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Is it Time to Change NRC's Regulations for Radioactive Effluents From Nuclear Power Plants?

NRC Public Meeting

Lisle, IL

August 28, 2014

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Category 2 Public Meeting

- This is a Category 2 public meeting. Category 2 meetings are open to the public, petitioners, interveners, or other parties pursuant to the "Commission Policy Statement on Staff Meetings Open to the Public: Final Policy Statement." (67 Federal Register 36920, May 28, 2002).
- NRC and industry representatives may ask questions at any time. The public will be invited to participate at selected points throughout the day.

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Meeting Logistics

- Ground rules
- Exits
- Agenda
- Breaks
- Sign-in Sheet
- Feedback Form
- Bridge Line
- Keep questions and comments relevant to the topic
- You may notice a security presence (standard practice)
- Questions from the public will be allowed at designated times.

The Title for Appendix I to Part 50

Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low as is Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents

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What is Appendix I?

- Nuclear power plants release radioactive materials
  - Radioactive releases are sometimes referred to as radioactive effluents or radioactive emissions
  - For brevity, the term “effluents” may be used in this presentation
- NRC regulations require monitoring radioactive effluents
  - Appendix I has applicability for monitoring effluents
- NRC regulations require licensees to demonstrate radioactive effluents are as low as is reasonable achievable (ALARA)
  - Appendix I is used to demonstrate ALARA
- NRC regulations require reporting radioactive effluents
- NRC inspectors routinely inspect all of the above

Radioactive Releases

- Releases are often referred to as radioactive effluents
- Effluents are regulated by the NRC
- Effluents include waste generated during facility operation
- For Appendix I, effluents are in the form of:
  - Liquid (water), and
  - Gases, as atmospheric releases (gases, particulate aerosols)
- The dose from natural background radiation is typically hundreds or thousands of times larger than the dose from NPP effluents

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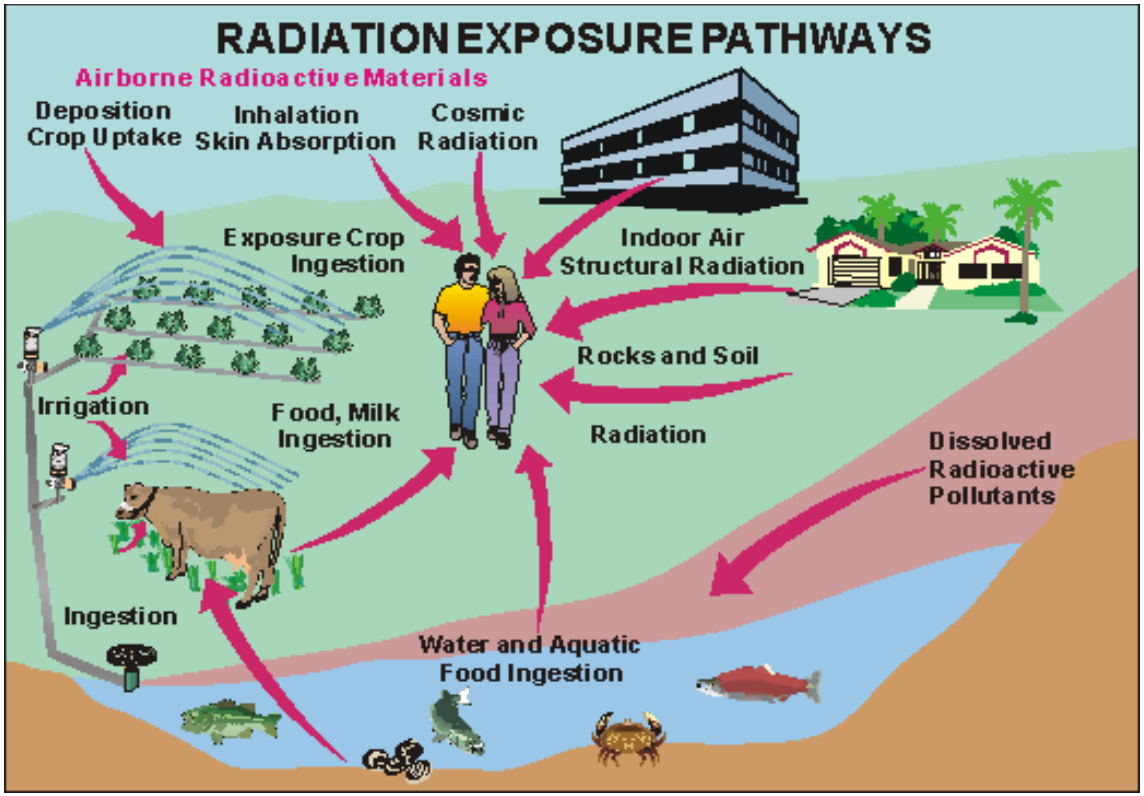
Radiation Exposure Pathways



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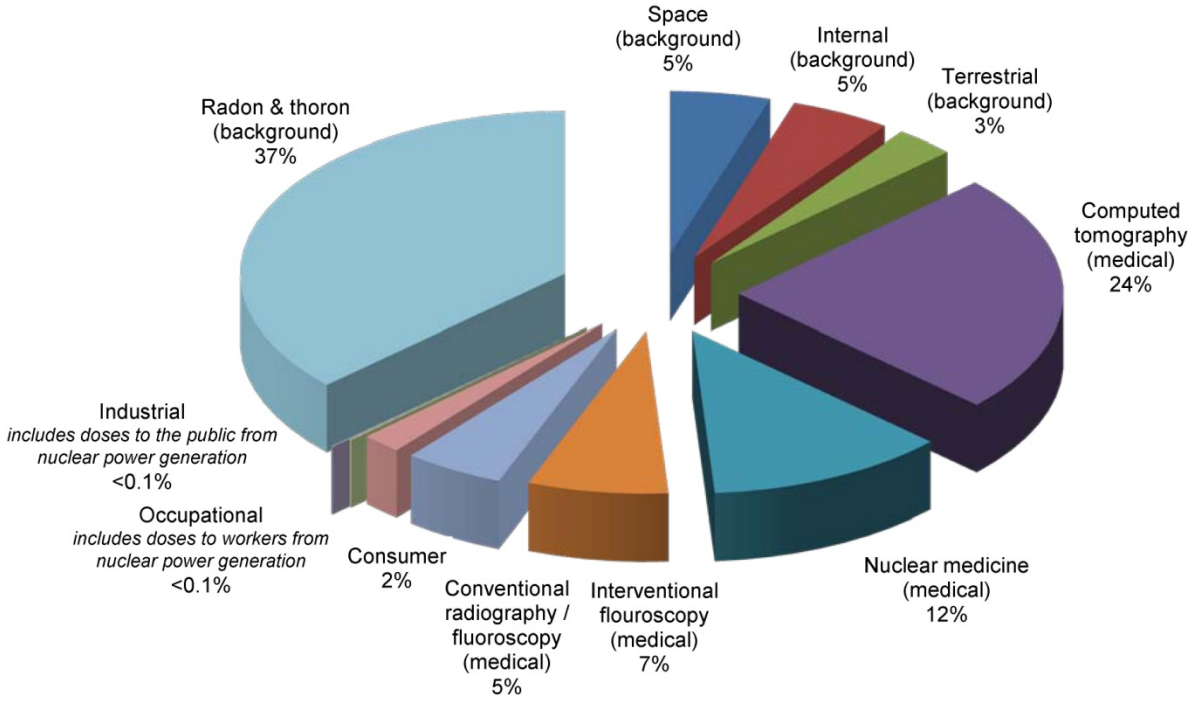
Radiation Exposure to US Population

Percent contribution of various sources of exposure to the total collective effective dose and the total effective dose per individual in the U.S. population for 2006. Percent values have been rounded to the nearest 1%, except for those <1 % [less than 1%]. *Credit: Modification to image courtesy of National Council on Radiation Protection and Measurements.*



Monitoring Effluents

- Licensees are required to have instrumentation that continuously monitors significant waste streams.
- Licensees are required to sample effluents at specified intervals.
- Licensees measure activity (e.g., curies) of effluents.
  - prior to release
  - during release
  - after release (in the environment)
- Licensees calculate doses (mrad, mrem) based on the measured effluent activity.
- NRC inspects these measurement records.
- **Appendix I** contains provisions for sampling effluents and the environment.

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Effluents Must Be ALARA

- Licensees compare effluent doses to release limits
- Licensee's limits are based on the NRC's design objectives for plant systems.
- These design objectives are contained in Appendix I to 10 CFR 50.
- **Appendix I** contains both:
  - numerical guides (design objectives), and
  - requirements (e.g., for controlling operation of plant systems)
- **Appendix I** provide a method licensees can use to demonstrate ALARA.
  - If doses are not ALARA, NRC requires licensees to take actions (e.g., to operate plant systems) to ensure effluents remain a small fraction of the radiation protection standards in 10 CFR 20 (100 mrem annually) .
- **Appendix I** is designed to ensure plant systems are operating per design so that:
  - effluent doses are ALARA, and
  - dose limits of 10 CFR 20 are not exceeded.

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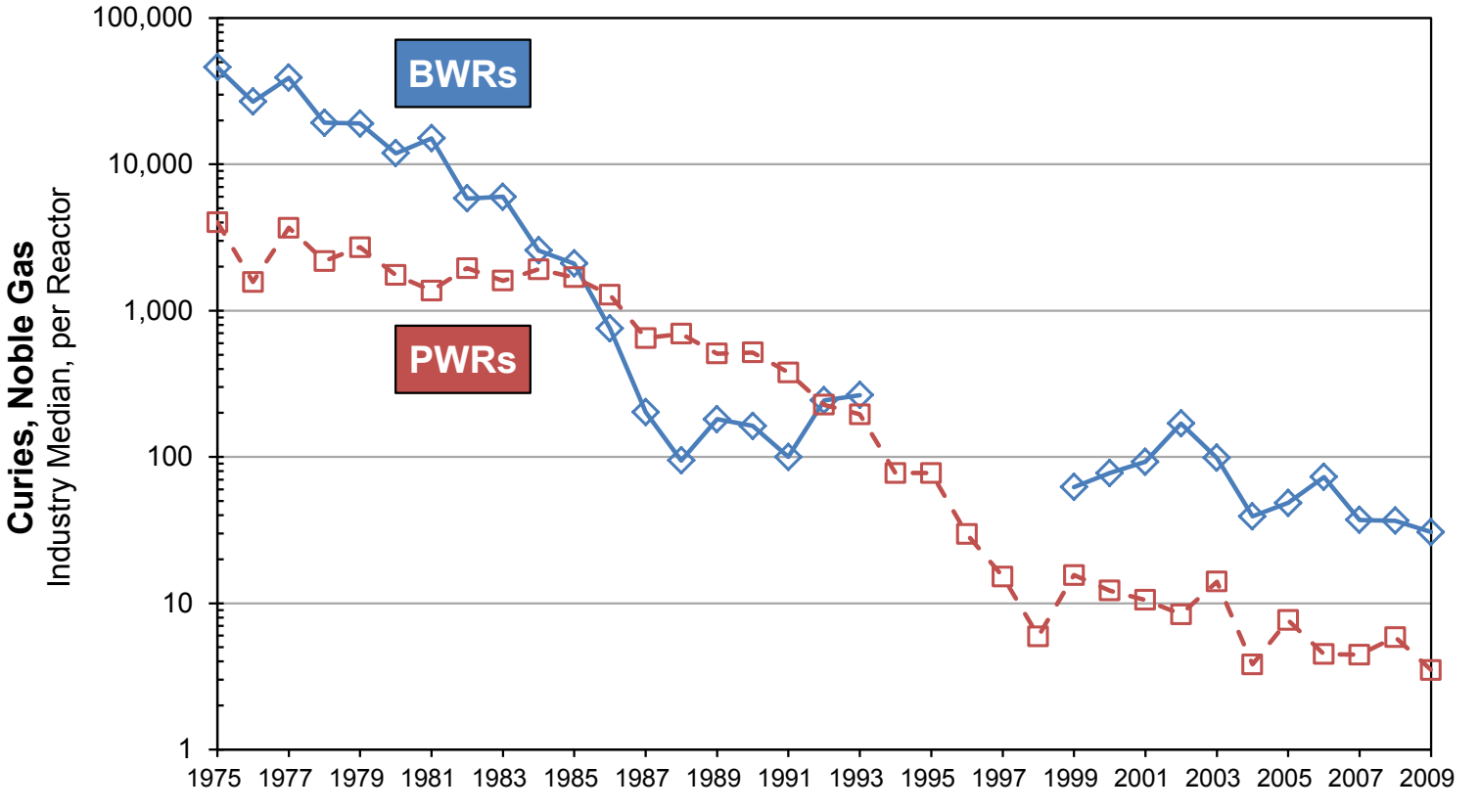
Reporting Effluents

- NRC requires licensees to report radioactive effluents.
  - NRC guidance is in Regulatory Guide 1.21
- Annual effluent reports are in ADAMS.
- Effluent reports since 2005 are on NRC's public web page. http://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-info.html
- NRC is publishing summaries of licensee's effluent reports. Radioactive Effluents from Nuclear Power Plants: Annual Report _____
  - 2009 (NUREG-2907, Volume 15) (ML13218A300)
  - 2008 (ML103620452)
  - 2007 (ML103620453)

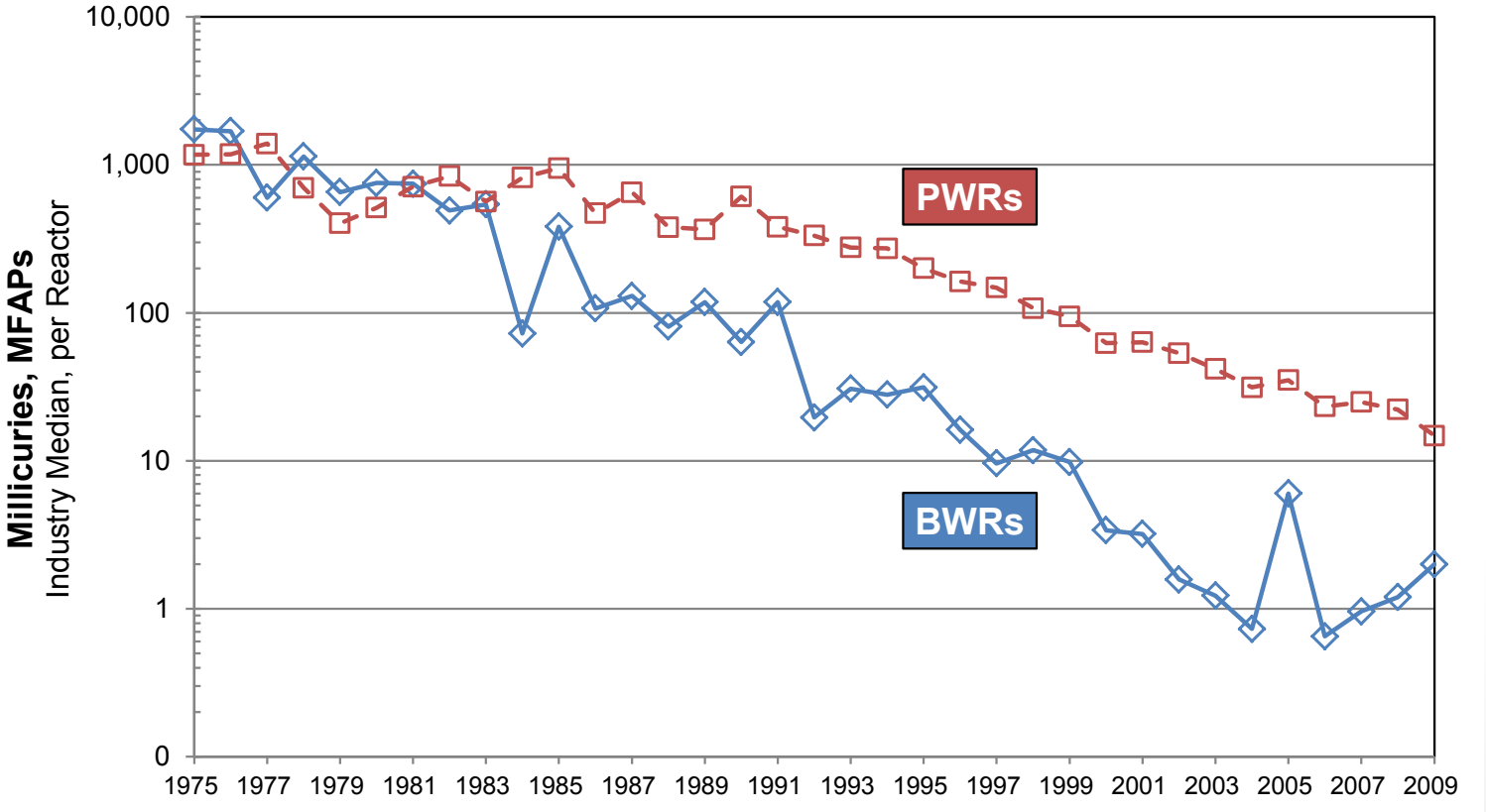
Effluent Trend – Gases – Noble Gases

34-year trend of noble gases from boiling water reactors and pressurized water reactors in the United States -- 1975 through 2009



Effluent Trend – Liquids – MFAPs

34-year Trend of mixed fission and activation products from boiling water reactors and pressurized water reactors in the United States - 1975 through 2009



Appendix I – Description

- Comprises 4 pages in the regulations
- Section I – Introduction
- Section II – Guides on design objectives …
- Section III – Implementation
- Section IV – Guides on Technical Specifications for Limiting Conditions of Operation…
- Section V – Effective dates
- Concluding Statement of the Position of the Regulatory staff (Docket-RM-50-2)

Appendix I – Opportunities

- NRC regulations use:
  - ICRP-2 Recommendations, 1959 (Appendix I)
  - ICRP-26 Recommendations, 1977 (10 CFR 20)
  - ICRP-60 Recommendations, 1990 (Decommissioning)
  - Still protective of the public
- Issues of concern:
  - Multiple methods of calculating dose
  - Multiple definitions of dose
- Opportunity to align Part 20, Part 50, & all regulations

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Commission Direction

- NRC Direction – in SRM-SECY-12-0064 (17-Dec-12)
  - "…Develop a regulatory basis…"
  - "…for a revision of …Part 20 and … Appendix I, to align with the most recent methodology and terminology…"
- ICRP-103, "The 2007 Recommendations of the International Commission on Radiological Protection"
- Commission had specific instructions for Part 20
- No explicit instructions for Appendix I
- Central theme of SRM is for alignment

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Regulatory Basis

- What is a Regulatory Basis?
  - Options for proposed changes
  - Evaluation of proposed changes
  - Justification for proposed changes
  - Staff recommendations to Commission
- What is the process?
  - NRC staff to engage stakeholders, public, industry, others
  - NRC will collect input and evaluate feedback
  - One regulatory basis for Appendix I effort
  - One regulatory basis for the Part 20 effort
  - Commission to review merits of regulatory bases
  - Commission vote for rulemaking (proceed or not)

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Logistics

- NRO is leading the Appendix I effort at the NRC
- FSME is leading the Part 20 effort at the NRC
- SRM/SECY call for separate rulemaking & bases
- Coordination
  - Part 20 Working Group (WG) and Appendix I WG
  - Reg Guide Upgrade Project
  - Oak Ridge National Laboratories (ORNL)
  - Cost-benefit analysis criteria ($1000 per man-rem value)
  - Federal family (EPA, DOE, others)

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Tentative Schedule

- Public Mtgs (DC- Oct 10th)
- Publish ANPR (Target October 2014)
- Revise Regulatory Guides, NUREGS (2014-2020)
- ORNL publishes Dose Coefficients (2015)
- Complete Basis Document (2015)
- Revise Computer Codes (LADTAP, GASPAR) (2017)*
- Prepare the proposed rule (2018)*
- Publish Final Rule (2020)*

* Provided the Commission approves rulemaking.

Opportunities – Dose Concepts

- Replace terminology/concepts
  - Total body dose → effective dose
- Replace terminology/concepts/numerical values
  - Organ dose → organ dose (or) effective dose (?)
  - Air dose (mrad) → effective dose or eliminate
  - Skin and TB Dose Rates (setpoints) → effective dose rate (?)
- Replace concepts/numerical values
  - MEI (4 → 6 age groups)
  - ECLs (adult → average adult, per capita composite individual…)
  - Should D.O. for liquids ~ D.O. gases?
    - Liquid D.O. = 3 mrem, annual
    - Gases reference a value of 5 mrem (not a D.O.)

Opportunities – Implementation

- Concluding Statement RM-50-2
- Schedule for implementation
- Cost-benefit Criteria $1000 per man-rem
  - NUREG-1530, $2000 per man rem
  - $1000 → $2000 → higher (?)
- Change supporting documents
  - Regulatory Guides (~15)
  - NUREGs (~25)
  - Generic Communications

Opportunities – Organization

- Arrangement of Appendix I, Section II (as an example)
  - Systems approach (objectives for system designs)
  - Group sections by release type
  - Liquid Releases (Section II.A)
  - Gaseous Releases of Noble Gases (Section II.B)
    - B.1 – Noble Gases (gamma-air, beta-air)
    - B.2(a) – Reduce noble gas design objectives (if TB>5 mrem)
    - B.2(b) – Increase noble gas design objectives (if TB<5, Skin<15)
  - Gaseous Releases of Other Nuclides (Section II.C)
    - Iodines
    - Particulates
    - Other nuclides → H-3, C-14 (?)
- Reg Guide 1.21 organized similar to Appendix, I Section II

Comporting Changes -- Authority

- Scope of SRM (re “conforming changes”)
- Develop bases for revisions of Part 20 and Appendix I
- Other Parts will need to be changed (“ASAP”)
- Part 2, 19, 30, 31, 32, 40, 50, 51, 52, 61, 63, 70, 71, 72, 76, 100, 140
  - Definitions/terminology (comporting to Part 20)
- Current plan -- separate regulatory actions
- Consider cumulative effects of regulation when changing other Parts

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Questions Before Break

- 10 minutes for Q&A period
- Comments or questions on material presented thus far
- One at a time (the public and all are invited participate)
- Questions from the audience:
  - Raise your hand
  - We will bring you a microphone.
  - Please begin by introducing yourself and summarize your question.
- Questions from the phone (bridge line).
- Questions from the webinar participants

- NRC staff will be available for approximately 30 minutes following the meeting to answer questions.

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Question 1:

- **Should Appendix I be Changed (or Not)?**
  - Advantages of change?
  - Disadvantages of change?
  - Costs to change programs (and cost savings)?
  - Same Impacts to BWRs and PWRs?
  - Benefits to changing Appendix I to align with ICRP-103 or should changes be delayed until future ICRP recommendations?

Question 2:

- **What is the scope of changes that should be made to Appendix I?**
  - Very limited? (only the following)
    - Appendix I (e.g., the design objectives for total body only)
    - RG 1.109
      - Tables B1, Dose factors for Noble Gases
      - Tables E-6 through E14, Dose factors for shoreline, inhalation, ingestion
  - Full change?
    - RG 1.109 through RG 1.113 (complete overhaul)
    - NUREGs, Generic Communications (retire, rewrite, combine)
    - Radwaste source term (ANSI N18.1)
    - New dispersion/diffusion models (liquid and gaseous effluents)
    - Evaluate new radwaste system designs
  - Somewhere in between “limited” and “full?”

Question 3:

- **Limit technical changes to Appendix I to "align with ICRP-103"?**
  - Keep numerical values for Design Objectives?
  - Eliminate organ dose?
  - Eliminate gamma-air, beta-air doses (gases)?
  - Update cost benefit criteria ($1000/man-rem)?
  - Eliminate RM-50-2 (Appendix I, Section V)?
  - Expand scope beyond light-water reactors (Appendix I Title)?
  - Eliminate skin and whole body dose (gases)?
    - dose rates for skin and whole body (gases) (NUREG-0133)?
  - Report organ doses, thyroid doses, skin doses?
  - Release types in Appendix I match the types reported (RG 1.21)?

Question 4:

- **Should NRC include both metric and English units?**
  - Dual units (e.g., Bq and Ci) in:
    - Reports,
    - Appendix I, and/or
    - Part 20 Appendix B
  - Would this introduce too much confusion?
  - Undue burden?
  - Costs for program changes?

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Question 5:

- **What effective date should be included for any revision of Appendix I (in Section V) for licensee implementation?**
  - How long to change programs, training, & procedures?
  - What actions could minimize implementation time?
  - What other NRC requirements may compete with implementation of any change to Appendix I?
  - What unintentional consequences may arise from a revision to Appendix I?

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Thanks and Adjourn

- NRC staff will be available for approximately 30 minutes following the meeting to answer questions.
- For openness and transparency, the transcript will be available on NRCs web page.

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Acronyms

ANPR	Advanced Notice of Proposed Rulemaking
ANSI	American National Standards Institute
ASAP	As soon as practical
BWR	Boiling Water Reactor
CFR	code of Federal regulations
D.O.	Design Objective
DOE	Department of Energy
ECL	Effluent Concentration Limit
EPA	Environmental Protection Agency
FSME	Office of Federal & State Materials & Environmental Management Programs
GASPAR	Computer program to calculate doses from gaseous releases
HP	Health Physics
ICRP	International Commission on Radiological Protection
LADTAP	Computer program to calculate doses from liquid releases
MEI	Maximum Exposed Individual
NEI	Nuclear Energy Institute
MFAP	Mixed Fission and Activation Products
NRC	Nuclear Regulatory Commission
NRO	Office of New Reactors, NRC
NUREG	NRC information document
ORNL	Oak Ridge National Laboratory
PWR	Pressurized Water Reactor
RETS-REMP	Radioactive Effluent Technical Specifications/Radiological Environmental Monitoring Program
SECY	NRC staff evaluation report submitted to the Commission
SRM	Staff Requirements Memorandum