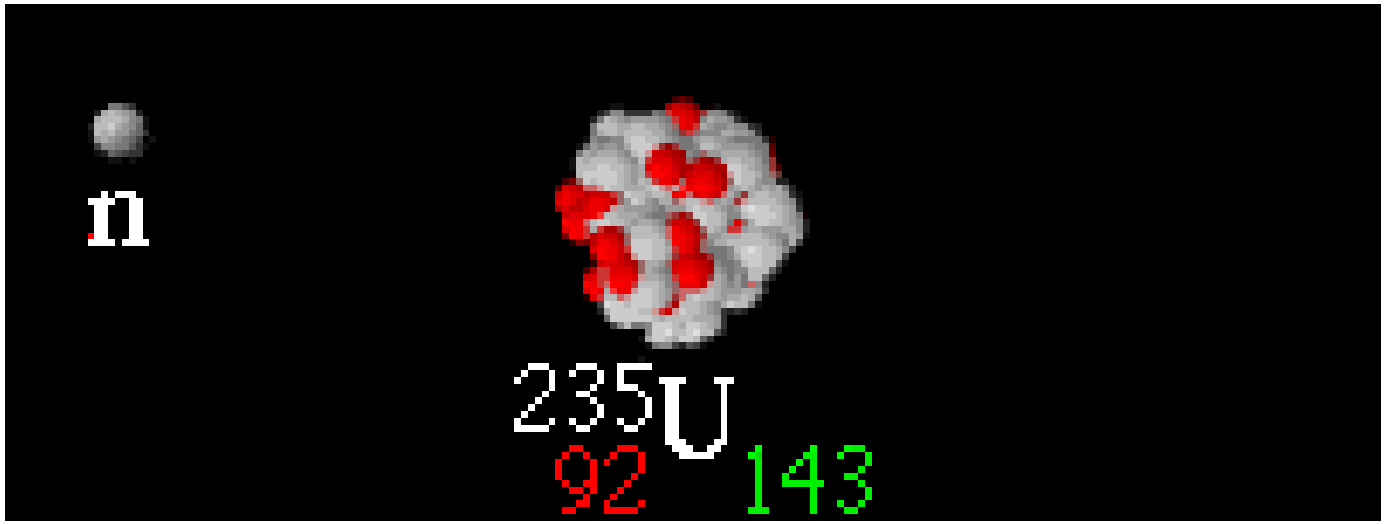
Fundamental Principles of Radiation



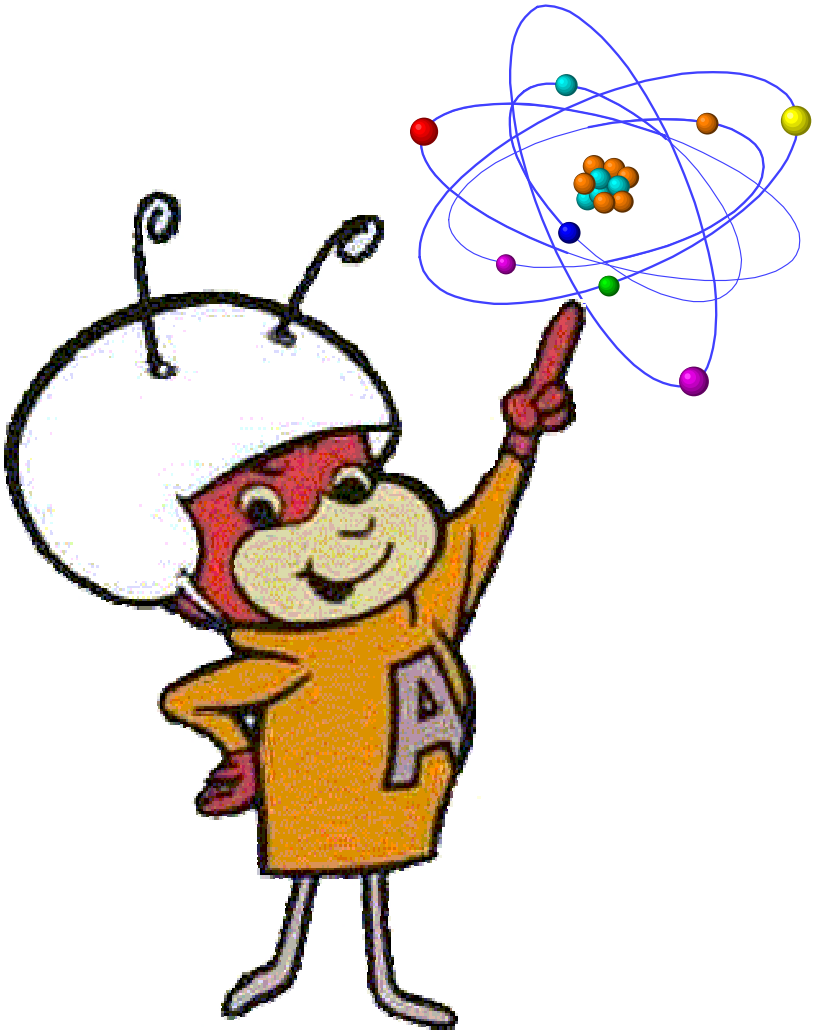
February 16, 2011

Instructor: Tom Enyeart, CHP

National Nuclear Security Administration
Nevada Site Office

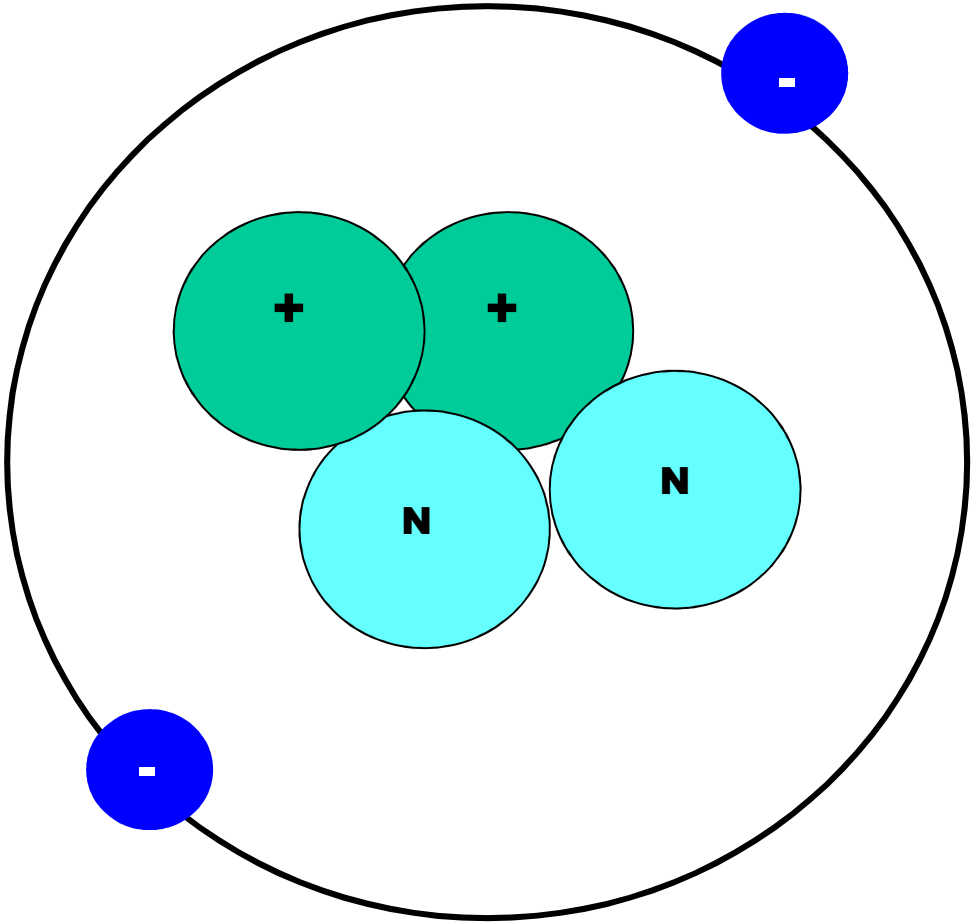
FUNDAMENTALS OF IONIZING RADIATION

What is an Atom?



Atoms

Atoms are the building blocks of ALL matter



A Helium atom is used in this example

Nucleons

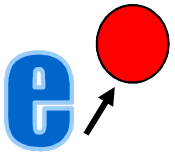
Neutron

Mass is about 1 amu

Proton

Mass is about 1 amu

1 amu = 1.66 x 10^{-24} gram



Mass is about 0.0005 amu

Atoms

- Nuclear particles form atoms
- Similar atoms combine to form elements
- Elements combine to form molecules
- Molecules combine to form compounds

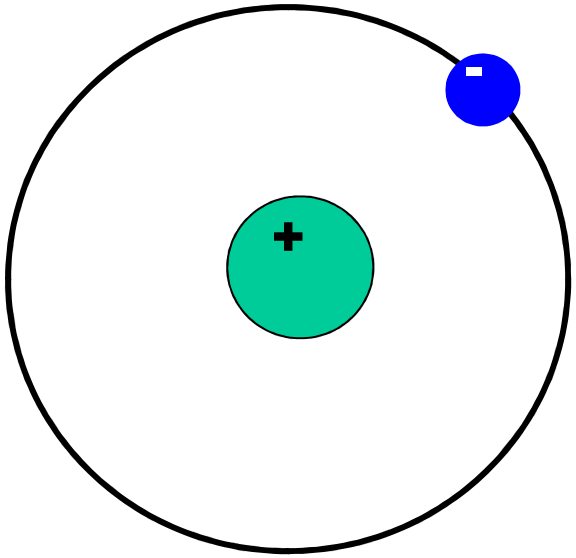
Isotopes

- The number of PROTONS defines the ELEMENT
- The number of NEUTRONS defines the ISOTOPE
- The isotopes of an element have similar chemical properties but different nuclear properties
  - Some isotopes are stable
  - Some isotopes are radioactive

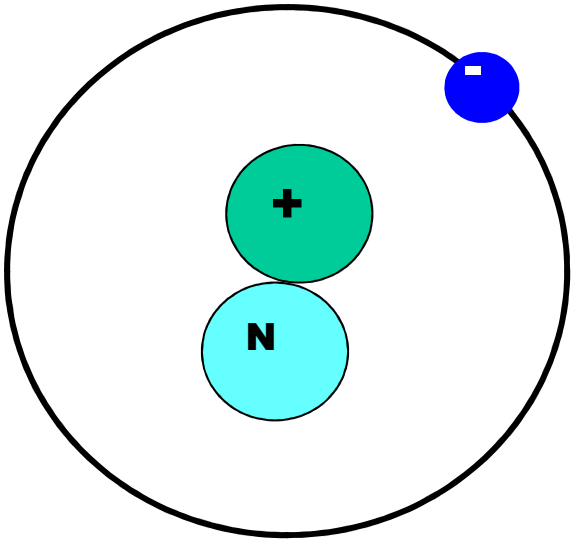
Isotopes

Different Isotopes of Hydrogen

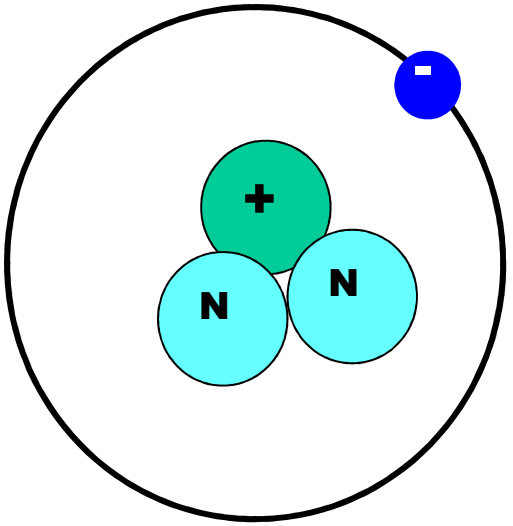
“Normal” Hydrogen
or Protium
1 proton
0 neutron
1 electron
$_1H^1$



Deuterium
1 proton
1 neutron
1 electron
$_1H^2$



Tritium
1 proton
2 neutrons
1 electron
$_1H^3$



Isotopes & Atomic Notation

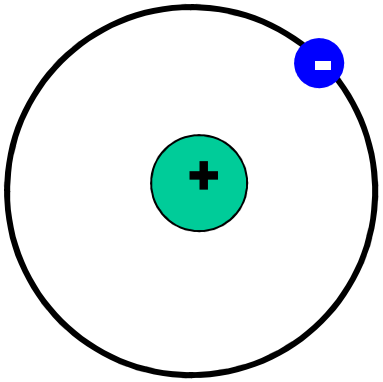
X = The symbol of the element

Z = The atomic number (# of protons) $_{Z}X^{A}$

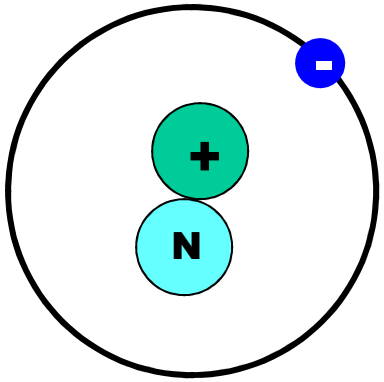
A = The atomic mass number (# of protons + neutrons)

Different Isotopes of Hydrogen

"Normal" **Hydrogen** or Protium
1 proton
0 neutrons
1 electron
$_{1}H^{1}$



Deuterium
1 proton
1 neutron
1 electron
$_{1}H^{2}$



Tritium
1 proton
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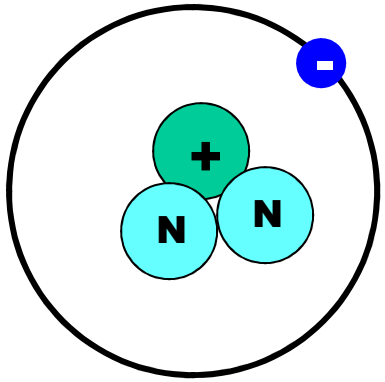


IONIZING RADIATION

Two Types of Radiation

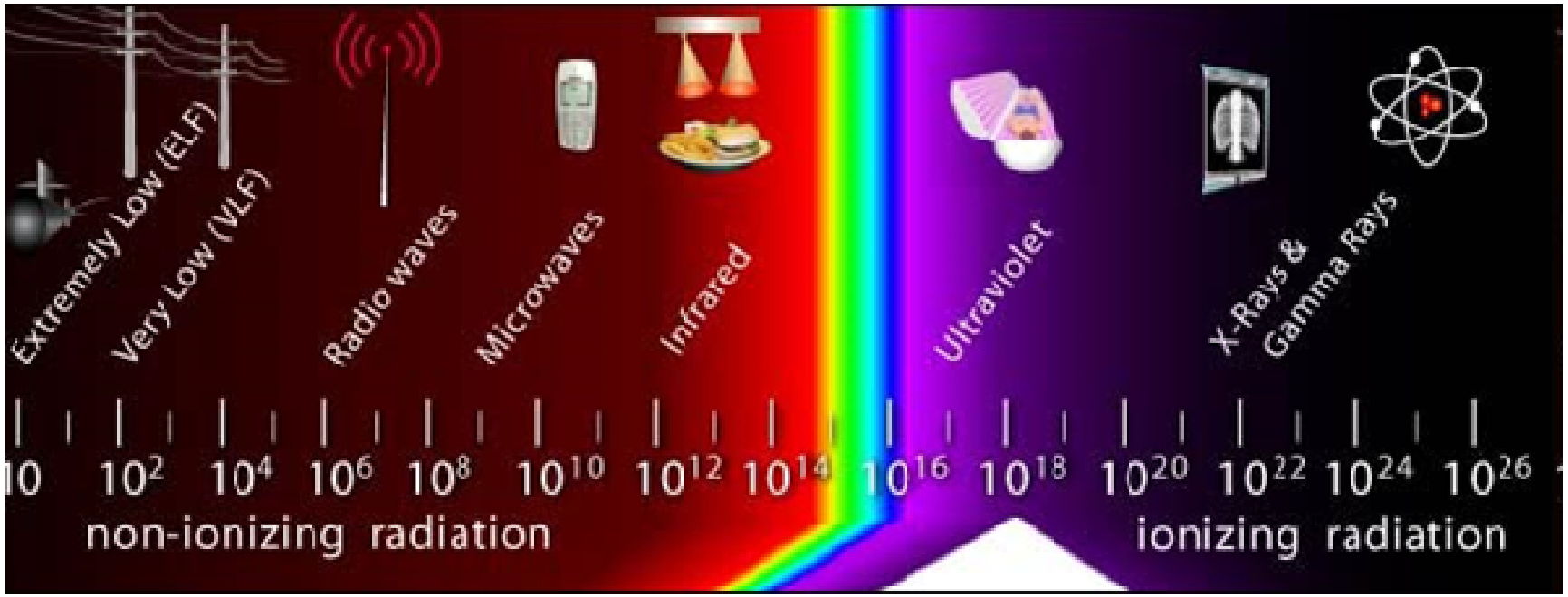
- Non-Ionizing
- Ionizing

Non-Ionizing

Radiation that doesn't have enough energy to form ions:

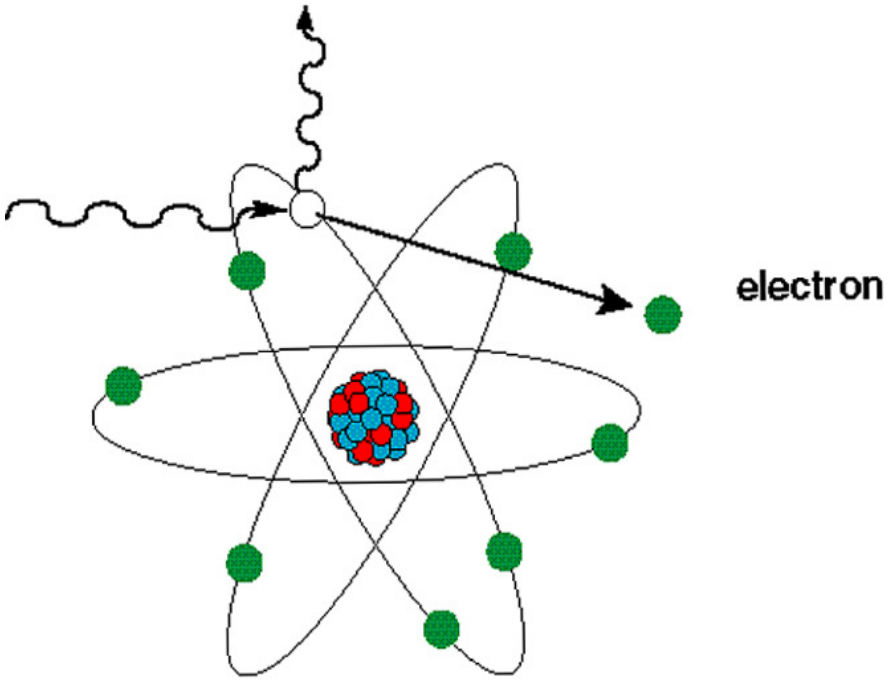
- **Radar Waves**
- **Microwaves**
- **Laser**
- **Visible Light**

The Electromagnetic Spectrum
is a large family of radiation that includes light, infrared, ultraviolet, X-rays, radio waves, and gamma rays



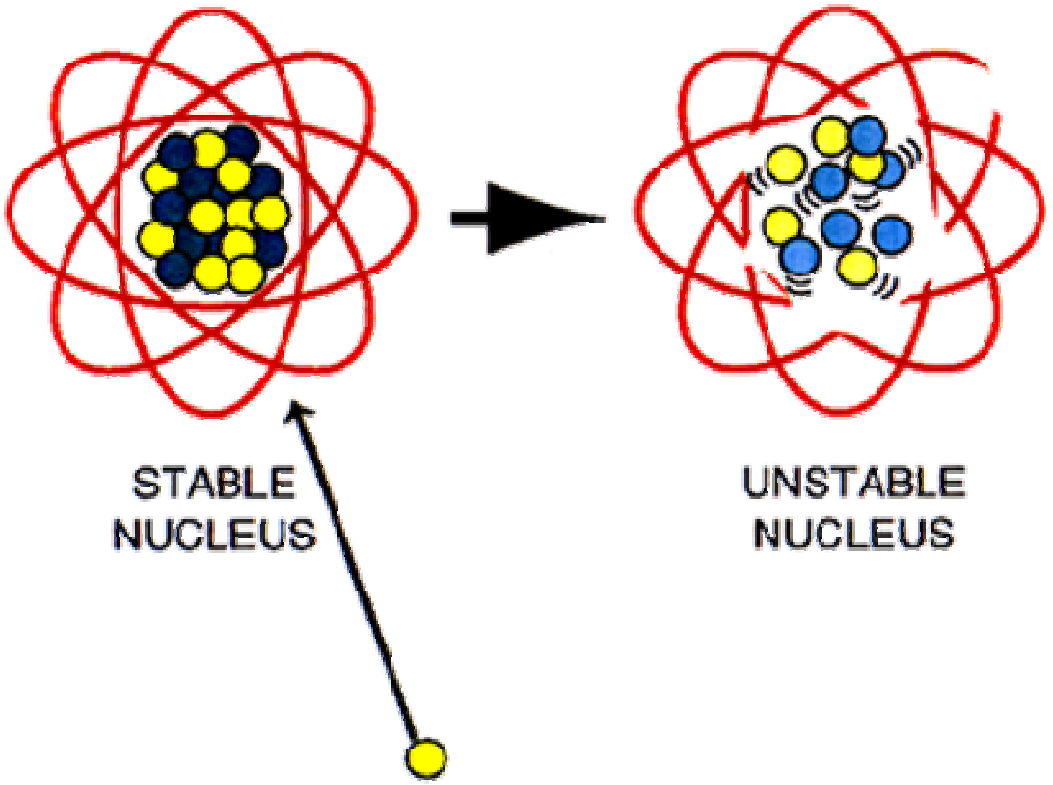
Ionizing Radiation

Excess energy (from unstable atoms) capable of removing orbiting electrons from an atom, producing electrically-charged particles called ions. The "free" electron (- charge) and the remaining atom (+ charge) are the ions.



Stability of Nucleus

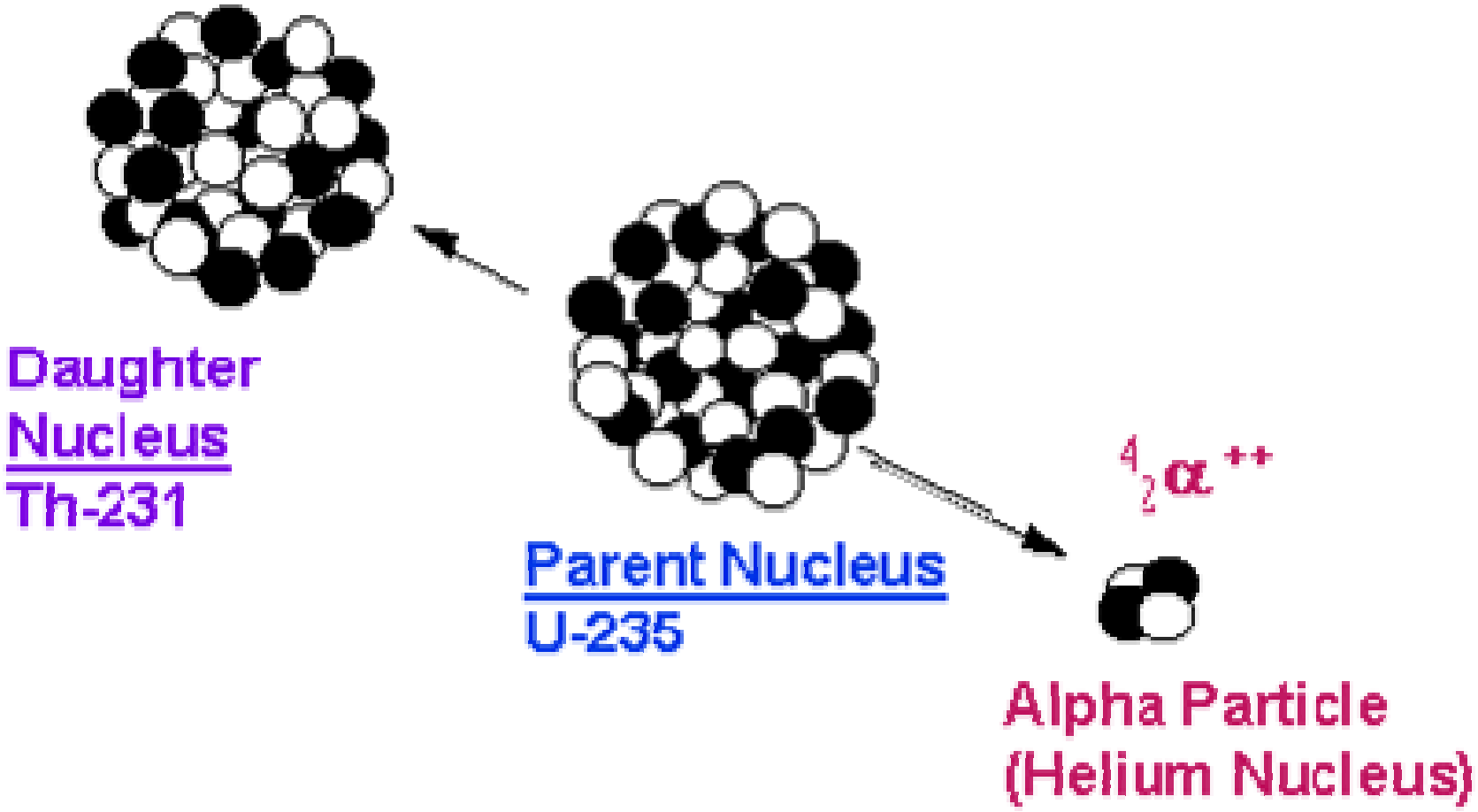
NUCLEI MAY BE STABLE OR UNSTABLE



Do any or all of the following:

- **Emit particle**
  - Alpha (α)
  - Beta (β)
  - **Positron**
  - **Neutron**
- **Emit EM radiation**
  - Gamma (γ)
- **Grab electron**
- **Split (fission)**

Alpha Particle Radiation

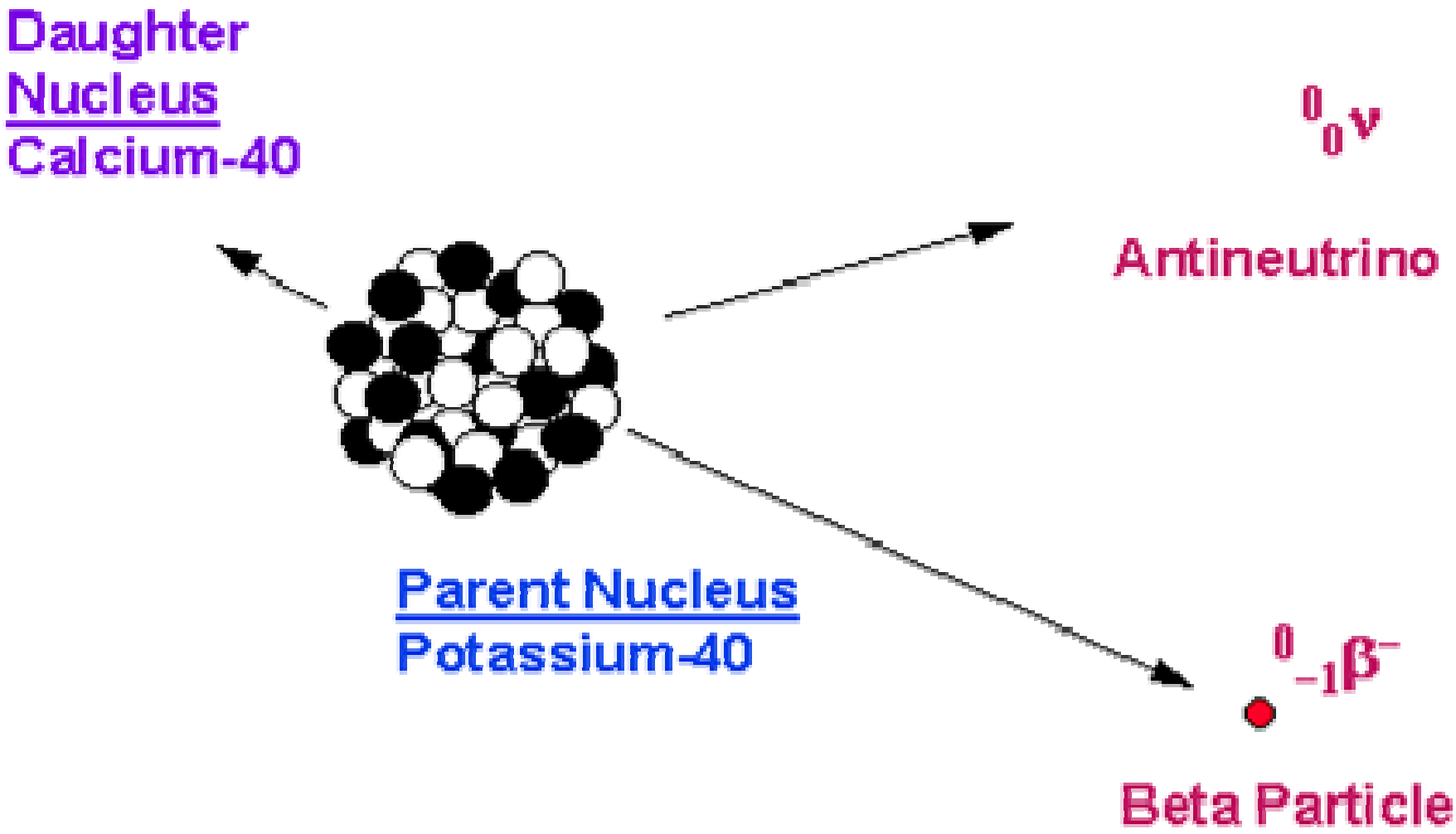


Alpha Particle Radiation

Alpha

- Large, highly positive charged particle
- Range in air about 1 - 2 inches
- Shielding can be a piece of paper, clothing or even the dead outer layer of skin
- Biological hazard is inhalation or ingestion

Beta Particle Radiation

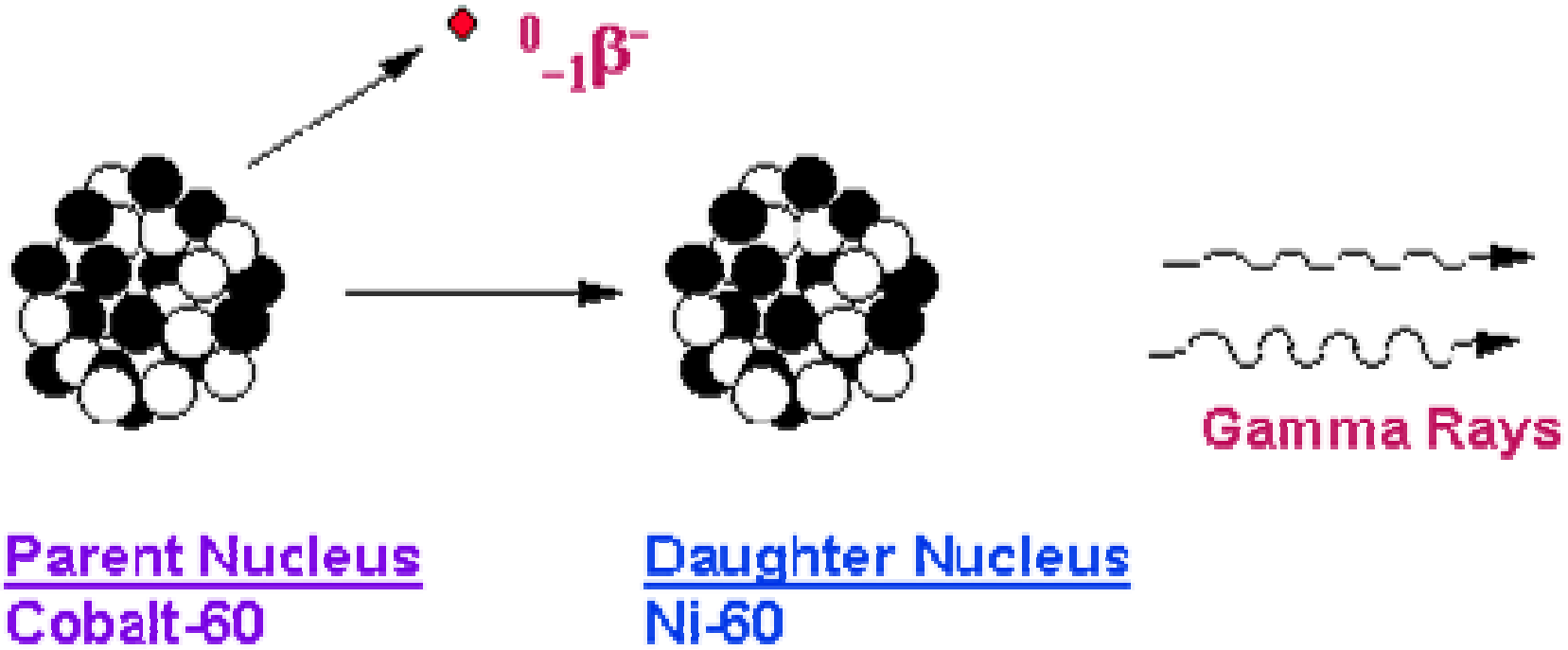


Beta Particle Radiation

Beta

- Small, negative charged particle
- Range in air is about 10 feet
- Shielding can be plastic, glass, metal foil, or safety glasses
- Biological hazard is inhalation or ingestion
- Externally, the eyes and skin are at risk

Gamma-Ray Radiation



Gamma-Ray Radiation

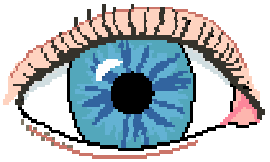
Gamma

- Electromagnetic waves or photons that have no charge, similar to X-rays
- Range in air is several hundred feet
- Shielding is more difficult due to high penetrating power - dense materials (high Z number) such as concrete, lead, steel
- Biological hazard is whole body

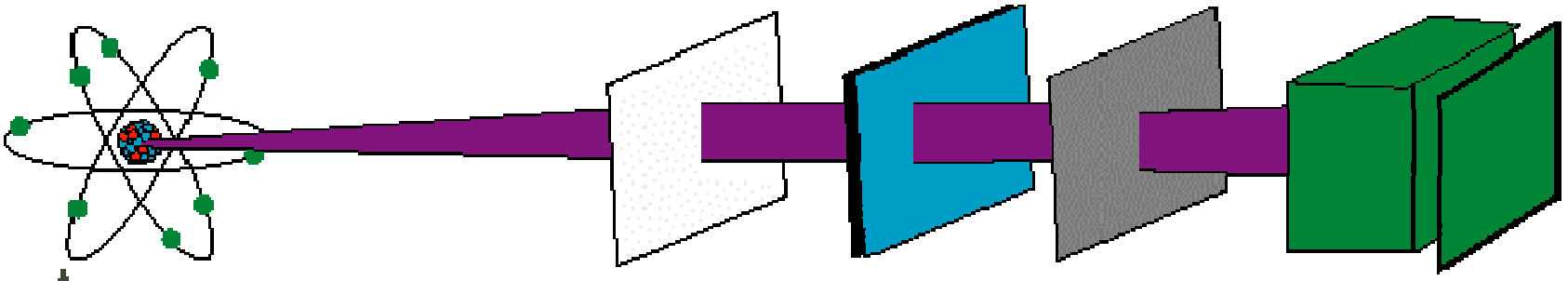
Neutron Radiation

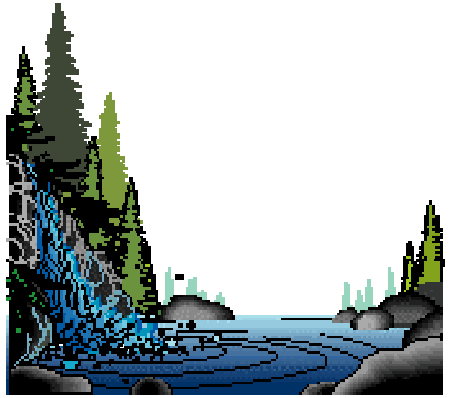
are very penetrating;
therefore, they can affect all organs.

eyes are the most susceptible

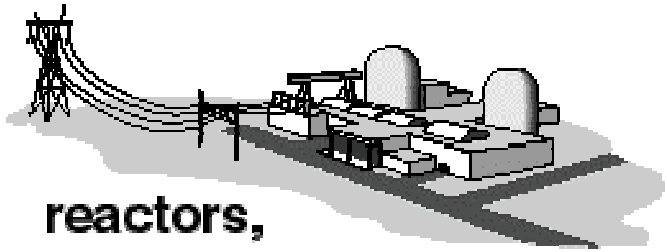


slowed by hydrogenous materials and then absorbed by cadmium or boron





few natural emitters



reactors,
research accelerators

Neutron Radiation

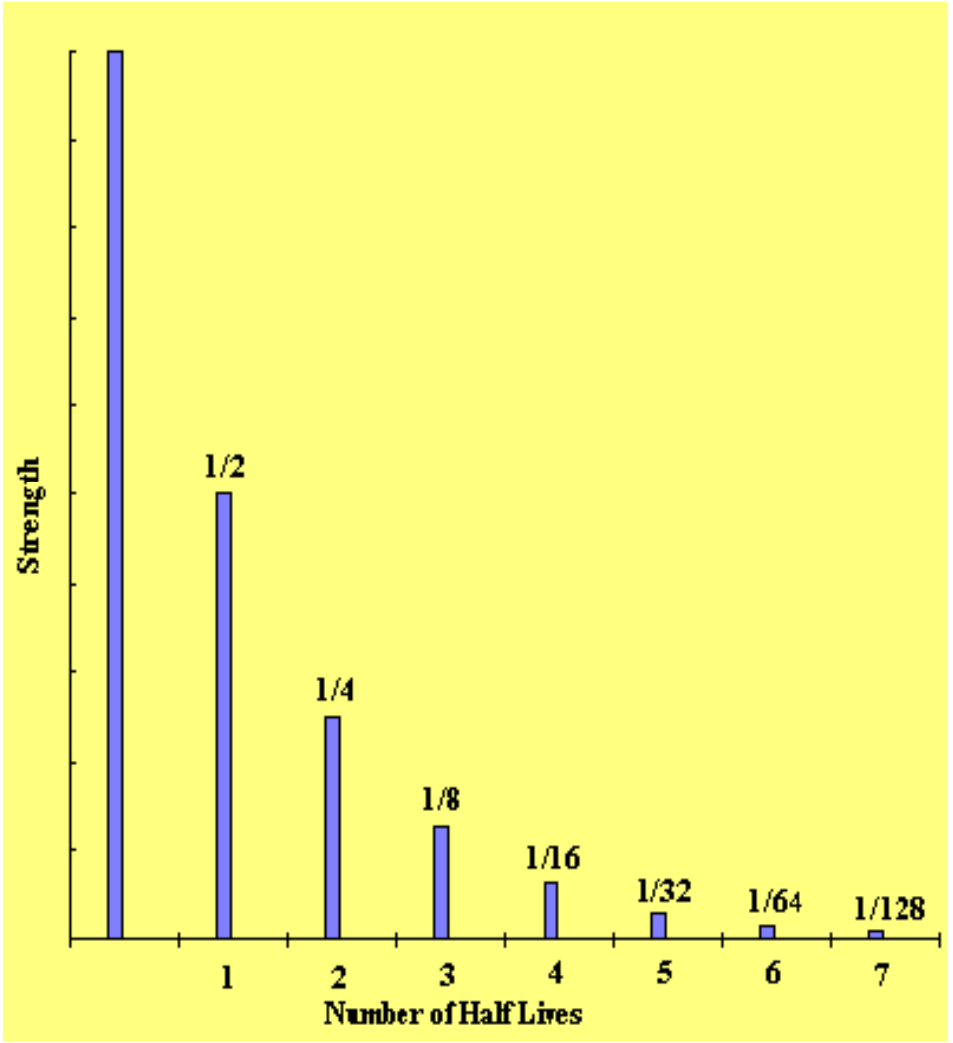
Neutron

- Neutral particle ejected from nucleus
- Range in air is several hundred feet
- Shielding is better with materials that have high hydrogen content - water, plastic, boron, and even paraffin (low Z number)
- Biological hazard is whole body due to high penetrating power

Radioactivity

Radioactivity is a natural and spontaneous process by which unstable radioactive atoms decay to a different state and emit excess energy in the form of radiation

Half-life (T½) is the amount of time required for radioactive material to decrease by one half. Each radioisotope has a unique Half-life time period.



UNITS OF MEASURE

Units for Radiation Dose and Exposure

Roentgen (R)
Unit for measuring exposure
Defined only for effect on air
Applies only to gamma and X-ray radiation
Does not relate biological effects of radiation to the human body

Units for Radiation Dose and Exposure

Rad (Radiation Absorbed Dose)
Unit for measuring absorbed dose in any material
Defined for any material.
Applies to all types of radiation
Does not take into account the potential effect that different types of radiation have on the body

Units for Radiation Dose and Exposure

Rem (Roentgen Equivalent Man)
Unit for measuring effective dose (most commonly used unit)
Pertains to human body
Applies to all types of radiation
Takes into account the energy absorbed (dose) and the biological effect on the body due to the different types of radiation

Units for Radiation Dose and Exposure

Roentgen (R)	**Rad (Radiation Absorbed Dose)**	**Rem (Roentgen Equivalent Man)**
Unit for measuring exposure.	Unit for measuring absorbed dose in any material.	Unit for measuring dose equivalence (most commonly used unit)
Defined only for effect on air.	Defined for any material.	Pertains to human body.
Applies only to gamma and X-ray radiation.	Applies to all types of radiation.	Applies to all types of radiation.
Does not relate biological effects of radiation to the human body.	Does not take into account the potential effect that different types of radiation have on the body.	Takes into account the energy absorbed (dose) and the biological effect on the body due to the different types of radiation.

Rem = Rad x WF

Not All Radiation Is The Same

- Different radiation has different biological effects
- Radiation WEIGHTING FACTORS

•	Alpha = 20	α
•	Neutron = 5 - 20	η
•	Beta = 1	β
•	Gamma = 1	γ

Prefixes for Units

1 rem = 1,000 mrem (millirem)

1 mrem = 1,000 µrem (microrem)

The same holds true for the new SI units, i.e.,

1 Sievert (Sv) = 1,000 mSv (millisieverts)

1 mSv = 1,000 µSv (microsieverts)

Unit Conversions

	Source Activity (disintegrations per unit time)	Exposure	Dose
Old Units	Curie (Ci) = 37×10^9 dps dps = disintegrations per second	Roentgen (R). RAD or rad: radiation absorbed dose	Rem – roentgen equivalent man
New SI Units	Becquerel (Bq) 1 Bq = 1 dps 1 Ci = 37 GBq	Gray (Gy) 1 Gy = 100 rad 1 rad = 1 cGy	Sievert (Sv) 1 Sv = 100 rem 1 rem = 10 mSv

For gamma and x-ray radiation, a common "conversion factor" between exposure, absorbed dose, and dose equivalent is:

1 R = 1 rad = 1 rem

SOURCES OF RADIATION

Natural Sources of Radiation

- Cosmic radiation
- Terrestrial radiation
- Radon
- Human body

Man-made Sources of Radiation

- Medical radiation
- Nuclear Power
- Consumer products
- Industry and Research
- Other minor sources

Average Annual Dose

Cosmic radiation – 30 mrem/yr @ sea level

Terrestrial radiation – 19 mrem/yr

Radon – 230 mrem/yr

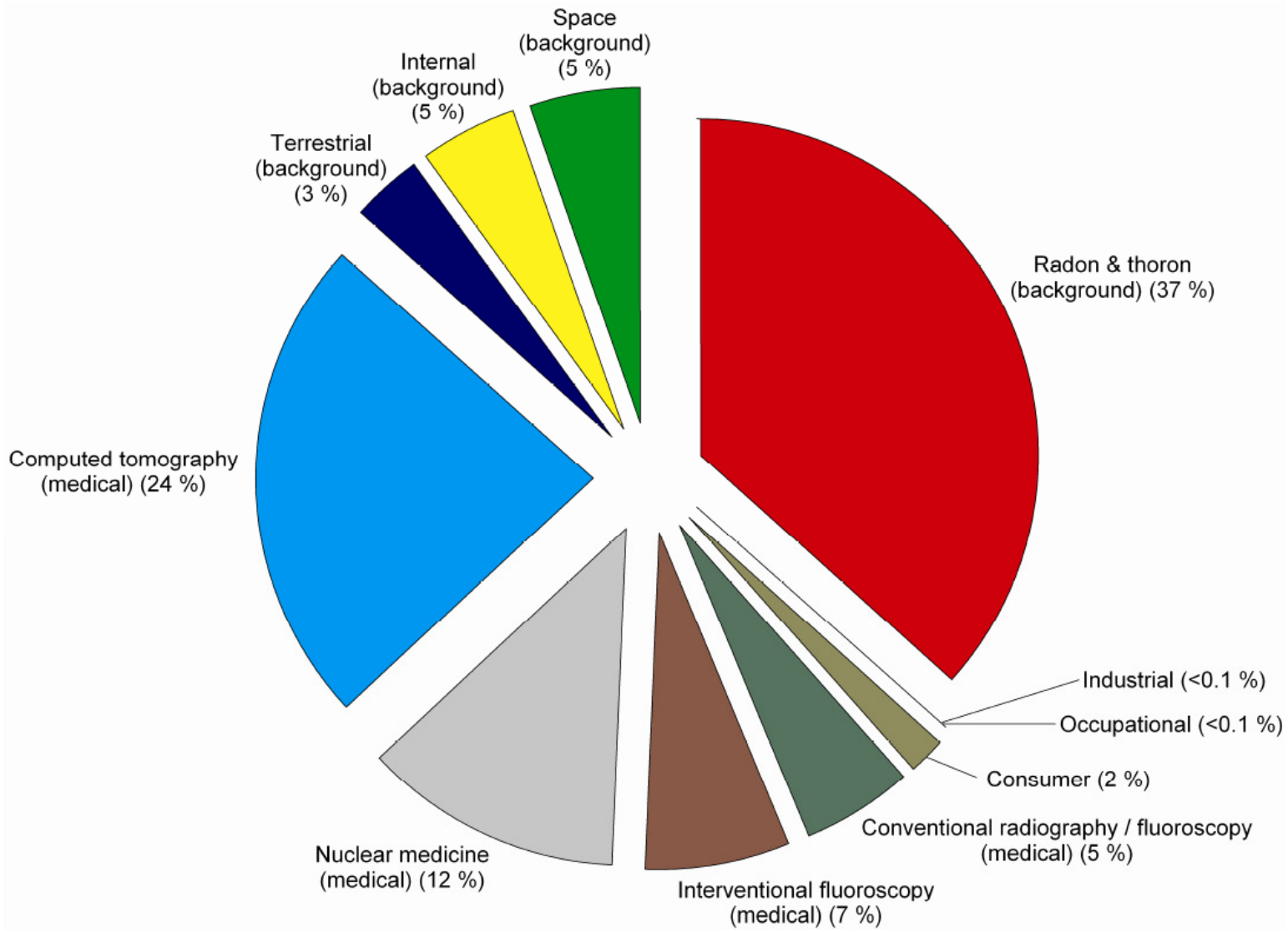
Human body – 31 mrem/yr

Medical radiation – 298 mrem/yr

Consumer products – 12 mrem/yr

Nuclear power, industry, research – <1 mrem/yr

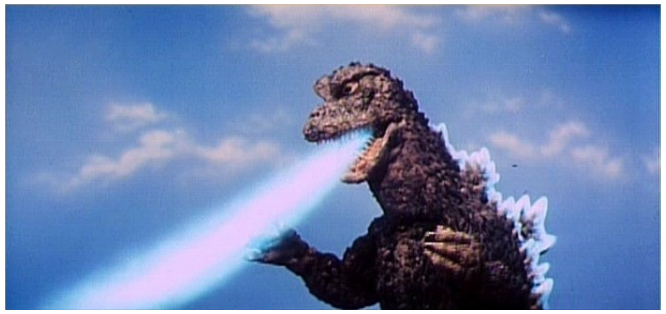
Average Annual Total – 620 mrem/yr

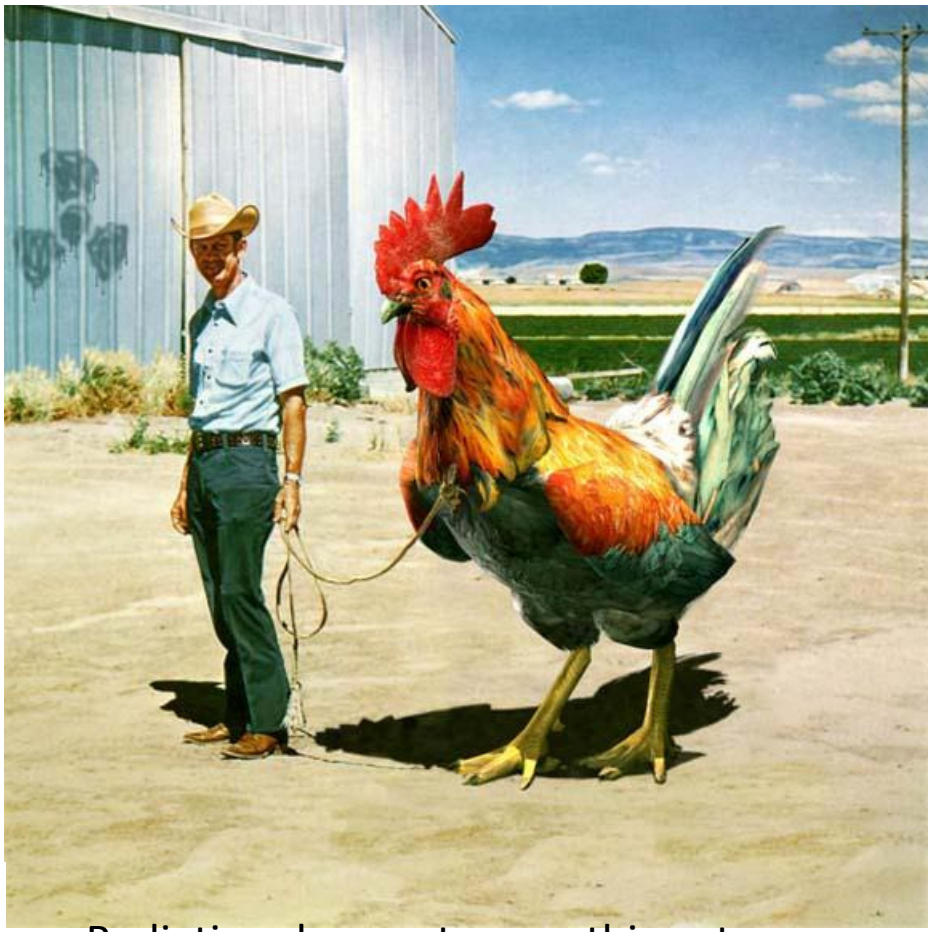


From NCRP Report No. 160, “Ionizing Radiation Exposure of the Population of the United States” (2009)

BIOLOGICAL EFFECTS OF RADIATION EXPOSURE

Exposure to radiation will cause <u>none</u> of these things to happen.

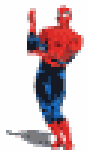


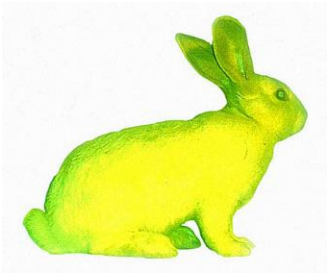


Radiation does not cause things to grow larger.

You will not turn green.

You will not get super powers.





You will not glow in the dark.

Two Categories of Radiation Dose

- Acute
- Chronic

Acute Radiation Doses

- An acute effect is a physical reaction due to massive cell damage.

- Damage caused by a large amount of radiation in a short period of time.

Acute Radiation Dose Effects

Blood changes	25 – 100 Rad
Anorexia (loss of appetite)	150 Rad
Nausea	200 Rad
Fatigue	220 Rad
Vomiting	280 Rad
Epilation	300 Rad
Diarrhea	350 Rad
Mortality (w/o supportive care)	350 Rad
Mortality (with supportive care)	500 Rad

Chronic Radiation Doses

- **Chronic radiation dose is typically a small amount of radiation received over a long period of time.**

- **Example: the dose we receive from natural background radiation every day of our lives.**

Chronic Radiation Dose Effects

- **The principal effect of chronic radiation dose is increased risk of contracting cancer.**

- **No increased risk of cancer has been observed in individuals who receive radiation dose at occupational levels (500 – 5,000 mrem/yr).**

- **No observable radiation effects in humans below a one-time dose of about 10,000 mrem.**

Possible Effects of Radiation on Cells

When a cell is exposed to ionizing radiation, several things can happen:

- **No damage**
- **Cells repair the damage and operate normally**
- **Cells are damaged and operate abnormally**
- **Cells die as a result of the damage**

Factors Affecting Biological Damage from Radiation

- Total dose
- Dose rate
- Type of radiation
- Area of the body receiving the dose
- Cell sensitivity
- Individual sensitivity

Genetic Effects

There is no direct evidence of radiation-induced genetic effects in humans, even at high doses. Various analyses indicate that the rate of genetic disorders produced in humans is expected to be extremely low, on the order of a few disorders per million live born per rem of parental exposure.

Comparison of Risks

Health Risk	*Estimate of Life Expectancy Lost*
Smoking 20 cigarettes a day	**6 years**
Overweight (by 15%)	**2 years**
Alcohol consumption (U.S. average)	**1 year**
Agricultural accidents	**320 days**
Construction accidents	**227 days**
Automobile accidents	**207 days**
Home accidents	**74 days**
1 rem/yr from age 18 to 65	**51 days**
All natural hazards (earthquake, etc.)	**7 days**
Medical radiation	**6 days**

RADIATION PROTECTION

ALARA

As Low As Reasonably Achievable

ALARA Exposure Practices

There are three basic practices used to maintain exposures to ALARA:

TIME	Reduce Exposure Time
DISTANCE	Increase Distance
SHIELDING	Use Shielding

TIME

DOSE RATE: Energy per unit time

DOSE: Total energy absorbed

Dose = (Dose rate) x Time

Example of dose rate: 100 mrem/hr

TIME

DOSE RATE: Energy per unit time

DOSE: Total energy absorbed

Dose = (Dose rate) x Time

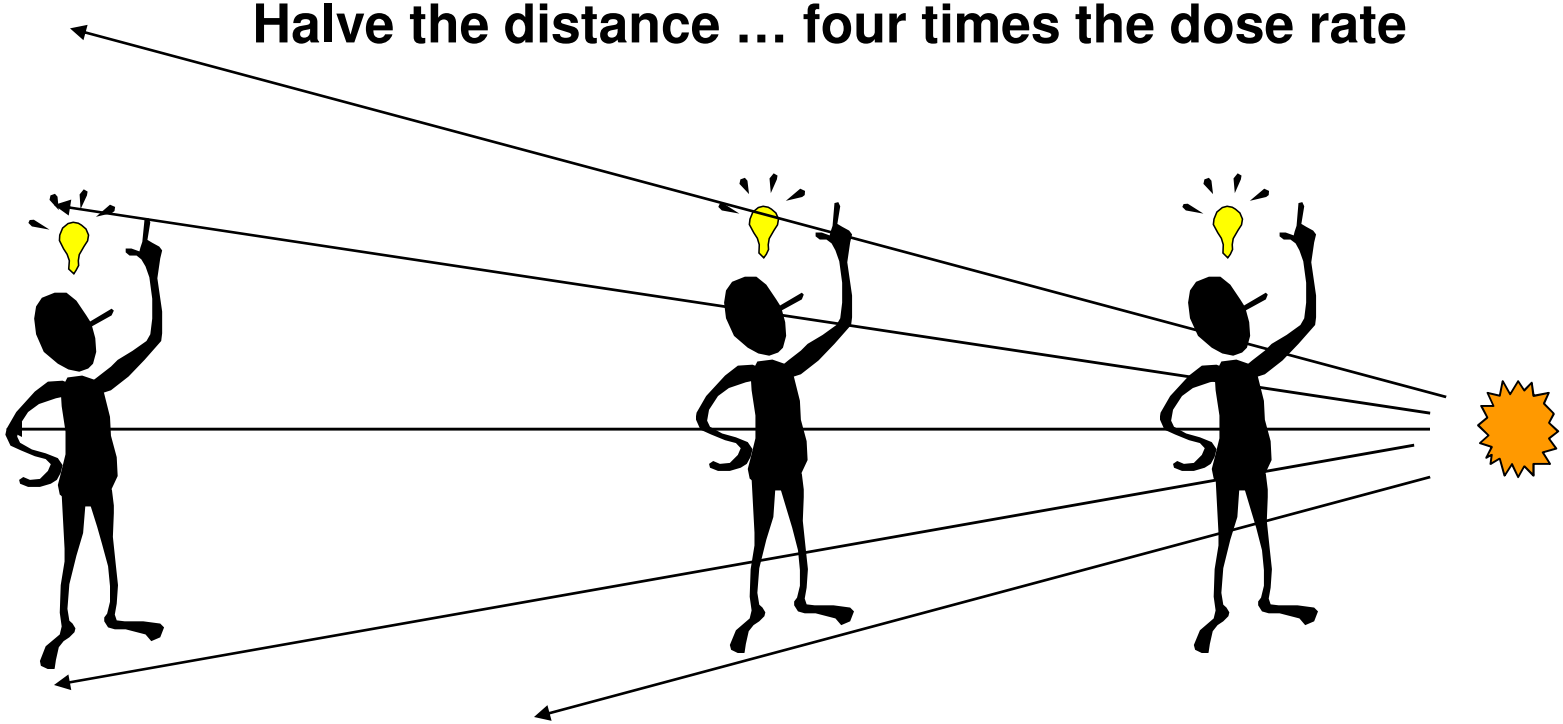
Example of dose rate: 100 mrem/hr

- **If you stayed in this *dose rate* for an hour, what would your *total dose* be ?**
- **What would your *dose* be after 15 minutes ?**
- **If your allowed total dose is 75 mrem, what is your stay time ?**

DISTANCE

Inverse Square Law

Double the distance … ¼ the dose rate
Halve the distance … four times the dose rate



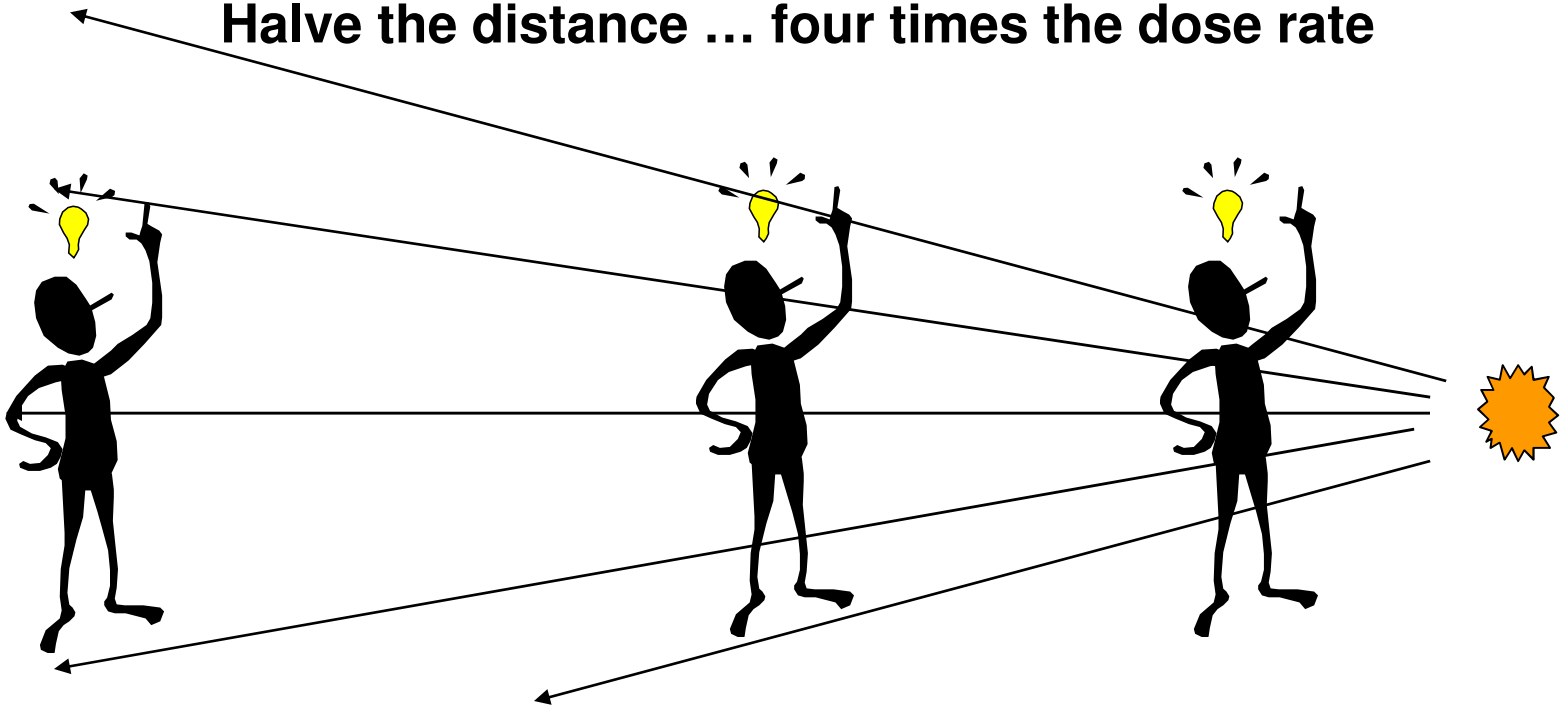
DISTANCE

Inverse Square Law

$$R_1 D_1^2 = R_2 D_2^2$$

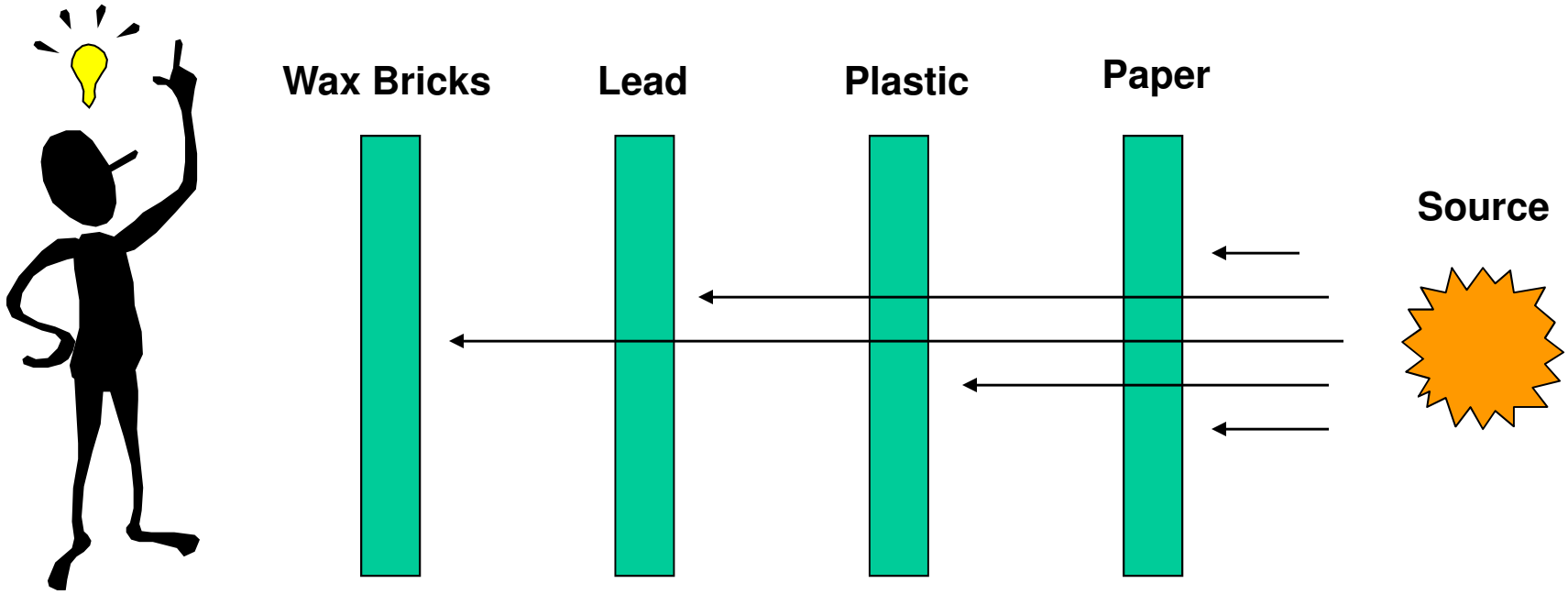
R = Radius, D = Dose Rate

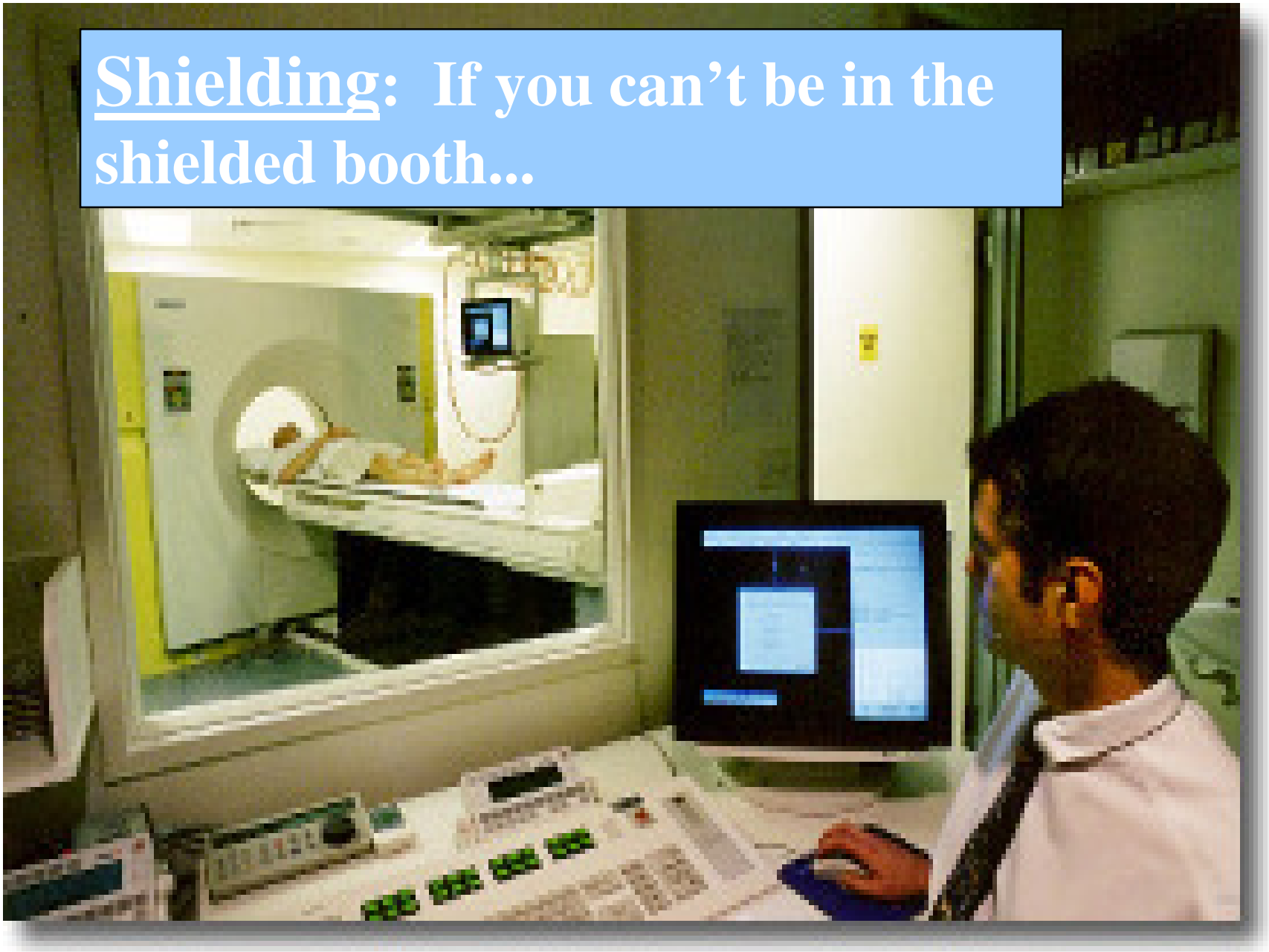
Double the distance … ¼ the dose rate
Halve the distance … four times the dose rate



SHIELDING

Shielding: Material between you and the source




Shielding: If you can't be in the shielded booth...


...then stand behind the doc.

Radiation Dose Limits *

	Mrem
Annual limit for occupational workers	5,000
Annual limit for member of public	100

* Limits for radiation exposure above background radiation (620 mrem/yr U.S. average from all sources)

ALARA

Radiation exposure to the work force and general public shall be controlled such that exposures are well below regulatory limits and that there is:

- **no radiation exposure without an equal benefit.**

February 17, 2011

Mr. Frank DiSanza
Waste Management Federal Project Director
U.S. Department of Energy, Nevada Site Office
232 Energy Way, M/S 505
North Las Vegas, NV 89030

RE: Letter of Support for Mixed Low-Level Waste (MLLW) Treatment Permit Application

Dear Mr. DiSanza:

The Nevada Site Specific Advisory Board (NSSAB) has reviewed the information contained in your November 10, 2010 presentation to the NSSAB and the *Conceptual Evaluation for the Installation of Treatment Capability for Mixed Low-Level Waste at the Nevada National Security Site DOE/NV25946—1109* report regarding the feasibility of MLLW treatment at the Nevada National Security Site (NNSS). Four waste treatment technologies are under consideration.

- Macroencapsulation
- Microencapsulation
- Sort and segregate
- Small scale amalgamation of mercury-containing waste

Most MLLW is currently treated at commercial facilities located outside the state of Nevada. Since these facilities are not in Nevada, the State of Nevada Division of Environmental Protection (NDEP) must travel out-of-state to inspect the waste processors, or rely on out-of-state regulators to monitor the facilities' compliance with Resource Conservation and Recovery Act (RCRA) regulations and Land Disposal Restrictions (LDR), prior to disposal at the NNSS. In addition, classified MLLW cannot be treated at commercial facilities.

Hence, the establishment of a MLLW treatment capability at the NNSS would provide the following benefits.

- Provide for treatment of classified MLLW
- Eliminate the need for NDEP staff to travel out-of-state
- NDEP would oversee treatment versus relying on out-of-state regulators
- Waste treatment would continue to be verified in accordance with the NNSS Radioactive Waste Acceptance Program
- Nevada Site Office (NSO) would have greater control of the waste treatment processes for those wastes destined for ultimate disposal at the NNSS

Finally, there appears to be sufficient capacity within the existing permitted RCRA disposal facility at the NNSS to allow disposal of the projected MLLW volumes from around the DOE complex for at least the next five years.

Therefore, in view of these benefits, the NSSAB unanimously supports the NSO application to NDEP for a MLLW treatment permit at the NNSS.

Sincerely,

Walter F. Wegst, Chair

cc: M. Nielson, DOE/HQ (EM-13) FORS
C. Alexander Brennan, DOE/HQ (EM-13) FORS
A. Clark, DOE/HQ (EM-13) FORS
K. Snyder, PSG, NNSA/NSO, Las Vegas, NV
C. Lockwood, PSG, NNSA/NSO, Las Vegas, NV
D. Rupp, NREI, Las Vegas, NV
NSSAB Members and Liaisons
NNSA/NSO Read File

Mr. Rob Boehlecke,
Environmental Restoration Project Director
U.S. Department of Energy, Nevada Site Office
P. O. Box 98518
Las Vegas, NV 89193-8518

SUBJECT: Recommendation on Closure of Corrective Action Unit (CAU) 374

Dear Mr. Boehlecke:

The Nevada Site Specific Advisory Board has reviewed several potential closure scenarios for CAU 374. This CAU consists of the Corrective Action Site (CAS) for the Schooner test in Nevada National Security Site (NNSS) Area 20, and the CAS for the Danny Boy test in NNSS Area 18, as well as three additional CASs for drums and miscellaneous waste around the Danny Boy test.

The NSSAB considered three Corrective Action Alternatives as identified in the Federal Facility and Consent Order.

- Clean closure
- Closure in place with use restrictions
- No further action

For CAU 374 the NSSAB recommends closure in place with use restrictions. We understand, based on your letter of January 10, 2011, that this closure in place includes the removal and disposition of the drums and miscellaneous waste at Danny Boy.

The cost of clean closure is significantly greater than closure in place. While closure in place is estimated to cost about $80,000, the cost estimate for clean closure is $260 million. The total dose to workers under both scenarios is very low and the large cost for clean closure would likely adversely effect other clean up programs at the NNSS. We concluded that clean closure does not appear to be a prudent use of the limited available funds; and that the cost of closure in place is not so excessive that no further action would be justified.

The CAB also considered various use standards for the closure in place scenario. The standards considered included the same two previously evaluated in our recommendations for CAU 371 and 372.

- Industrial Use exposure of 2250 hours per year
- Remote Area Worker exposure of 400 hours per year
- Occasional Use exposure of 80 hours per year

The CAB recommends the Remote Area Worker exposure standard for CAU 374.

The Schooner and Danny Boy sites are in remote locations and there is no reasonable likelihood of their being developed into a project suggesting the Industrial Use standard to be the prudent choice. The likelihood of an NNSS worker or visitor experiencing even 80 hours per year exposure (Occasional Use) at these sites is very low. However, since the Remote Area Worker exposure standard appears to be preferred by the State of Nevada, and there does not appear to be a significant cost difference between the Remote Area Worker standard and the Occasional Use standard it appears to be a better choice.

We are also confident there are sufficient administrative controls in place at the NNSS to ensure that if a permanent project was ever proposed for these locations that an appropriate hazard or risk analysis would be performed to protect any worker permanently stationed at these locations.

Sincerely,

Walter F. Wegst, Chair

Public Notification of Corrective Actions
January 27, 2011
Las Vegas, Nevada

The Department of Energy (DOE) will not be submitting any Corrective Action Unit (CAU) final Corrective Action Decision Documents (CADDs), CADD/Corrective Action Plans (CAPs), CADD/Closure Reports (CRs), or Streamlined Approach for Environmental Restoration (SAFER) Work Plans, proposing closure-in-place to the Nevada Division of Environmental Protection (NDEP), during the next 60 days.

Southern Nevada Public Reading Facility
c/o Nuclear Testing Archive
775 East Flamingo Road
Las Vegas, NV 89119

Northern Nevada Public Reading Facility
Nevada State Library and Archives
100 N. Stewart Street
Carson City, NV 89701-4285

The following is a list of all documents submitted to the Public Reading Facilities during January 2011. Attached is the Executive Summary from the document listed below.

CAU Number	CAU Description	Document
365	Baneberry Contamination Area	Corrective Action Investigation Plan (CAIP)

Executive Summary for CAU 365 CAIP

Corrective Action Unit 365 is located in Area 8 of the Nevada National Security Site (formerly known as the Nevada Test Site), which is approximately 65 miles northwest of Las Vegas, Nevada. Corrective Action Unit 365 comprises one corrective action site (CAS), CAS 08-23-02, U-8d Contamination Area.

This site is being investigated because existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives (CAAs). Additional information will be obtained by conducting a corrective action investigation before evaluating CAAs and selecting the appropriate corrective action for the CAS. The results of the field investigation will support a defensible evaluation of viable CAAs that will be presented in the Corrective Action Decision Document.

The site will be investigated based on the data quality objectives (DQOs) developed on July 6, 2010, by representatives of the Nevada Division of Environmental Protection and the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office. The DQO process was used to identify and define the type, amount, and quality of data needed to develop and evaluate appropriate corrective actions for the Baneberry site.

The primary release associated with Corrective Action Unit 365 was radiological contamination from the Baneberry nuclear test. Baneberry was an underground weapons-related test that vented significant quantities of radioactive gases from a fissure located in close proximity to ground zero. A crater formed shortly after detonation, which stemmed part of the flow from the fissure.

The scope of this investigation includes surface and shallow subsurface (less than 15 feet below ground surface) soils. Radionuclides from the Baneberry test with the potential to impact groundwater are included within the Underground Test Area Subproject. Investigations and corrective actions associated with the Underground Test Area Subproject include the radiological inventory resulting from the Baneberry test.

The presence and nature of contamination at Baneberry will be evaluated based on information collected from a field investigation. Surface-deposited radiological contamination will be evaluated based on a comparison of the total effective dose (TED) at sample plot locations to the dose-based final action level (FAL). The TED will be calculated as the total of separate estimates of internal and external doses. Results from the analysis of soil samples collected from sample plots will be used to calculate internal radiological dose. Thermoluminescent dosimeters placed at various locations and at the center of each sample plot will be used to measure external radiological dose.

The DQO process was based on an assumption that TED within the crater and fissure exceeds the FAL and requires corrective action. A field investigation will be performed to define any additional area outside the fissure and crater where TED exceeds the FAL and to determine whether contaminants of concern are present at the site from other potential releases.

The presence and nature of contamination from other types of release pathways (such as migration, excavation, and any potential releases discovered during the investigation) will be evaluated using soil samples collected from the locations most likely containing contamination, if present. Appendix A provides a detailed discussion of the DQO methodology and the DQOs specific to Baneberry.

The scope of the corrective action investigation for Baneberry includes the following activities:

- Conduct radiological surveys.
- Perform field screening.
- Measure *in situ* external dose rates using thermoluminescent dosimeters.
- Collect and submit environmental samples for laboratory analysis to determine internal dose rates.
- Evaluate the TED in drainages and excavated soils outside the initial corrective

  action boundary.
- Collect and submit environmental samples for laboratory analysis to determine the nature and extent of any contaminants of concern that are present.
- If contamination is present at levels that exceed a FAL beyond the crater and fissure, define the extent of the contamination.
- Collect waste samples, as needed, for waste management purposes.
- Collect quality control samples.

This Corrective Action Investigation Plan has been developed in accordance with the *Federal Facility Agreement and Consent Order* that was agreed to by the State of Nevada; DOE, Environmental Management; U.S. Department of Defense; and DOE, Legacy Management. Under the *Federal Facility Agreement and Consent Order*, this Corrective Action Investigation Plan will be submitted to the Nevada Division of Environmental Protection for approval. Fieldwork will be conducted following approval of the plan.

Department of Energy
National Nuclear Security Administration
Nevada Site Office
P.O. Box 98518
Las Vegas, NV 89193-8518

JAN 24 2011

Walt Wegst, Chair
Nevada Site Specific Advisory Board
232 Energy Way
North Las Vegas, NV 89030

RESPONSE TO THE NEVADA SITE SPECIFIC ADVISORY BOARD (NSSAB) 01-13-11 RECOMMENDATION LETTER REGARDING CORRECTIVE ACTION UNIT (CAU) 372 AREA 20 CABRIOLET/PALANQUIN UNIT CRATERS

We appreciate the NSSAB's efforts in reviewing the closure options for CAU 372, Area 20 Cabriolet/Palanquin Unit Craters. After reviewing data for these sites, evaluating the closure options, and receiving your recommendation, we have decided to proceed with Closure in Place with use restrictions under the Remote Work Area exposure scenario. The Federal Facility Agreement and Consent Order process requires us to present a formal recommendation to the Nevada Department of Environmental Protection (NDEP), respond to comments, and receive formal acceptance of our approach prior to implementation.

The closure recommendation will be finalized and documented in a Corrective Action Decision Document/Closure Report (CADD/CR). The CADD/CR will include specific information on any posting, fencing, or other physical and administrative controls to be included in the closure recommendation. The current milestone with NDEP for completion of the CADD/CR is May 31, 2011.

The Nevada Site Office Environmental Restoration Project appreciates the interest of the NSSAB in this activity and the efforts made by the NSSAB to review the closure options. We will continue to keep the NSSAB informed on this activity. If you have any further questions, please contact Kelly K. Snyder at (702) 295-2836.

Robert F. Boehlecke
Federal Project Director
Environmental Restoration Project

PSG:7173.KKS

cc via e-mail:
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NSSAB Members and Liaisons
NNSA/NSO Read File

Department of Energy
National Nuclear Security Administration
Nevada Site Office
P.O. Box 98518
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February 16, 2011

Walt Wegst, Chair
Nevada Site Specific Advisory Board
232 Energy Way
North Las Vegas, NV 89030

RESPONSE TO THE NEVADA SITE SPECIFIC ADVISORY BOARD (NSSAB) 01-13-11 RECOMMENDATION LETTER REGARDING CORRECTIVE ACTION UNIT (CAU) 547, MISCELLANEOUS CONTAMINATED WASTE SITES

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) appreciates the NSSAB's efforts in reviewing the closure options for CAU 547, Miscellaneous Contaminated Waste Sites. Based on the evaluation of the closure options for these sites, discussions with the NSSAB, and discussions with the Nevada Division of Environmental Protection (NDEP), NNSA/NSO is proceeding with a recommendation of Closure in Place with use restrictions, as recommended by the NSSAB. The Federal Facility Agreement and Consent Order process requires a formal recommendation to the NDEP, response to comments, and receipt of formal acceptance of the approach prior to implementation.

The closure recommendation will be finalized and documented in a Streamlined Approach for Environmental Restoration (SAFER) Plan. The SAFER Plan will include specific information on the decision factors used to evaluate the closure options and determine the recommended path forward. As discussed with the NSSAB Industrial Sites sub-committee, these factors include risk to workers and future land use. The SAFER Plan will also include information on the engineering controls (e.g., soil, synthetic cover, and fencing) and administrative controls (e.g., postings and land use restrictions) that will be put in place to control worker exposure and inadvertent intrusion. The current milestone for submittal of the SAFER Plan to NDEP is May 31, 2011.

In addition to a closure recommendation the NSSAB provided two specific recommendations regarding actions to be considered as part of the path forward for closure in place. The first recommendation is to have an independent review of the stability of the soil cover design for the pipe on the slope at Corrective Action Site 09-99-06 (Gas Sampling Assembly), the PLAYER site. The NNSA/NSO has considered this recommendation and plans to have an independent review of the closure design for this feature.

The second specific recommendation provided by the NSSAB was to consider immobilizing the plutonium contamination that is in the piping if it could be done safely. The NNSA/NSO evaluated several methods for immobilizing the contamination through the application of fixative

to the interior pipe walls and introducing a material such as wax or grout to fill the void space inside the pipe. The benefits of both options are that contamination would be "fixed" in place providing an additional safety margin when the pipe eventually corrodes or in the event of an inadvertent intrusion. The drawbacks for both methods include the need to penetrate the pipe to install the fixative thereby increasing the potential for worker exposure. Both methods would also likely result in pressure differences inside the pipe which could cause the uncontrolled release of contamination through potential unknown outlets. Additionally, although grout and/or wax fillers would likely still prevent the spread of contamination when the pipe eventually corrodes, the fixatives that were evaluated are estimated to have a working lifetime of up to 50 years. Thus, they would likely not provide additional protection after this time period or would require additional applications. A soil cover over the pipes will provide an effective barrier to prevent migration of contaminants and can be readily repaired if needed. NNSA/NSO believes that the application of a fixative or filler is not warranted given the potential for significant negative consequences (e.g., inadvertent damage to the pipe, release of contaminants to the environment, and worker exposure) while offering limited benefit.

The NNSA/NSO Environmental Restoration Project appreciates the interest of the NSSAB in this activity and the efforts made by the NSSAB to discuss and review the closure options. NNSA/NSO will continue to keep the NSSAB informed on this activity.

If you have any further questions, please contact Kelly K. Snyder at (702) 295-2836.

Robert F. Boehlecke
Federal Project Director
Environmental Restoration Project

PSG:7256.KKS

cc via e-mail:
C. A. Brennan, DOE/HQ (EM-13) FORS
A. E. Clark, DOE/HQ (EM-13) FORS
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NNSA/NSO Read File

Preliminary Agenda

EM SSAB Chairs Meeting

April 13th and 14th, 2011
Green Valley Ranch Resort
Henderson, Nevada

DAY 1 - Wednesday, April 13, 2011	
8:00 am – 8:20 am	**Welcome and Opening Remarks** ▣ Walt Wegst, Chair, Nevada Site Specific Advisory Board ▣ Scott Wade, Asst. Manager for Environmental Management, Nevada Site Office ▣ Cate Alexander Brennan, EM SSAB Designated Federal Officer
8:20 am – 8:30 am	**Overview of Meeting** Lori Isenberg, Facilitator ▣ Objectives, Agenda, and Ground Rules
8:30 am – 10:00 am	**EM Program Update** *(standard presentation)* Ineś Triay, Assistant Secretary for EM ▣ Questions and Discussion
10:00 am – 10:15 am	**Break**
10:15 am – 11:30 am	**Round Robin** ▣ Site Update (5 minutes per site) *(1-3 slides highlighting specific issue, activity, or accomplishment)* ▣ Discussion/development of EM SSAB Work Plan and Associated Product Development ▪ *Using Rail Transport for Moving Waste* (Northern New Mexico) ▣ Questions and Discussion
11:30 am – 12:45 pm	**Lunch** (on your own)
12:45 pm – 2:00 pm	**EM Headquarters Updates** *(standard presentation)* ▣ **Budget Update** Joann Luczak, Deputy Assistant Secretary ▪ EM plans to adjust to overall Federal budget cuts ▣ **American Recovery and Reinvestment Act Update** *Presenter TBD* ▪ Phase out, transition and staffing ▪ Plans for potentially unspent funds ▣ **Questions and Discussion**

2:00 pm – 3:00 pm	**Environmental Management Advisory Board (EMAB)** *(stand-alone presentation)* *Presenter TBD* ▣ Definition and scope ▣ Synergy ▣ Recommendations ▣ Role regarding tank waste ▣ Questions and Discussion
3:00 pm – 3:15 pm	**Public Comment Period**
3:15 pm – 3:30 pm	**Break**
3:30 pm – 4:45 pm	**Waste Disposition** Frank Marcinowski, Deputy Assistant Secretary for Technical and Regulatory Support ▣ High level waste ▣ Tank Waste ▣ Recycling ▪ Microwave technology ▪ Metals and decontamination and decommissioning materials recycling ▪ Asset recovery ▪ Smelting microwave ▪ Nickel request for proposal ▪ DOE restrictions and technologies ▣ Greater than Class C Update ▣ Questions and Discussion
4:45 pm – 5:30 pm	**Day 1 Summary** Lori Isenberg, Facilitator ▣ Significant Issues from Presentations and Discussions ▣ EM SSAB Product Development
DAY 2 - Thursday, April 14, 2011	
8:00 am – 9:00 am	**DOE-HQ News and Views** *(standard presentation)* Melissa Nielson, Director, Office of Public Intergovernmental Accountability and Cate Alexander Brennan, EM SSAB Designated Federal Officer
9:00 am – 10:30 am	**Groundwater** *(stand-alone presentation)* Kurt Gerdes, Director, Office of Groundwater & Soil Remediation ▪ Monitoring ▪ Remediation ▪ Successes ▪ Modeling ▪ Technology (including vadose zone and thermal extraction) ▪ Questions and Discussion

10:30 am – 10:45 am	Break
10:45 am – 11:00 am	Public Comment Period
11:00 am – 12:00 pm	**Day 2 Summary** Lori Isenberg, Facilitator ▣ Significant Issues from Presentations and Discussions ▣ EM SSAB Product Development
12:00 pm – 12:15 pm	Closing Remarks and Adjournment

Las Vegas Sun

Yucca Mountain or not, nuclear waste resides here

Millions of tons of low-level material are buried at the Nevada National Security Site — and the state can do little about it

By Steve Kanigher (contact)

Sunday, Feb. 13, 2011 | 2 a.m.

Up the road from Las Vegas, a little-known site houses enough nuclear waste to more than fill New York City's 102-story Empire State Building or cover a football field to nearly the height of Hoover Dam.

During the decades that Yucca Mountain has been the focus of political passion and controversy over the safety of transporting and storing high-level radioactive waste, the Energy Department's Nevada National Security Site has quietly received 40.8 million cubic feet of low-level waste, some of it passing through Las Vegas on its way to the disposal site 80 miles northwest of downtown.

Government officials say the waste poses no threat to public health, except in cases of extreme exposure. Some environmentalists and scientists disagree.

"Low-level waste is a misnomer because it seems to signal to the public that low level equals low risk, but low level does not mean low risk," said Marylia Kelley, executive director of Tri-Valley CARES, a Livermore, Calif., environmental group focused on nuclear weapons policies. "The whole way we classify nuclear waste needs to be changed."

But Frank DiSanza, waste management federal project director for the National Security Site, said that even when a truck carrying radioactive concrete debris tipped over in the southern valley, the risk of contamination was virtually nil.

"Somebody would have had to come up and sniff the concrete to come close to inhaling any radioactive contaminants," he said. "You'd have to get down on your knees and get your face right into it and then inhale. You wouldn't die immediately. There may be a possibility of a latent cancer 20 to 25 years down the road."

Soon, there might be clarity on the potential effect of low-level waste in the state.

At the insistence of Nevada Attorney General Catherine Cortez Masto and other state officials, the Energy Department is reviewing how the National Security Site should be used over the next 10 years and whether that use should include nuclear waste disposal. The review will cover the swath of desert, formerly called the Nevada Test Site, that is dotted with shrubbery, scorpions, rabbits and radiation-monitoring devices where nuclear weapons were tested.

What could get the most scrutiny is whether the site should continue to accept radioactive waste from Energy and Defense department facilities, where nuclear weapons were designed and built through the early 1990s. Among questions it raises:

• How dangerous is low-level nuclear waste?

• How reliable is the packaging and transport of the waste?

• What is the possibility that buried waste can contaminate groundwater below the National Security Site?

The Energy Department argues that low-level waste exposure is life threatening only under extreme conditions that would require several unlikely mistakes to occur. When the truck carrying low-level concrete waste to the National

Security Site in 2008 rolled on its side on the northbound Interstate 15 ramp to Blue Diamond Road, the waste packages retained their contents and were transferred to another truck.

There have been 15,500 shipments of low-level waste to the National Security Site since 1999. Annual transportation reports by the Energy Department for fiscal 2000 through 2009 showed five truck accidents and dozens of other mishaps, including contaminated trailers, waste packages that were either contaminated or breached, mistakes that occurred while unloading packages, and waste shipment labeling or paperwork errors.

DiSanza said he considered the transportation record to be excellent because no one was killed or seriously injured as a result of the accidents or mishaps, and that no contaminants were released into the environment.

But Vermont physicist Marvin Resnikoff, a nuclear waste expert and adviser to Nevada on Yucca Mountain issues, said: “The more shipments that come to Nevada, the more the likelihood of accidents.”

Shipment of low-level waste, which the Energy Department began accepting from out of state in 1976, is largely under the radar for two reasons. Nevada politicians, the media and environmentalists have focused on the plan to turn Yucca Mountain into a repository for the nation’s deadly high-level waste — spent fuel from commercial nuclear reactors and certain highly radioactive waste from weapons programs.

The other reason: There is virtually nothing the state can do to block those shipments. The Atomic Energy Act gives the Energy Department the authority to manage its waste, including transfer from one facility to another, without state approval.

It’s not that state officials haven’t tried to exert influence. They’ve filed lawsuits to block shipments of radioactive waste they didn’t think was suitable for the National Security Site. They’ve also written letters to the department questioning the extent to which the site should be used for waste disposal.

Their tactics sometimes have worked. Nevada officials in 1997 objected vociferously after shipping mishaps involving waste sent from a former nuclear weapons plant in Fernald, Ohio — one involving a loose container lid and the others dealing with water that leaked from waste storage boxes. Shipments from that plant resumed only after the containers were modified.

The state in 2005 blocked shipment of uranium waste from Fernald that then-Attorney General and current Gov. Brian Sandoval said was too dangerous for disposal at the National Security Site. The waste was shipped to a site in Texas.

But Nevada politicians have stopped short of advocating a ban on waste shipments because they support the National Security Site’s defense mission and are reluctant to do anything that might be perceived as disrupting that mission.

“Years ago, the state looked into this pretty carefully,” said Joe Strolin, acting director of the Nevada Agency for Nuclear Projects, which has waged the state’s fight against Yucca Mountain. “What we found is that there was no good legal ground for us to oppose this. It had been going on for a long time, so we didn’t think there was a way we could stop it.”

Chief Deputy Attorney General Marta Adams said that when the Energy Department’s draft environmental impact statement for the National Security Site is released for comment, which is expected in April, the state may review whether it has legal standing to challenge the disposal of nuclear waste.

As for the chances of such a challenge succeeding, she said: “It is possible but I’m not sure it’s probable.”

If waste disposal is allowed to continue, the next key date won’t be until 2027, when the site is scheduled to have cleaned up its own waste, which it has disposed of on-site for a half-century. The Energy Department could decide to close the waste site or keep it open for shipments from out of state.

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Low-level nuclear waste isn’t your typical garbage. The inventory includes reactor equipment and water-treatment residues, soiled clothing, filters, rags, tools and construction debris. The site accepts mixed low-level waste that

combines radioactivity with other hazardous chemicals. High-level waste is considered more dangerous because it decays so slowly and contains more radioactivity, but low-level waste can contain the same radioactive substances, the Government Accountability Office, the investigative arm of Congress, reported in 1998. It quoted one study that found low-level waste contains cesium 137, a product of nuclear fission that could kill someone standing three feet away in 20 minutes.

Environmental groups complain that low-level waste contains such a broad range of radioactivity — divided into three classes by the Nuclear Regulatory Commission — that the term needs to be redefined.

“Low-level does not mean low hazard,” Resnikoff said. “If you’re a football field away from an accident, that would not be harmful. But if the material got out of a container, everyone in that area would have to be evacuated, and it would have to be cleaned up. The first responders or anyone else near the material could get exposed.”

The commission said in a brochure on nuclear waste that the degree of danger depends on the type and concentration of radioactive material.

“Low-level waste containing some radioactive materials used in medical research, for example, is not particularly hazardous unless inhaled or consumed, and a person can stand near it without shielding,” the commission said. “Low-level waste from processing water at a reactor, on the other hand, may be quite hazardous. For example, low-level waste could cause exposures that could lead to death or an increased risk of cancer.”

But Senate Majority Leader Harry Reid, the Nevada Democrat who has led the effort to derail the Yucca Mountain plan while staunchly defending the National Security Site mission, sees a big difference between high-level and low-level waste.

“There are no comparisons to be drawn between low-level waste and high-level waste as the dangers to both public health and the environment are not remotely comparable,” Reid spokesman Zac Petkanas said. “However, Sen. Reid believes that storing low-level waste should remain only a small part of the work done at the Nevada National Security Site.

“High-level waste, including spent fuel from nuclear reactors, is dangerous beyond 10,000 years and the National Academies of Science has advised EPA (Environmental Protection Agency) to create a radiation protection standard for 1 million years. Low-level waste, while radioactive, can be stored in NRC or state-licensed landfills.”

Another difference between high-level and low-level waste, DiSanza said, is that an individual would need thick concrete or stainless steel to be protected from high-level radiation. “But with low-level waste, the protection could be as simple as a piece of paper, and the alpha particles don’t even penetrate your skin,” he said. “That’s not to say there aren’t dangers associated with it. But they’re very easily controlled.”

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As the Sun accompanied Energy Department officials to the National Security Site, agency spokesman Darwin Morgan of the Nevada site office pointed to a truck heading north on U.S. 95 beyond Ann Road.

“Did you see that truck?” Morgan said. “It’s carrying explosives. But that doesn’t seem to be as big of an issue for people here in Las Vegas. There are a wide variety of Department of Transportation-approved materials coming through town that would instantly cause death.”

Morgan’s argument is that there is less danger to the public from transport of low-level nuclear waste than from shipment of “chlorine, paints and chemicals.” The biggest danger of hauling low-level waste, he said, is “if a package falls from the back of a truck onto a car and kills the person in the car.”

Still, that did not stop Gov. Kenny Guinn from meeting with Energy Secretary Bill Richardson in 2000 to express concerns about the transport of low-level waste through heavily populated areas in Southern Nevada. Guinn highlighted shipments in the Spaghetti Bowl where I-15 and U.S. 95 meet. Richardson, too, recognized that trucks were at greater risk of getting into accidents there because of the congestion.

So he got his department to warn waste generators not to use the Spaghetti Bowl if they wanted to continue sending waste to Nevada. For the most part, they complied, although 13 truckloads passed through the Spaghetti Bowl in 2001 and 2002.

When two shipments passed through it in November 2006 from the Savannah River Site, an Energy Department facility in South Carolina, the facility was required by the agency to take corrective action. It also ordered another waste generator to correct its transportation plan after sending a truck through the Spaghetti Bowl in 2009.

Hoover Dam also was crossed off transit routes after the 9/11 attacks, and the Energy Department has never authorized use of the Las Vegas Beltway, although twice in 2004 and once in 2007 that highway was used.

Today, the closest the waste is allowed near Las Vegas is on Blue Diamond Road (State Route 160) in the southern valley. Over the past decade, that road has witnessed tremendous residential and commercial growth. Yet Strolin said the state can't take it off the table because of a compromise with California, whose State Route 127 through Death Valley is also used to haul waste to the National Security Site from the south. California and Nevada have agreed to a split schedule that allows for waste transports along both routes.

"Our preference is that they don't use Route 160," Strolin said of the waste transporters. "The preferred route is to use California Route 127. But California has objected to having a lot of the shipments going on 127 because of concerns that it will set a precedent for use should the Yucca Mountain project go forward. California is nervous about high-level waste."

A citizens advisory panel that reviews safety issues at the National Security Site urged the Energy Department to review use of Blue Diamond Road. But DiSanza said a transportation expert found in 2009 that public exposure to radiation along that route was less than one-millionth of a millirem, a fraction of the one millirem limit he said the Environmental Protection Agency considers safe. The agency estimates that the average American gets a dose of about 360 millirem a year, most of it from radon in the air, and some from man-made sources such as X-rays.

Outside the valley, waste that enters Nevada goes through rural communities such as Amargosa Valley, Beatty, Ely, Goldfield, Pahrump, Tonopah and Searchlight.

Transport of low-level waste isn't perfect, Kelley of Tri-Valley CARES said, because at many Energy Department facilities "there's still more emphasis on nuclear weapons research and too little emphasis on the security and safe disposal of nuclear waste. They get less money and staffing for that."

But DiSanza said the technicians who package the waste where it is generated are well-trained. A 50-cent-per-cubic-foot surcharge on waste shipments has raised more than $10 million to equip emergency personnel statewide.

If accidents occur, cleanup or other corrective action is the responsibility of the trucking company that hauls the waste.

When the Energy Department discovers packaging mistakes, waste generators are ordered to correct them before they can ship more waste. Problems with the waste packages mostly involve condensation that builds up inside trucks during cross-country journeys, DiSanza said.

"This water can and has made its way out of the containers," he said. "But there really hasn't been any contaminants in that liquid. We follow all the procedures to alert the state of Nevada and then we go through a series of lessons learned to make sure we don't repeat that type of mistake."

As for the packages, DiSanza said, "there's always room for improvement and the generators are always willing to not only improve the containers, they're willing to be more efficient in selecting and utilizing the containers to ship the waste to our site."

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Follow the winding road off U.S. 95 past the National Security Site gate, go about 15 miles into a desert valley and you reach several buildings surrounded by earth-moving equipment and 38 earthen disposal cells, including 11 in use.

The 740-acre Radioactive Waste Management Site on the western edge of the site is in Area 5, a place where nuclear weapons were detonated. Although waste has also been buried in craters in Area 3 to the north that were created by nuclear blasts, the Area 5 disposal cells are the only ones in use.

With an annual budget of $22 million, 55 people work on-site and 30 others off-site, including planners and engineers.

Operating from 7 a.m. to 5 p.m. Monday through Thursday, the site is open for business to trucks on a first-come, first-serve basis, resulting in many lining up outside the gate waiting their turn. A busy shift could see the arrival of more than 40 truckloads.

Trucks are greeted by workers wearing safety hats, glasses, vests, gloves and shoes, not the space outfits of science-fiction movies.

The Sun followed an 18-wheel truck carrying mixed low-level waste containing toxic PCBs. The truck first went through an exterior inspection where an instrument was used to measure radiation. The truck passed inspection but if it hadn't, it would have undergone more thorough examination to determine the cause of the high radiation readings.

The truck was directed to a mixed-waste cell that opened Jan. 26. Three hundred feet long, 180 feet wide and 27 feet deep, the cell is practically large enough to insert a football field with bleachers. It is the only cell that requires a permit from the Nevada Environmental Protection Division because it accepts radioactive waste with hazardous chemicals.

Once inside, the truck's contents — four large metal containers — were gauged for exterior contamination as was the floor of the trailer. Samples of these readings are taken to an on-site laboratory to make sure there are no abnormalities. A forklift retrieves the waste packages and lines them up with others.

"Sometimes a shipment is rejected, and it's sent back to the shipper," DiSanza said. "We have a no-tolerance policy. We may ask the generator to come to our site and devise a method to repackage a container. Usually it's put in a bag and wrapped and put on the truck and sent back. There have been many times when the trailer couldn't be released.

"I'm guessing there are two or three a year where we'll find contamination on the floor of the trailer. Most of these trailers have wooden-plank flooring that we can cut out. We'll either keep the contaminated flooring or send it back to the generator."

Over time the waste containers will be stacked atop each other, and the cell, once it reaches capacity, will be capped with dirt and vegetation.

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One thing that makes this cell unique is that it's the only one with a double synthetic liner to meet the standards of a new state law covering hazardous waste disposal.

The fact that all other cells, including one that handles classified waste from the Defense Department, don't have linings is a sore spot with environmentalists because of groundwater below the waste. They fear the waste could further contaminate underground aquifers.

The Energy Department estimates that underground nuclear testing contaminated nearly 124 billion gallons of groundwater, five-hundredths of 1 percent of the estimated water volume beneath the National Security Site. A study for Nye County, though, estimated contamination of as much as 1.6 trillion gallons.

Republican Assemblyman Ed Goedhart is among the skeptics who think that the buried waste will contribute to groundwater pollution if it hasn't yet done so. The dairy farmer from Amargosa Valley, south of the National Security Site, wants the Legislature to approve a resolution urging the federal government to provide restitution to the state and Nye County for groundwater contamination.

"It's not a question of if the waste will also pollute the groundwater, but when," Goedhart said. "Yucca Mountain has been distracting people from the continuous dumping of low-level waste in Nevada. But the people out here feel there's

not much we can do because the federal government is so powerful. They're just playing us all for fools, and they're giving us nothing back."

Goedhart may have reason to be concerned. A study last year by the U.S. Geological Survey of groundwater at the National Security Site found it drains in a south/southwest direction toward Ash Meadows in Amargosa Valley and beyond to Death Valley.

The Energy Department, which monitors the groundwater, says it's confident its unlined waste trenches prevent radioactivity from leaching down to the top layer of aquifers 700 to 1,700 feet below the surface. The probabilities, DiSanza said, are "extremely, extremely low" because the area gets only five inches of rainfall annually, not enough to drive the radiation deep below the thick sediment and volcanic rock under the disposal site. DiSanza isn't sold on the usefulness of linings for low-level waste cells, saying they might not last as long as the radioactivity in the waste or they might trap water, which could actually force the waste toward groundwater. "I say we have 700 feet of natural alluvial lining," he said.

Vinson Guthreau, spokesman for the state Environmental Protection Division, said his agency hasn't found evidence of waste dump seepage affecting groundwater. "Unlined doesn't mean unsafe," Guthreau said, adding that federal law requires the Energy Department to make sure that radioactivity doesn't migrate from the dumps.

But Diane D'Arrigo, radioactive waste project director for the Nuclear Information and Resource Service in Takoma Park, Md., an advocacy group opposed to nuclear power, said the Energy Department doesn't line its low-level waste pits because it wants to save money.

"It's what they've done since the beginning of the atomic age," she said. "They stick it in a ditch, and they're done with it. What would make more sense is to containerize it in a way where we're not leaving it in leaky trenches and ditches for future generations."

Strolin said the state "has always had concerns" about the possibility the waste would seep into groundwater.

"The Department of Energy has always assured us that the water table is so deep and that any seepage would be so slow it would take thousands of years to reach the water table," he said. "We say the jury is still out on that."

Years ago there were fears about potential groundwater contamination from nuclear waste that was stored in unlined trenches at a commercial low-level waste site in Beatty, up the road from the National Security Site. That site was closed by the state in 1993 in a dispute with operator US Ecology over hazardous waste disposal fees.

When the U.S. Geological Survey conducted underground tests near the dump in 1994, scientists taking gas samples found radioactive tritium 357 feet below the surface, not far from an aquifer. That the radiation had traveled to such a depth in just 30 years caught them by surprise.

Scientist David Prudic, who helped conduct the tests and is now an adjunct professor at UNR, said his latest readings in 2003 showed the radioactive levels had tapered off. Still, he said it is possible radioactive gases from the shuttered dump could reach groundwater, although it could take decades.

But he's not convinced that waste at the National Security Site will have much effect on groundwater contamination there.

"I suspect that if there was contamination, it would be very small compared to the tests."

It was partly over concern about groundwater contamination that Cortez Masto pressed for a new environmental impact statement that covers the National Security Site, neighboring Nellis Air Force Range and Yucca Mountain. She said the document should update groundwater contamination and waste disposal activities from the last study in 1996.

"The full extent of such contamination is only partially understood," Cortez Masto's office stated in 2009 remarks about the proposed environmental impact statement.

Her office insisted the Energy Department calculate where contaminated groundwater is likely to flow beyond the National Security Site and over what period of time. The state also wants the department to develop plans to protect people and the environment from contaminated groundwater.

Even if all groundwater contamination is identified, the Energy Department has said there is no known method for getting rid of its radioactivity. If the contamination reaches a drinking water source, it said its only option would be to "coordinate with the state of Nevada to shut down the well and pursue an alternate water supply."

But Susan Corbett, South Carolina-based chairwoman of the National Sierra Club Nuclear Issues Activist Team, said all doubts about possible groundwater contamination from low-level waste could be removed if the waste was housed above ground, where it could be monitored. If breaches occur, she said they could be addressed there rather than risk the chance that the radioactivity will leach into groundwater. But she conceded that's a pricey alternative unlikely to occur.

"In some ways, low-level waste is worse because it doesn't get handled as carefully as high-level waste," Corbett said. "There's no good solution to handling this stuff. We've created a monster."

DRAFT

To the Editor: February 16, 2011

In the Sunday, February 13 issue of the Las Vegas Sun there was a long article about the disposal of Low Level Radioactive Waste (LLW) at the Nevada National Security Site (NNSS), formerly known as the Nevada Test Site. This article contains some useful and relevant information about the disposal of LLW at the NNSS, but it also contains a number of inaccurate and inflammatory statements. The article mentions a citizen's advisory panel that reviews safety issues at the NNSS. I am writing this letter as the Chairman of that advisory board officially designated as the Nevada Site Specific Advisory Board (NSSAB).

In the subtitle to the article the statement is made that "Millions of tons of low-level material are buried at the NNSS". This statement is simply not accurate – there may be millions of cubic feet of materials buried, but certainly not millions of tons.

The statement by Marylia Kelley (Tri-Valley CARES) that low level does not mean low risk is patently false. LLW is in fact very low risk under all possible scenarios of transport and disposal. (I make this statement based on my education- PhD in Environmental Health; experience- 40 years managing Environmental, Health and Safety programs including radioactive materials; and my Certification as a Health Physicist.)

The statement by Marvin Resnikoff (a long time anti-nuclear activist) that: "The more shipments that come to Nevada, the more likelihood of accidents" is gratuitous and irrelevant. This statement is akin to saying, "The more miles that you drive your car, the more likely you are to have an accident".

The statement that LLW can contain the same radioactive substances as High Level Waste is patently false. Part of the definition of LLW is, in fact, that it DOES NOT CONTAIN long lived radioactive isotopes such as Plutonium, Neptunium, various rare earths, etc. Further, this same paragraph states that LLW "contains Cesium 137, a product of nuclear fission that could kill someone standing three feet away in 20 minutes". There are no quantities of any radioactive material in LLW that could cause a lethal dose to humans under ANY circumstances. (That is another reason that such waste is designated low-level.)

The new disposal cell for mixed low level waste, that is low level radioactive waste mixed with chemically hazardous waste, was not constructed to meet a new state law covering hazardous waste disposal. It was constructed to meet the requirements of the Federal "Resource Conservation and Recovery Act" (RCRA) which has been the law since 1976.

Finally, the issue of contamination reaching groundwater is presented in a way that ignores scientific fact, but relies on statements from various activist groups who may or may not have any scientific expertise. In fact, the annual rainfall at that site is so low (5 inches) and the climate so arid that the water in the ground evaporates into the atmosphere long before it can reach the groundwater (700 to 1700 feet below the surface). Further, there is no mention that the radioactivity in the waste steadily decays over time and hence presents a steadily decreasing risk.

The state attorney general's office wants the Energy Department to "Calculate where contaminated groundwater is likely to flow beyond the NNSS and over what period of time". In fact, the DOE has an ongoing program that is at least 10 years old to drill many characterization wells to obtain the data to do exactly what the Attorney General is requesting. The NSSAB (Citizens Advisory Board) has been actively

involved with this program and has made significant recommendations to the DOE that have been accepted and acted upon.

In summary, this article by Mr. Steve Kanigher appears to have been crafted to instill fear in the reader and many of the inaccuracies that I have mentioned above were apparently included to increase the level of fear generated in the reader. He cites several anti-nuclear activist groups, including the Sierra Club, but does not cite any group that supports the waste disposal and environmental management activities of the DOE Nevada (such as the NSSAB and for that matter the Nevada Department of Environmental Protection). The continued disposal of LLW at the NNSS is a critical part of the DOE's program to clean up the contaminated sites that resulted from the U.S. nuclear weapons program over the past 50 years. The production of nuclear weapons was designed to provide protection for the entire country and Nevada should be willing to take some responsibility for helping to clean up the legacy of the nuclear weapons program.

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