What If?

- In a car heading toward a cliff with no way to steer away
- At this point, how many of us wish we would have taken the time to know how the brakes work and did the maintenance to keep from going over the cliff?
- Knowledge and proper implementation of regulations will keep you from “going over the cliff”

History of RETS

(as told by Jim Key)

Prepared by Jim Key, Key Solutions

Presented by Greg Barley, Duke Energy

(single day non-payed employee of Key Solutions)

Objectives

- Provide overview of history
- Assist in “knowing what you don’t know”
  - (I may not be a mechanic, but I know that I need brakes on my car to keep from going over the cliff!)

Key Solutions

Federal Law Regulating Effluents

- 10 CFR 20 – NRC

  "Standards for Protection Against Radiation"
- 10 CFR 50 – NRC

  "Domestic Licensing of Production and Utilization Facilities"
- 40 CFR 190 – EPA

  "Environmental Radiation Protection Standards for Nuclear Power Operations"

RETS

Radiological Effluent Technical Specifications

- The RETS are the Technical Specifications that deal with radioactive waste management systems and with environmental monitoring.
- The Model RETS (Standard RETS or SRETS) grew out of the 1970 requirements for keeping releases ALARA which were later quantified in “Appendix I” of 10 CFR 50. However, the RETS do contain other requirements as well.

ODCM

Off-Site Dose Calculation Manual

- The ODCM document contains the methodology and sufficient parameter values which serves as the bases for accepting a licensees' calculated off-site doses.
- The ODCM implements the RETS and shows by calculation how the RETS will be satisfied.

10 CFR 20

“Standards for Protection Against Radiation”

Purpose is twofold…

10 CFR 20 - Purpose

1. Establish standards for protection against radiation hazards arising out of activities under licenses issued by the Nuclear Regulatory Commission.

10 CFR 20 - Purpose

2. Control the possession, use, and transfer of licensed material by any licensee in such a manner that the total dose to an individual does not exceed the standards of radiation as put forth in 10 CFR 20.

10 CFR 20 Revision

- January 1986 – Proposed changes to Part 20 published in order to update dose methodology.
- December 1991 – Additional clarifications and changes published.
- January 1993 – NRC expected initial implementation.

10 CFR 20 Revision

- Little or no thought given to the impact of the Part 20 changes on effluents.
- Part 50, Appendix I limits much more restrictive than Part 20.
- NRC wanted to minimize impact on industry.
- NRC had neither the time nor resources to provide guidance for effluents.

10 CFR 20 Revision

- Generic Letter was promised but never formally issued.
- The GL was published in the Federal Register as a “Proposed Generic Communication” (Vol 58, No. 245, pp 68170 – 68179, December 23, 1993.)

Part 20 Changes

Member of the Public – “Old” Part 20

- Instantaneous dose rate limits based on 0.1 of ICRP 2 worker limits
  - –Total Body – 500 mrem
  - –Skin – 3000 mrem
  - –Organ – 1500 mrem

Part 20 Changes

Member of the Public – “New” Part 20

- 100 mrem TEDE
  - –ECLs bases on 50 mrem internal and 50 mrem external dose
- **NRC says keep old instantaneous dose rate limits since App I is more restrictive**

Impact of Part 20 Changes

Liquids

- "Old" Part 20

  Instantaneous concentrations at site boundary not to exceed 1 × App B, Table 2

- "New" Part 20

  Instantaneous concentrations at site boundary not to exceed **10** × App B, Table 2**

** Note the 10 times credit is not applicable to the Tech Spec limits on liquid holdup tank content. See NUREG 0472, LCO 3.11.1.4.

Impact of Part 20 Changes

Gases

- "Old" Part 20

  Total Body, Skin and Organ instantaneous dose rate limits based on 0.1 of ICRP 2 worker limits.

- "New" Part 20

  Total Body, Skin and Organ instantaneous dose rate limits are now only Tech Spec limits.

10 CFR 20 Changes for Effluents

"Old" Part 20

- Liquid Concentration
  - 1 x MPC
  - Instantaneous Limit
- Gas Concentration
  - Derived From 0.1 × ICRP 2 Worker Limits
  - Instantaneous Limit

"New" Part 20

- Liquid Concentration
  - 10 x ECL
  - Instantaneous Limit
- Gas Concentration
  - No Connection to Part 20
  - Tech Spec only
  - Instantaneous Limit

10 CFR 20

Standards for Protection Against Radiation

- Release Concentrations at the Site Boundary Shall Not Exceed 10 Times Appendix B, Table 2 Limits (New Part 20 – Implied)
- Credit May Be Taken For Dilution, Dispersion or Decay Between the Release Point and Site Boundary.
- Results in Tech Specs Which Require Liquid and Gaseous Monitor Setpoints
- Requires Compliance With EPA 40 CFR 190

10 CFR 20 Limits
(Per Site Limits)

Liquids

Offsite Concentrations Limited To:

10 Times Appendix B, Table 2 Values

10 CFR 20 Limits
(Per Site Limits)

Gases

Noble Gas Dose Rate Limited To:

500 mrem/year Total Body

3000 mrem/year Skin

10 CFR 20 Limits
(Per Site Limits)

Gases

Radioiodine, Tritium and Particulate Dose Rate Limited To:

1500 mrem/year To Any Organ

10 CFR 50 Appendix A

General Design Criteria For Nuclear Power Plants

General Design Criteria 60

- Effluent Releases Must Be Controlled

General Design Criteria 64

- Effluent Releases Must Be Monitored

10 CFR 50.34a

Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents – Nuclear Power Reactors

- Established Design Criteria for Effluents
- Requires Plants to be Designed to Keep Levels of Radioactive Material in Effluents "As Low As is Reasonably Achievable"
- Set Forth Numerical Guidance in Appendix I on Meeting ALARA Design Objectives
- Appendix I Values are Intended as Design Objectives and Limiting Conditions for Operations. They are NOT Radiation Protection Standards.

10 CFR 50.36
Technical Specifications

Requires That Technical Specifications Be Established and Followed

The Technical Specifications Will Address:

1. Safety Limits
2. Limiting Conditions for Operations
3. Surveillance Requirements
4. Design Features
5. Administrative Controls
6. Initial Notification
7. Written Reports

Key Solutions

10 CFR 50.36a

Technical Specifications on Effluents from Nuclear Power Reactors

Technical Specifications are Explicitly Required in the Following Areas:

1. Releases Shall Comply With the 10 CFR 20 Limits.
2. Procedures Shall Be Established and Followed For Operating Radwaste Treatment Systems.
3. Radwaste Treatments Systems Shall Be Maintained and Used.
4. Annual Release Reports Shall Be Prepared and Submitted to the NRC

10 CFR 50.36a

Technical Specifications on Effluents from Nuclear Power Reactors

Provides Guidelines in the Following Areas:

1. Releases Should Be a Small Fraction of the Section 20.1301 dose limits.
2. Best Efforts Shall Be Exerted to Keep Releases ALARA.
3. Appendix I to 10 CFR 50 Provides Numerical Guidance On Limiting Conditions For Operation For Effluents.

10 CFR 50 Appendix I

Numerical Guides for Design Objectives and Limiting Conditions for Operations to Meet the Criteria “As Low As is Reasonably Achievable” for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents

10 CFR 50 Appendix I

Effluent Design Objectives

1. Liquid effluents from each reactor each year shall not expose any individual to more than 3 mrems to the total body and 10 mrems to any critical organ.
2. Gaseous effluents from each reactor each year (A) shall not produce, at any occupiable off-site location, air doses greater than 10 mrad gamma and 20 mrad beta or alternately, (B) shall not expose any individual to more than 5 mrem to the total body or 15 mrem to the skin.

10 CFR 50 Appendix I

Effluent Design Objectives

3. Airborne iodine and particulate effluents from each reactor each year shall not expose any individual to more than 15 mrem to any critical organ.
4. Doses shall be further reduced as much as practical up to the expenditure of $1000 per person-rem saved

10 CFR 50 Appendix I

Limiting Conditions for Operation (LCO) Specified in Appendix I:

1. If releases during any calendar quarter cause doses exceeding half an annual design objective, the licensee shall investigate, correct and report to the NRC in 30 days.
2. Surveillance programs shall be established to monitor releases, monitor the environment and identify changes in land use.

10 CFR 50 – (Per Reactor Unit)

- Liquids
  - Total Body Dose Limited To:
    - 1.5 mrem/quarter and
    - 3.0 mrem/year
  - Organ Dose Dose Limited To:
    - 5.0 mrem/quarter and
    - 10.0 mrem/year

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10 CFR 50 – (Per Reactor Unit)

- Gases
  - Gamma Air Dose Limited To:
    - 5 mrad/quarter and
    - 10 mrad/year
  - Beta Air Dose Limited To:
    - 10 mrad/quarter and
    - 20/mrad/year
  - Organ Dose Limited To:
    - 7.5 mrem/quarter and
    - 15 mrem/year

40 CFR 190

Environmental Radiation Protection Standards for Nuclear Power Operations

The Dose To Any Member of the Public Shall Not Exceed:

- 25 mrem Whole Body
- 75 mrem Thyroid
- 25 mrem Any Other Organ

Radon and Daughter Products Are Excepted

Liquid Effluents

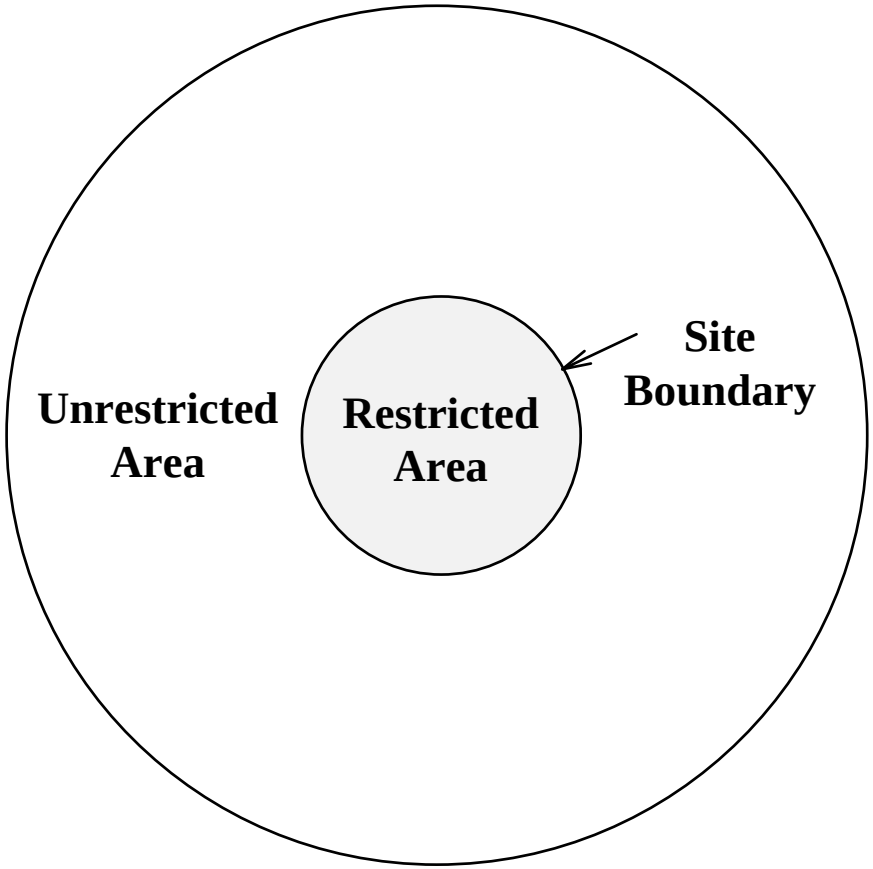
10 CFR 20

- Per Site Offsite Concentrations
  - Limited to 10 Times Appendix B, Table 2 Values

10 CFR 50

- Per Unit Dose Limits
  - Total Body Dose
    - 1.5 mrem/qtr and 3.0 mrem/year
  - Organ Dose
    - 5.0 mrem/qtr and 10.0 mrem/year

Liquid Effluents



Site Boundary Concentrations Limited To:

- 10 Times 10 CFR 20, App B, Table 2, Col 2

Dose to Member of Public Not To Exceed:

- 1.5 mrem/qtr and 3.0 mrem/yr Total Body
- 5.0 mrem/qtr and 10 mrem/yr Any Organ

Liquid Effluent Implementation Methodology

10 CFR 20 Concentration Limits

Calculate Liquid Effluent Monitor Setpoints to Terminate Release in the Event Activity Concentration Exceeds 10 Times 10 CFR 20 Limits at the Site Boundary

NOTE: For Purposes of Setpoint Determination, the 10 CFR 20 Concentration Limits are Considered to be Instantaneous Limits

Liquid Effluent Implementation Methodology

10 CFR 50 Dose Limits

Calculate Cumulative Total Body and Organ Doses to Real Individual Based on Existing Pathways

Note: Dose is calculated at the location in the unrestricted area where the combination of existing pathways and receptor age groups indicated the maximum potential exposures.

Gaseous Effluents - I

10 CFR 20

Per Site Dose Rate Limits

Derived From Old 10 CFR 20 Appendix B, Table 2
Offsite Concentration Limits

- Noble Gas Dose Rate Limits
  - 500 mrem/year Total Body
  - 3000 mrem/year Skin
- Radioiodine, Tritium and Particulate Dose Rate Limits
  - 1500 mrem/year Any Organ

Gaseous Effluents - II

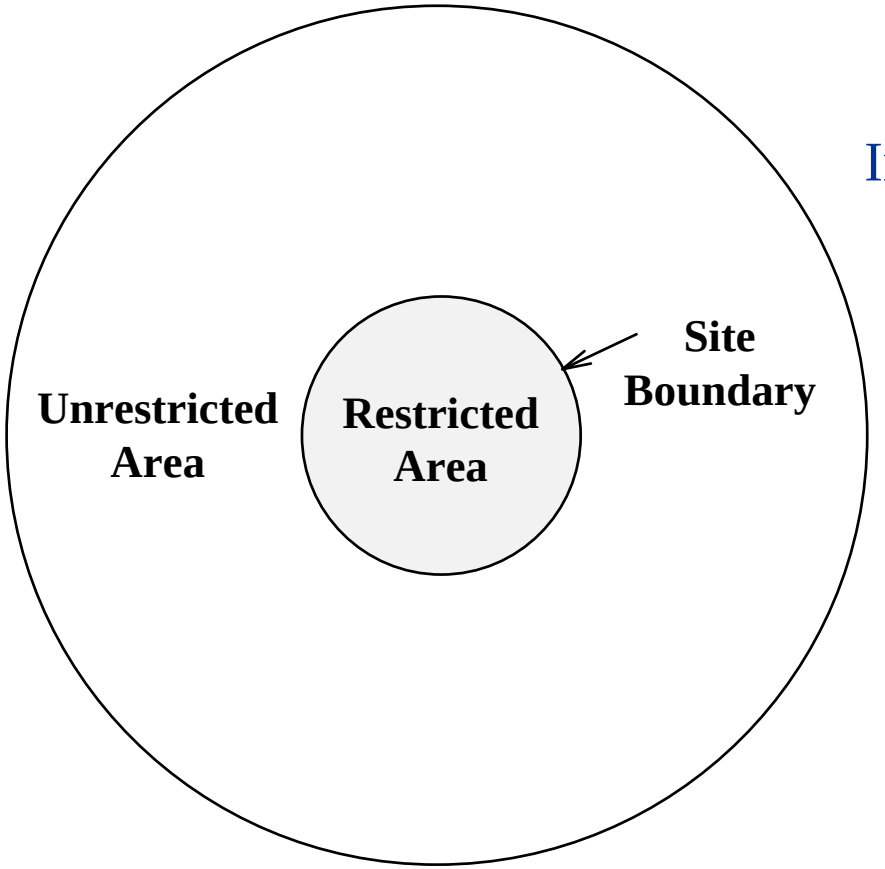
10 CFR 50

Per Unit Dose Limits

Based Upon Appendix I Design Objectives

- Air Dose Limits
  - 5 mrad/qtr and 10 mrad/year Gamma
  - 10 mrad/qtr and 20 mrad/year Beta
- Organ Dose Limits
  - 7.5 mrem/qtr and 15 mrem/year Organ

Gaseous Effluents

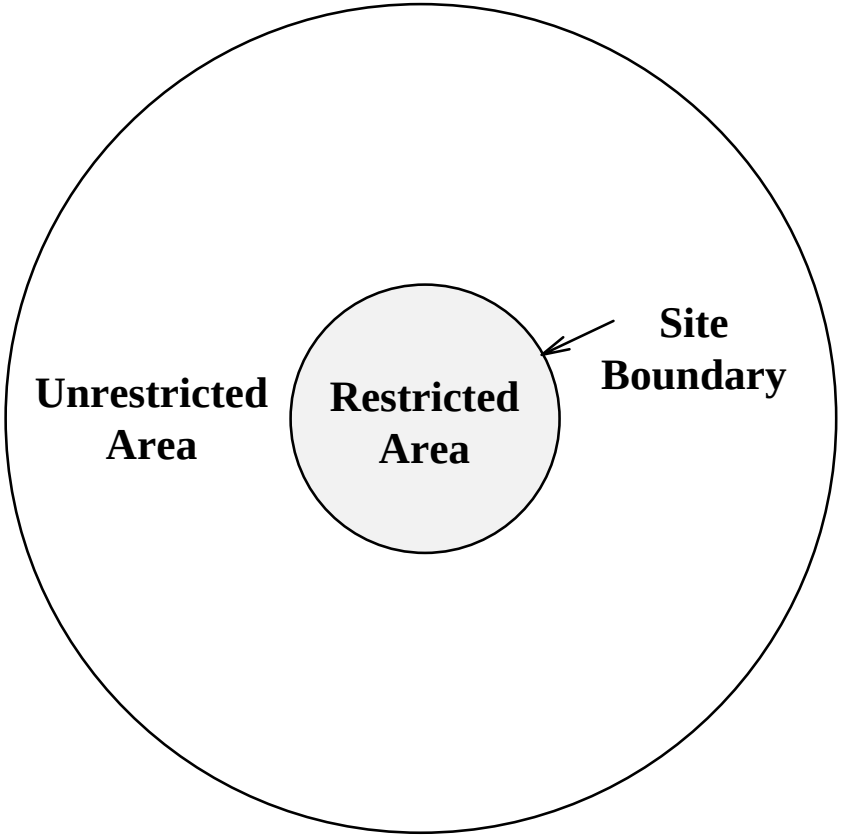


At the Site Boundary

Instantaneous Dose Rates Limited To:

- Noble Gas:
  - •500 mrem/yr Total Body
  - •3000 mrem/yr Skin
- Radioiodines, Tritium and Particulates:
  - •1500 mrem/yr Any Organ

Gaseous Effluents



At or Beyond the Site Boundary

Noble Gas Air Dose Limited To:

- 5 mrad/qtr and 10 mrad/yr Gamma
- 10 mrad/qtr and 20 mrad/yr Beta

Dose to Individual From Radioiodines, Tritium and Particulates Limited To:

- 7.5 mrem/qtr and 15 mrem/year

Key Solutions

Gaseous Effluent Implementation Methodology

Tech Spec Airborne Concentration Limits (Driven by "Old" 10 CFR 20)

Calculate Rad Monitor Setpoints to Limit Instantaneous Noble Gas Dose Rates To:

500 mrem/year Total Body

3000 mrem/year Skin

Calculate Radioiodine, Tritium and Particulate Dose Rates to Verify Compliance With the 1500 mrem/year Organ Dose Rate Limit

Gaseous Effluent Implementation Methodology

10 CFR 50 Dose Limits

Calculate Cumulative Total Body and Organ Doses to Real Individual Based on Existing Pathways

Note: Dose is calculated at the location in the unrestricted area where the combination of existing pathways and receptor age groups indicated the maximum potential exposures.

Boldly Go…

- Knowing and implementing the regulations will allow you to…

- LIVE LONG AND PROSPER!