity to an original, standard, or ideal. Some believe that truth is derived from social processes and perceptions. Consensus theory says truth is what we agree upon, such as the basis for radiation measurements and calibration in comparison with an agreed upon standard.

Truth and Ethics
The moral principles of ethics dictate that we should tell the truth to the extent that we understand the meaning of truth. This invites the question, “Are we morally ethical in our public communications about radiation risks? Is there a right and wrong way to tell people about radiation? Should we just present the facts? If so, what are the true facts? Can we justify simplifying technical information to enhance understanding. Which is more important, technical accuracy or compassion and understanding? Which approach can we defend? What is professionally or ethically acceptable?

Ethics and Lying
Most will agree that purposely not telling the truth (lying) is unacceptable. In a courtroom we swear an oath to tell the truth, the whole truth, and nothing but the truth. We can be charged with perjury if caught making a false statement under this oath. What about telling a half truth or an exaggeration, is that the same as lying? Falsifying information will result in penalties by radiation safety regulators. What if we honestly say what we believe without knowing that it is not technically true? Technical specialists are constantly dismayed about widespread acceptance of “radiation mythology” or common beliefs about radiation that are not technically true. Is the perpetuation of radiation myths by the media unethical or lying?

The Importance of Truth and Faith
We have to believe (have faith) in something. Truth is needed for survival and coping with the world. We need realistic expectations to live. By faith we lead active lives aligned with ideals and beliefs in what is true. The question is, “How do we assess or determine meaning and truth?” In 1900 H.G. Wells stated that, “A fact is a synthesis of impressions.” Current studies of how our minds process data indicate that Wells was about 100 years ahead of his time.
How We Determine the Truth
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 to determine meaning and truth. The initial processing of data is done subconsciously by the computer that runs the machine called our body. This processing occurs continuously and instantaneously. Our subconscious mind is also programmed to be constantly on the alert for any signs of danger. Instant automatic responses are crucial for our survival. When alerted our subconscious immediately triggers a fight or flight response. Do we really want to take the time for our rational conscious mind to evaluate whether a snake in the grass looks angry or should we instinctively jump back.

Role of Our Subconscious Mind
The automatic processes of our subconscious mind influence our conscious awareness of the world in fundamental ways, such as how we view ourselves and others. It influences the meanings and truths that we attach to everyday events in our lives. It affects the actions we take in response to our instinctive experiences of the world. To conserve energy our conscious mind will usually accept the instant processing of our subconscious mind. While quick responses are crucial for survival, when based on limited and unevaluated information, such responses may not be best in the long run.

Fears of Radiation are Involuntary
Everyone has an instinctive fear of snakes, heights, spiders, closed spaces, submersion, and public speaking. Because of the often repeated message of “deadly radiation” those words have now become embedded in our subconscious mind as the basis for meaning and truth of radiation. For many people radiation is now an instinctive source of fear and no longer a conscious choice. When alerted to radiation (such as a screaming Geiger counter) our subconscious reacts without consulting our rational conscious mind. Thus the decision to “RUN” is now automatic. As a result, our best efforts to present scientifically factual data about radiation may not change the perceived truth that radiation is always to be avoided.

Ethical Answers to Public Communication
Specialists in radiation safety can serve as a resource to help people find the “truth” about radiation. We can begin by letting people know that it is OK to be afraid of radiation. We should not make people wrong for their fears. We can use “Active Listening” to show that we care by hearing and reflecting feelings. We can help people find their own answers, such as showing them how to make their own radiation measurements. We can help people answer their questions about radiation safety by showing them the steps from cause to effect.

Steps from “Cause to Effect”
A technical specialist will go through the following steps or questions to determine the truth about radiation safety.
1. What are the properties of the radiation? Type, form, and quantity.
2. Where is the radiation located? Distance is a powerful way to reduce exposure.
3. How is the radiation or materials contained? Shielding reduces exposures.
4. What are the exposure conditions, internal or external – mSv / hour?
5. What is the duration of the exposure – hours?
6. How much radiation energy is deposited in our body – mSv?
7. What are possible health risks at 1 death per 10 person-Sv (according to the National Research Council, BEIR VII).

**Ethics and Truth in Public Communications**

While we can agree that it is ethically important to tell the “truth” about radiation, we also now see that truth may have different meanings. Even when evaluating the same information, people may arrive at very different conclusions on the meaning. Radiation safety specialists may prefer logical analysis for determining the truth, however, most of the public may prefer to take into account feelings and circumstances. While the subconscious minds of many people are programmed to fear radiation by the words “deadly radiation,” specialists in radiation safety can serve as a resource to help people determine their own truths by acknowledging their fears and leading them through the scientific process of steps from cause to effect.

**References**

1. How Risky is it Really, David Ropeik, 2010
2. Thinking, Fast and Slow, Daniel Kahneman, 2011
4. How We Make Decisions for Radiation Safety and are Prone to Errors, Ray Johnson, a series of monthly columns in the Health Physics Society Newsletter, 2012-2013

Ray Johnson, MS, PSE, PE, FHPS, CHP, is a 50 year career specialist in radiation safety. He currently directs the Radiation Safety Counseling Institute where he provides consulting, training, and counseling on issues involving radiation safety. He specializes in radiation instruments, nuclear gauges, industrial x-ray, NORM, and radiation risk communication. He has trained over 3,000 radiation safety officers. He is a past president of the Health Physics Society and the American Academy of Health Physics and has over 500 publications and presentations on radiation safety.
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Outline for this CEL
- Have we been telling the truth about radiation?
- What is the TRUTH?
- Is lying the opposite of truth?
- Truth, beliefs, ethics, faith
- How we process data
- Effects of random chance
- Role of radiation mythology
- Possible answers to risk communication

Did You Know?
- You can save 15% in just 15 minutes
- And the answer is?
  - Everybody knows that
- Well, did you know? ---- ?
- Radiation is not nearly as dangerous as most people believe it is!
- It is actually very difficult to seriously harm someone with radiation
  - Is this true?
  - If so, “Why aren’t we telling people that?”

Is the Answer to Tell the Truth?
- Anecdote of HP at ACS meeting - 1985
  - “So Ray, you are going to tell us the answers to risk communication”
  - “I do not pretend to have all the answers, I hope to share a few helpful insights”
- “Ray, the answer is simple, “Just tell people the truth”
- “I agree, however, MBTI shows that truth based on logical analysis is only favored by ½ the population”

How We Make Decisions

Thinking - 50%
- Logical
- Analytical
- Objective
- Laws
- Principles
- Firmness
- Justice
- Criticize
- Analysis
- Impersonal
- Cool
- Truth

Feeling - 50%
- Personal
- Empathic
- Subjective
- Circumstances
- Values
- Persuasion
- Harmony
- Appreciate
- Sympathy
- Personal
- Caring
- Goodness

Radiation Professionals
MBTI % Preference

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Is Telling the Truth the Answer to Effective Radiation Risk Communication?

Will the Truth of Radiation Prevail?

- Technical approach
  - Belief that truth of technical message will prevail
- Public interpretation
  - Different than expected?
  - How come?

Have We Been Telling the Truth?

- Yes or No?
- Is telling the truth working?
- Is public opinion of radiation any different today than 50 years ago?
- If telling the truth is NOT the answer,
  - Should we forego telling the truth?
  - What is the answer?

Public Understanding of Radiation

- We have learned to depend on our senses to warn us of danger
- Radiation gives no signal
  - Forces us to rely on what we have heard and our imagination
- Conditioned by “Deadly Radiation”
  - Frame of reference
  - Basis of views on radiation
- Has our communication on radiation risks been successful?

What is the Truth?

- Do we agree it's important to tell the truth?
- What is the Truth?
  - In accord with fact or reality?
  - Fidelity to an original or to a standard or ideal?
- What is a proper basis for deciding how words, symbols, ideas, and beliefs may properly be considered true?

Bases for Truth

- Correspondence theory
  - Relation to actuality
- Coherence theory
  - Fit of elements within a whole system
- Constructivist theory
  - Truth from social processes, perceptions
- Consensus theory
  - Truth is what we agree upon
  - Basis of measurements and calibration

More Bases for Truth

- Pragmatic theory
  - Results from putting concepts into practice
- Minimalist (deflationary) theories
  - $2 + 2 = 4$ is true
- Performative theory of truth
  - Signaling agreement, saying “I do”
- Redundancy and related theories
  - “Snow is white is true”
Is Telling the Truth the Answer to Effective Radiation Risk Communication?

More Bases for Truth

- Pluralist theories
  - Having particular properties or coherence
- Truth in logic
  - Determined by patterns in reasoning
  - Scientific truth (often favored by HPs)
- Truth in mathematics
  - Provable within an axiomatic system
- Semantic theory of truth
  - “This sentence is true”
- Objective and subjective truth

Truth and Ethics

- Ethics - Moral principles that govern a person’s or group’s behavior.
- Rules of conduct recognized in respect to a particular class of human actions, or a particular group, or culture
- Synonyms: moral code, morals, morality, values, rights and wrongs, principles, deals, virtues, standards (of behavior), value system, dictates of conscience

Ethics and Risk Communication

- Are we ethical in our communications?
- Is there a right or wrong way to tell people about radiation risks?
- What is morally justified?
  - Do we have moral principles to follow?
- Is “Telling the truth,” the answer?
- Should we, “Just present the facts”?
- If so, “What are the ‘true’ facts”?
- How do we know what we know?

Ethics and Risk Communication

- Can we justify simplifying technical information to enhance understanding?
  - Do we have to be technically accurate?
- Which is more important?
  - Technical accuracy?
  - Compassion and understanding?
- What approach can we defend?
- What is professionally acceptable?
  - Integrity and fairness?

Lying and Ethics

- Are there circumstances under which one can ethically lie?
- No matter the consequences?
- Scriptures – “Thou shall not bear false witness”
- What is lying?
- Are we bound ethically – not to lie?
- What are consequences of lying?

False, Falsify, or Lie

- Is not telling the truth, the same as lying?
- True or false on an exam
- Omission or commission
- Is telling a half – truth, lying?
- Falsification
  - Great concern for RAM licensees
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Types of Lying

Bare or bold faced lie
- Obviously not true

Big lie
- Attempts to trick

Bluffing lie
- Act of deception, in cards, sports

Bullshit lie
- To convey an impression

Butler lie
- I have a call on another line

Contextual lie
- State part of the truth, out of context

Economical with the truth
- Speaking carefully to avoid something

Emergency lie
- Strategic lie to minimize harm

Exaggeration lie
- Making something more meaningful than reality

Fabrication
- Statement made without verification

Fib
- No malicious intent

Half-truth
- Deceptive statement – partly true

Haystack answer
- Truth hidden in volume of false information

Honest lie
- Not knowing information is a lie

Jocose lie
- A lie meant in jest

Lie – to – children
- The stork brought you

Lying by omission
- Leaving something out to foster a misconception

Lying in trade
- Advertising untrue facts for marketing

Minimization lie
- Minimizing the facts to avoid something

Misleading and dissembling lie
- Statement to get someone to believe

Noble lie
- Statement made for the good of society

Perjury
- False statements made under oath

Polite lie
- I have another commitment at that time

View from nowhere lie
- Journalism showing both parties equal

Weasel word lie
- Ambiguity for deniability

White lie
- Harmless lie for the greater good
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Another View of a Lie by Tony Robbins

- A lie is to remind us that we do not know exactly how things are.
- Once we know a line is concave, we are no longer free to see it as convex.
- The word “lie” does not mean “to be deceitful or dishonest,” but rather to remind us that no matter how much we believe in a concept, we should be open to other possibilities and continuous learning.

Unlimited Power: The New Science Of Personal Achievement

- Free Press
- 1986

Lies and Processes?

- If you tell a big enough lie, loud enough, and often enough, sooner or later people will believe you.
- Our best information is meaningless unless it is understood intellectually and emotionally.
- Key:
  - How a person processes information.

Importance of Truth and Faith

- We have to believe (have faith) in something.
- We need realistic expectations to live.
- Truth is needed for survival:
  - For coping with the world.
- Faith leads to an active life aligned with ideals and beliefs.

Truth, Facts, Meaning

- "A fact is a synthesis of impressions."
  - Love and Mr. Lewisham,
  - H. G. Wells, 1900
- How do we assess meaning?
- All information is first processed subconsciously by association with stored memories, experience, beliefs.

How Our Brain Works

- Our brain flashes pictures, sounds, or feelings automatically which we can respond to on cue, like a Pavlovian dog.
- May be important for survival.
- We do not know how life really is, we only know how we represent it to ourselves - Tony Robbins.
- How do people represent radiation?
Is Telling the Truth the Answer to Effective Radiation Risk Communication?

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
   - For radiation safety, 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
   - Origin of most decisions, especially for 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
  - Example

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

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 – frame of reference
  - 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

How We Make Quick Decisions

- We process, sort, compare, categorize, and analyze information, in relation to –
  - Immediate circumstances – "Radiation OMG"
  - Experiences – what have we heard?
  - Life factors, such as health, wealth, traditions, and lifestyles
  - 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?

Instant Subconscious Processing

- Fukushima
- Chernobyl
- Cancer
- "Deadly Radiation"
- X-rays
- Property Damage
- Loss Avoidance
- "OMG – RUN!"
- Response

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Brain Function

- Our brain processes information like a computer
- We take in fantastic amounts of data and organize it into a configuration that makes sense to us
- A computer needs software, structure to perform certain tasks

Structure for Thinking Patterns of Behavior

- Software (patterns) for our brains
  - Provides the structure that governs what we pay attention to,
  - How we make sense of our experiences, and the directions in which they take us.
  - It determines whether something is interesting or dull, a potential blessing or a threat

Mental Patterns and Programs

- People have patterns of behavior
- They have programs by which they organize their experience to create those behaviors
- Only by understanding those mental patterns can we expect to get our message across

Experience Basis of Beliefs

- We generate our experiences (beliefs) in life by behavior or thought
- We store these experiences like files in a computer
- These files (beliefs) can be played back at any time, if the right stimulus is triggered

Role of Beliefs (Programs)

- Our beliefs are specific, consistent organizational approaches to perception
- Fundamental choices we make about how to perceive and live our lives
- We do not know if our beliefs are true or false, what we know is if they work and if they support us.

Beliefs and Lies

- Everything we believe could be a lie which we have accepted as the truth
- How do we derive meaning and understanding?
- Most people in our culture have been programmed to fear radiation
- No scientist can prove that our thoughts create our reality, but it’s a useful lie. Its an empowering belief
How much of What we Believe is Based on Faith?

- Faith is confidence or trust in a person, thing, deity, view, or in the doctrines or teachings of a religion.
- Belief that is not based on proof, rather more a matter of confidence based on some degree of warrant.
- The word faith is often used as a synonym for hope, trust, or belief.

Knowledge and Belief

- How do we know what we know?
- Definition of knowledge as “Justified True Belief”
- Justification is the reason why someone properly holds a belief,
  - the explanation as to why the belief is a true one,
  - or an account of how one knows what one knows

Errors of the Conscious Mind

- Relies on subconscious to continuously generate suggestions, impressions, intentions, intuition, and feelings
- When endorsed by our conscious mind, these become beliefs,
  - impulses turn into actions
- We generally believe our impressions and act on our desires
- That is fine – as long as subconscious is not biased

Justified Beliefs

- A justified belief is one that we are “within our rights” in holding.
  - The rights in question are neither political nor moral, however, but intellectual.
- In some way, each of us is responsible for what we believe.
- How sure are we that our beliefs correspond to the actual world?

Is Faith Blind?

- Does faith mean blind trust?
- One who has faith is “not blind, but intelligent” and “commences with the conviction of the mind based on adequate evidence”
- The validity, or warrant, of faith or belief depends on the strength of the evidence on which the belief is based

An Intellectual View of Faith

- Faith is belief without evidence; a process of active non-thinking.
- Faith degrades our understanding of the natural world by allowing anyone to make a claim based solely on their personal thoughts, and possibly distorted perceptions, that does not require testing, has no ability to make reliable and consistent predictions, and is not subject to peer review
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Faith is Needed for Living
- Faith is defined as "a trust in and commitment to what we have reason to believe is true"
- Evidence-based faith is the normal concept on which we base our everyday lives
- Belief in things not seen

Errors of the Conscious Mind
Is Seeing Believing?

How Hard Do we Expect People to Work?
- How much effort should people put into understanding radiation safety?
- How hard should we expect to work to understand how people make safety decisions?
- What is the incentive to commit this effort?
- Why should people change their views about radiation?

Can We Ignore Public Fears of Radiation?
- Do irrational fears influence public policy?
- Should we protect the public from fear?
- How do we justify expenses for reducing imaginary risks?
- Isn’t this actually happening all the time?
- How many of us are dealing with “real” risks?
- How much of what we do is driven by public views of what is needed for safety?

Patterns and Expectations
- The illusion of patterns strongly affects our views on radiation safety
- Paducah – Gaseous Diffusion Plant – reports of cancer incidence in many neighborhoods
- How many people in Japan who may get cancer among the Fukushima evacuees will likely conclude that the Daiichi incident is the cause?

Truth and The Illusion of Knowing
- We create good stories to explain the world around us – then we believe our stories
- It is easier to construct a good story when we know little and have fewer pieces to the puzzle
  – This might explain why some people are so convinced of the hazards of radiation
- Stories confirm what we have always believed and what we have always known
- What do we really know for sure?
Is Telling the Truth the Answer to Effective Radiation Risk Communication?

The Scientific Method

- The scientific method differs from other methods of acquiring knowledge in that scientists seek to let reality speak for itself, supporting a theory when a theory's predictions are confirmed and challenging a theory when its predictions prove false.

David Ropeik

- Bounded rationality
- How people make decisions,
  - When –
    1) Limited data
    2) No time to get data
    3) No understanding of data

Daniel Kahneman

- Ferrar, Straus, and Giroux, New York
- 2011

Subconscious Programming

- Constantly monitors all inputs to predict and avoid imminent danger
- Anything unusual, such as radiation, triggers a search of all knowledge and memories to decide if protective action is needed
- Most will conclude that radiation is bad
- Without technical knowledge, they may not be able to defend this decision, but deep in their gut, they know this is true
- Imagination of unacceptable consequences of radiation will win out every time.

Ways we are Prone to Errors

- We use mental shortcuts for quick decisions
- Decisions by subconscious mind are crucial for safety – especially for imminent danger
  - Does not do well for dangers that are not imminent
- Subconscious acts on impressions which may not be based on good information
  - Not based on evaluations and therefore it has no clues to errors or biases
- Conscious mind is not inclined to second guess subconscious decisions
  - Wants to conserve energy

Truth and Intuitive Bias

- We tend to believe what confirms our views and to discount other information
- Thus, we may accept data from small samples
- We may judge on basis of how information “resembles” something we already know
- We draw conclusions based on “ease of recall”
  - This may be function of media coverage
  - Paradox, media reports what people want to see
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Role of the Subconscious Mind
- Influences our conscious view of the world in fundamental ways
  - How we view ourselves and others
  - The meanings we attach to everyday events in our lives
  - Our ability to make quick judgments
  - The actions we take in response to instinctive experience of the world

My Courtroom Experience
- I used to believe I knew the truth until serving as an expert witness and observing courtroom proceedings
- Witnesses - “Swear to tell the truth, the whole truth, and nothing but the truth”
- Feedback from a Federal Judge
  - Courtroom is carefully orchestrated drama to persuade a judge or jury, truth is incidental

Have We Told the Truth About Radiation?
- Despite our best efforts most people’s perceptions of radiation are shaped by myths
  - Something believed which is not technically true
- Radiation mythology abounds
  - “Deadly Radiation”
  - “LNT”

Radiation Myths Abound
- When dealing with radiation fears, consider:
  - Most of what people believe is mythology, without special training in radiation safety,
  - People rely on what they have always heard as the basis for understanding radiation
  - Myths help explain science in ways that are understandable to lay persons
  - Simple, direct, makes sense, credible

Are We Most Afraid of What we Know the Least About?
- What do people know about radiation?
- What have you heard?
- Do you remember ever hearing anything good about radiation?
- What does the news media tell us about radiation?
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**Myth of “Deadly Radiation”**
- Media has used these words for over 60 years
- Now accepted as basis for understanding radiation
- Assumes cause and effect
  - Analogy with “Deadly Aspirin”
- Results
  - Fears of radiation seem out of proportion to risks as we would technically understand them

**Telling the Truth Possible Answers?**
- Let people know it’s OK to be afraid
- Show that you care
- Hear and reflect feelings
- Be a resource to help people to find their own answers
- Provide guidance on steps from cause to effect

**Remember**
- We are prone to numerous errors in decisions for radiation safety?
- Fear of radiation is automatic
- It’s OK to be afraid of radiation
- The question is –
  - How afraid is appropriate for the circumstances?

**We can be a Resource**
- We do not have to be the - “Giver of answers”
- We can ask questions – lots of questions
  - To identify images, knowledge, experience
- People have more confidence in their own answers
- How can we help people find their own answers?
  - What have your thought about?

**Help People Find Answers**
- Show – and – tell
- Demonstration of radioactive antiques
- Compare antique readings with sources of concern
- Let concerned person do measurements
  - Compare readings from antiques with readings for radiation source of concern
- Explain instrument readings

**Establish Rapport**
- Do not make people wrong for their fears
  - It’s OK to be afraid
- Use “Active Listening” to hear and respond to feelings
  - “I don’t want anything to do with radiation!”
  - Active Listening Response, “Radiation is scary isn’t it?”
- Invite workers to help answer the question –
  - Is this source of radiation safe? Cause to Effect
  - Workers have buy-in to their own answers
  - Invite workers to do measurements
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Steps from Cause to Effect
1. What are properties of radiation
   - $\alpha$, $\beta$, $\gamma$, x-ray? - Form and quantity?
2. Where is it located?
3. How is it contained?
4. How will it move in the environment?
5. What are the exposure conditions?
6. How much energy is deposited in body?
7. What is the health risk?
   - Based on evidence of actual effects
   "It is actually very difficult to seriously harm someone with radiation."

What have we Learned Today?
- Have we been telling the truth about radiation?
- What is the TRUTH?
- Is lying the opposite of truth?
- Truth, beliefs, ethics, faith
- How we process data
- Role of radiation mythology
- Possible answers to risk communication

Summary
- Is telling the truth – "The Answer"?
- What is the truth?
- What is lying?
- Faith and beliefs are needed for living
- Beliefs based on stored impressions
- Role of the subconscious mind
- Frames of reference – "Deadly Radiation"
- Views may be based on radiation mythology
- Best approach – help people find answers

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Questions?
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