

# Greetings from the Methow Valley!



Photo courtesy of Patricia Leigh, avid hiker and friend

# Ten Things I've Learned as a Health Physicist



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Opinions expressed are those of the author, not the Health Physics Society

# Introduction



- **I'm a Generalist Health Physicist.**
- **How and why did I get into Health Physics?**
  - Needed to do something meaningful
  - Biology background, but physics and math were easy "A's"
  - **My AEC Fellowship made the difference**
    - ✦ **Thank your Representatives and Senators for last year and ask them for this upcoming year's IUP**
      - House E&W Subcommittee just passed out \$15 million in grants for Nuclear Education Program. Let's hope the Senate side does, too.
- **What can a Generalist share? Anecdotes!**
  - **HP was a male-dominated field**

My first  
inspection

# 1. Listen to Others



- **Find one or more mentors**
- **Listen & Learn from them**
- **This talk was prepared with input from:**
  - **My husband**
  - **Jim Willison**
  - **Bill Morgan**  
(Boeing, deceased)
  - **Dade Moeller** (deceased)
  - **Ron Kathren**
  - **Sam Keith**
  - **Ray Johnson**
  - **Countless others...too numerous to mention**

## 2. Identify the Hazard



- **Radiological**
  - Internal, external, both?
  - Timed work required? Special tools, equipment?
  - **You will probably outlive the effects of radiological hazards**
- **Non-radiological**
  - Examples: UXO, chemical, biological, general safety
  - **Pay attention: these can be immediate threats to your health and safety**
- **Emotional distractions**
  - Can interfere with getting the job done safely and well
    - ✦ **SL-1 Reactor accident, family issues, fatigue, earthquake/tsunami damage**

# 3. Make/Use Quality Measurements



- **How well is the hazard quantified?**
- **What do you want to measure?**
  - Electronic instrumentation?
  - Other method? Autoradiography? Go/No Go?
- **Eventually, you are probably going to want a number with an understanding of the error (accuracy and precision) of that number.**
- **Figure out what information you need for your measurement: sensitivities, insensitivities, relationship to regulatory/administrative criteria**

# Instrumentation Do-Loop:



**Pick an instrument,  
any instrument**



**Understand what it does well**



**Understand what it can't do well\***

**e.g. alpha in presence of beta/gamma**



**How does the performance compare to your needs?**



**Not so good**

**\*Thank you  
Brookhaven**



**Works well, but  
how is it calibrated?**

**Photo from  
Ludlum  
Measurements  
Inc, Model 3**



## 4. The Three Rules of Health Physics\*



**As part of figuring out the “best” instrument, will it actually give you the results you are looking for?**

**1. Calibration**

**2. Calibration**

**3. Calibration**

**Reference: ISO/IEC 17025**

**\*Adapted from the Three Rules of Real Estate:  
Location, Location, Location**

# Things to consider about calibration...



- **WHO is doing the calibration?**
  - **Specific training and qualifications ?**
    - ✦ **Periodic training, retraining, evaluations?**
  - **Does the person know the instrument?**
    - ✦ **Manufacturer? Probably.**
    - ✦ **Local person with source? Maybe not.**
  - **ISO recommends that the Calibration Supervisor has:**
    - ✦ **3+ years of experience in instrument calibration or source preparation, as applicable.**
    - ✦ **BA or BS degrees preferred.**

# Calibration Facility Considerations



- **WHERE is the calibration occurring?**
  - Adequate facilities?
  - Temperature, pressure, and relative humidity controlled and recorded?
  - In un-collimated free-air calibration facilities, are there variable scatter conditions?
  - Is a scatter correction needed to meet accuracy goals?
  - Relative humidity should be within 15% and 65%
  - Differences in storage and calibration facilities should be minimized to achieve thermal equilibrium quickly.
    - ✦ What about differences in calibration facilities and where the instrument is going to be used?

# Paperwork Considerations



- **HOW is the Calibration being conducted?**
  - **Document** test and calibration procedures, methods, and method validation
- **Criteria should be established for accuracy and uncertainty.**
  - **Estimates of uncertainty should be periodically verified.**
  - **Methods should be published in international, regional or national standards and those methods should be followed.**
- **Deviations from calibration methods must be documented, technically justified, authorized and accepted by the customer.**

**Optimized  
detection  
for  
Thorium**

# WHAT is the Standard?



- **Standards should be:**
  - **Dedicated to calibration function.**
  - **Controlled so only qualified personnel may use them**
  - **Periodically re-calibrated or verified.**
- **Reference standards**
  - **Calibrated by NIST → secondary calibration**
  - **Calibrated to a secondary standard → tertiary calibration**
- **Most commercial calibrations are tertiary**

# Special Circumstances



- **Low-level and environmental measurements also need:**
  - **Conditions of low-background, unaffected by neighboring processes.**
    - ✦ **Documented background**
    - ✦ **Reschedule if needed, e.g., Industrial Radiography near**
  - **Contamination controlled to a higher degree than required for personnel safety.**
- **If you are making measurements at or near background (6 microrem/hr), is there any value in a calibration that starts at 15 microrem/hr?**

**Thank you  
Oregon PIC**

# Even more to think about for calibrations...



- **Data security is also important: validation and control of software and data.**
- **Estimates of uncertainty need to account for all uncertainty components of importance to the given situation.**

**Bean-shaped isodose curve?**

# Does your calibration facility do intercomparisons? Is it accredited?

- **Recalibration should be performed by comparison with a higher-level standard (secondary or reference standard).**
- **The overall program of calibration should be operated so that measurements are traceable to national standards.**
- **Intercomparisons are also recommended.**
- **Accredited calibration facilities are recommended.**
  - **AAPM and A2LA (Am. Assoc. for Lab. Accrd)**
- **Reference: ISO/IEC 17025, “General requirements for the competence of calibration and testing laboratories.”**

# One last thought on Calibration:



**Your measurement is only as good as your calibration.**

**NIST is no longer providing a Sr-90 ophthalmic standard.**

**HPS Laboratory Accreditation Program is cancelled.**

## 5. Maybe there is another side of ALARA



- **Can we reduce the EFFECTS of exposure to ionizing radiation, in addition to reducing the dose and optimizing the exposure?**

**1970 my unpublished  
work with gerbils and  
serotonin**

- **Pre-exposure radioprotectants of interest to:**
  - ✦ **NASA for space travel to/from Mars**
  - ✦ **DOD for Improvised Nuclear Device (IND)**

# The other side of ALARA?



**Buenos Aires  
IRPA Meeting**

- **Folates? Eat your spinach!**
  - **Steven Bailey and June Ayling (U.S. Patent Application Publication No. US 2009/0170858 A1)**
  - **Not so simple with people +/-**
- **Radioprotectants (post-exposure)**
  - **May and June HP News articles from REAC/TS**
- **This Other Side of ALARA should not be neglected**
  - **Diagnostic CAT scans**
  - **Pediatric imaging**

# 6. Trust is elusive, but necessary



- **“These people are EXPERTS - we can’t trust them.”**  
Testimony given at a public meeting that I attended as a state regulator. The Public applauded.
- **Every person has something valid to say; we may not want to hear it.**
- **How do we engender trust when we are “Experts” ?**
  - **Ray Johnson’s articles on communication offer insight. He just published an article on “Ethics of Radiological Protection in Public Communications -Is Telling the Truth the Answer?”**
  - **Howard Dickson’s March 2014 Newsletter article on “Why are People Afraid of Radiation” reiterates the importance of Trust.**
- **Seek the honest truth – Achieve CORNCOBS**

# Achieving CORNCOBS



- **Conscientious - Be honest with yourself and others, don't punish, don't over-promise**
- **Open - no hidden agendas, value-based goals**
- **Reasonable –understand the other person's interests, but don't abandon your own**
- **(Nuclear)**
- **Communication**
- **On Both Sides**

**LLW License  
Renewal**

# 7. Fear Usually Trumps Reason



- **Nuclear-related projects often span many years.**
- **On-going education and honest discussion is needed.**
- **Continuously!**

CA LLW Project

“What is Safe” Ted Lazo, Health Physics News,  
May 2014.

“Pleasure can sometimes trump fear.”

My personal  
observation

# 8. Decisions people make about their own personal risks can be irrational

are

## Two Recent Examples:

Alaska Pipeline/Arctic Circle



Argentina's Most Southern Road



# Risk Comparisons



## ● **Motorcycle**

- **Murdercycle, Organ Donor**
- **Control: I won't ride as a passenger**
- **Choice: My choice**
- **Risks and Benefits: Threat of injury vs. fun and friendship**

## ● **All Things Nuclear**

- **Deadly \_\_\_\_\_ (insert favorite nuclear word here)**
- **Control: Public has no or little control, but sometimes a Public Representative has been effective**
- **Choice: Imposed**
- **Risks and Benefits: Theoretical increase in cancer vs. reduction in greenhouse gas emission**

**Expectations can predispose outcomes**

**Design of Science Experiment**

**If a positive expectation: It won't happen to me.**

**If fear dominates: I'll be the one to get into an accident ...or have cancer.**

# On RISK, HPS President Hamrick says:



**While it is integral to our policies on risk management in this country that individuals have the right to make their own decisions related to what is an acceptable risk and what is not, if the decision is not adequately informed by the facts, then the right to make it cannot be fully exercised.**

# 9. Be a Sponge



**Dade Moeller:  
“Take a Shower”**

- **Joining the Health Physics Society is a great way to enrich your professional life and find that Fountain of Knowledge.**
- **“Every radiation safety professional in the United States should be an HPS Member.”**
- **Benefits of HPS Membership**
  - **Know and learn from the best in the profession (See my #1 Thing Learned)**
  - **Network**
  - **Practice management skills in a safe environment**
  - **Learn and practice new skills**

# Wring out your sponge



- **Join HPS**
- **Volunteer at Chapter and National Levels**
  - **Email me: [nancy.kirner@gmail.com](mailto:nancy.kirner@gmail.com)**  
**<https://hps.org/membersonly/committees/volunteer.cfm>**
- **Get Certified**
  - **Volunteer with the AAHP/ABHP, too.**
- **Be a Mentor**
- **Bottom Line: Help others**

# 10. Change is Constant



- **The Mid-Year Meeting is no longer a Topical Symposium.**
  - **Emphasizes training on a broader range of HP topics, instead of being perceived as single, possibly irrelevant topic.**
- **The HPS is considering re-organizing to help make the organization more streamlined and responsive to its members. So far:**
  - ✦ **First reorganization plan was to reduce the number of Directors from 13 to 7 – VOTED DOWN**
  - ✦ **Probably emphasizing a competency-based set of Leaders to direct the committees and sections.**
    - **Competencies are more leadership- than technically-based.**
- **Nothing concrete now – stay tuned.**

# 10 Things I've Learned:

1. Find mentors.
2. Identify the hazard.
3. Make quality measurements.
4. Remember the 3 Rules of Health Physics: Calibration, Calibration, Calibration.
5. Explore the other side of ALARA.
6. Engender Trust, even if you are an expert.
7. Remember that fear trumps reason.
8. Decisions people make about their personal risks can be irrational.
9. Be a sponge – say “Yes” to the HPS.
10. Change is constant.

# Thank You.



See YOU in Indy!  
July 12 – 16, 2015

Photo from Indianapolis Chamber of Tourism