

# SM-1 DEACTIVATED NUCLEAR POWER PLANT DECOMMISSIONING PROJECT FORT BELVOIR, VA

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# TOPICS

- U.S. Army Nuclear Power Program
- Deactivated Nuclear Power Plant Program
- Regulatory Framework for the Deactivated Nuclear Power Plant Program
- History of the SM-1 Deactivated Nuclear Power Plant
- Final Decommissioning of the SM-1
- Questions and How to Learn More

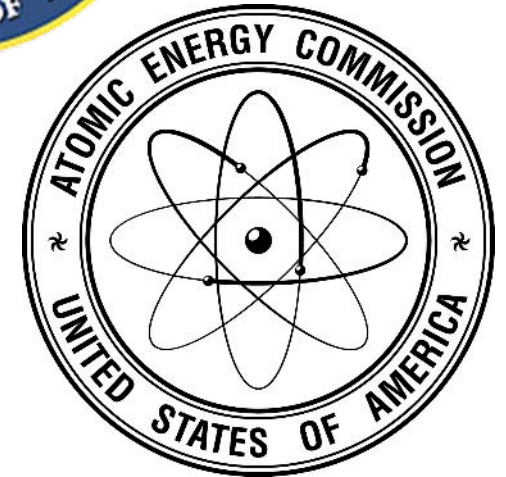


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# U.S. ARMY NUCLEAR POWER PROGRAM

- 1952 Department of Defense (DoD) study to determine the feasibility of developing reactor plants to serve military power needs on land.
- Joint program between DoD and the Atomic Energy Commission.
- Each service participated in the Army managed program.



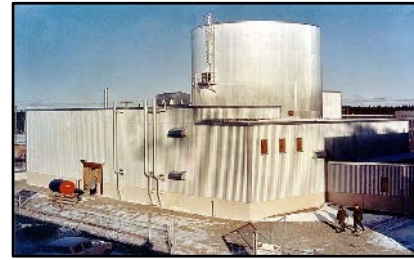
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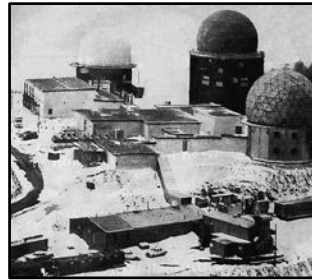
# U.S. ARMY NUCLEAR POWER PROGRAM

- Six DOD power reactors fielded between 1957-1976

Four Army:



One Air Force:



One Navy:



- Two at National Reactor Testing Station, Idaho



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# ARMY DEACTIVATED NUCLEAR POWER PLANT PROGRAM

- PM2A at Camp Century Greenland was fully decommissioned, the three others were placed into SAFSTOR and are controlled under Army issued Permits, and still require decommissioning
- For the three Army deactivated (fuel removed) reactors placed into safe storage, USACE:
  - Ensures the security of the residual radioactive materials present in the reactors
  - Ensures structural integrity of the facilities and performs required maintenance
  - Performs environmental monitoring to ensure exposure to the public is below limits and 'As Low As Reasonably Achievable'
  - Plans and performs final decommissioning within 60 years post-shutdown



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# CURRENT REGULATORY FRAMEWORK AND OVERSIGHT

- Defense Utilization Facilities Authorized by Section 91.b. of the Atomic Energy Act of 1954
  - Section 110.b. of the AEA Excludes DOD Utilization Facilities from AEC/NRC Licensing
- Army Reactor Program (AR 50-7)
  - Compliance With Federal Standards Required
- Army Radiation Safety Program (DA PAM 385-24)
  - USACE Developed Radiation Protection Programs
- Army Reactor Permits Issued to USACE by U.S. Army Nuclear and Countering WMD Agency (USANCA) in G-3/5/7
- Army Reactor Council Provides Oversight

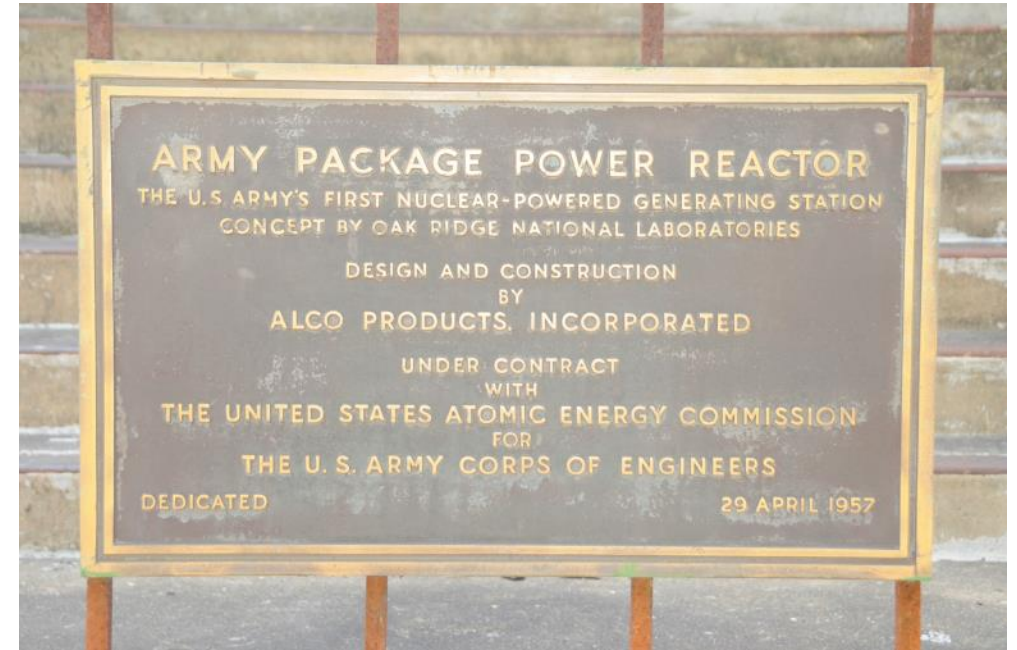


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# HISTORY OF THE SM-1 DEACTIVATED NUCLEAR POWER PLANT



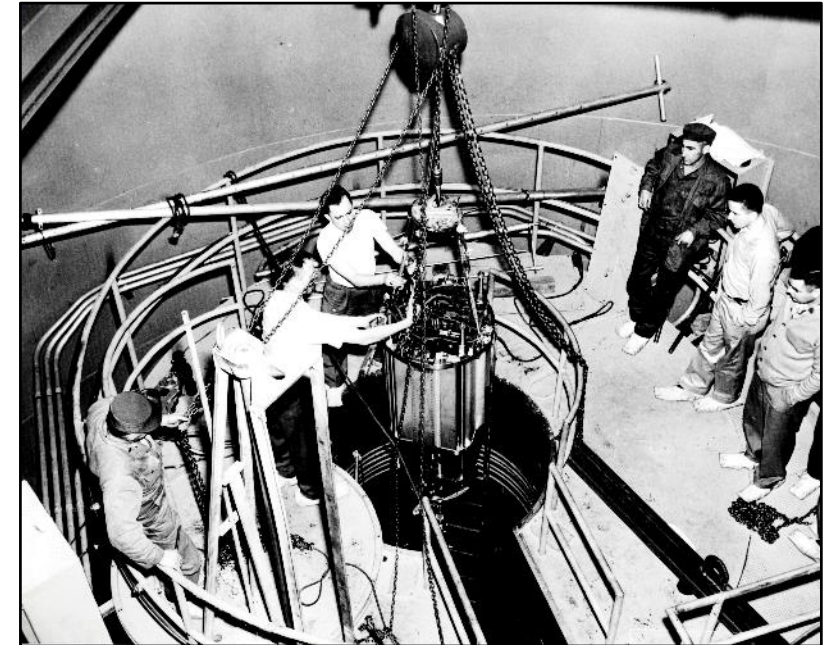
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# SM-1 TIMELINE: DETAILS

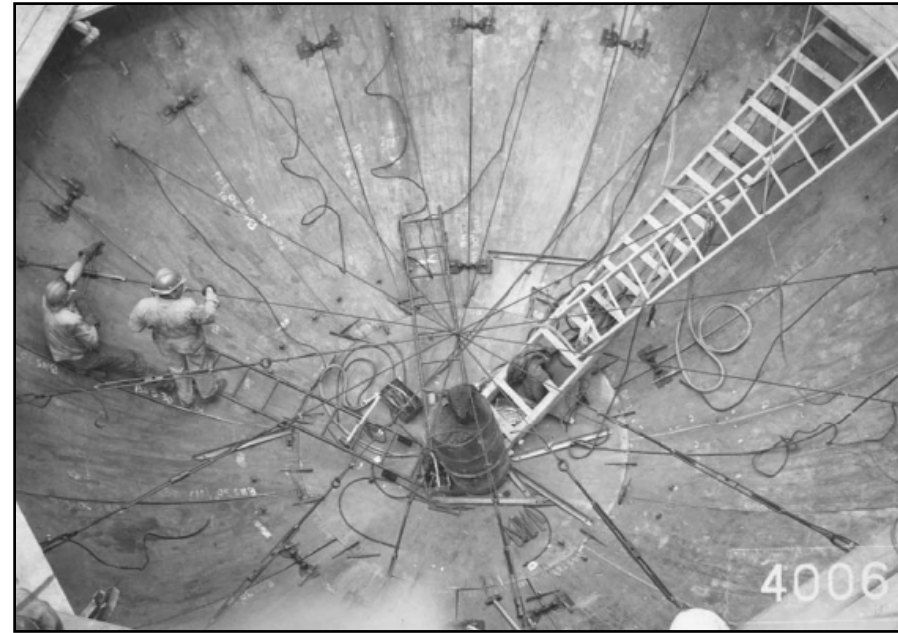
- 1952 : DoD studies development of reactor plants
- 1955: SM-1 Construction Begins
- April 8, 1957: SM-1 Reactor Startup
- March 1973: SM-1 Deactivated
- 1973-1974: Partial Decommissioning
  - Remaining low-level radioactivity placed in safe storage (SAFSTOR) with majority of remaining radioactivity allowed to decay over the years
- 2014: Army Corps awards decommissioning planning contract for SM-1
  - Planning is ongoing



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## 1956 Construction Photos



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# HISTORIC USE

- SM-1 provided partial power to Fort Belvoir, but was primarily used to train nuclear operators/technicians from all branches of the military from 1957 to 1973
- SM-1 also served as the prototype for the rest of the reactors designed by the Army
- After being deactivated, the SM-1 facility operated as a museum highlighting the Army Nuclear Power Program into the 1980's before being closed for good



Service members from the Army, Air Force and Navy are pictured in the control room of the SM-1, which was used as for training nuclear technicians from all branches.



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# 1973-74 PARTIAL DECOMMISSIONING ACTIVITIES AND SAFSTOR

- Removal of the nuclear fuel
- Shipment of the radioactive waste
- Minor decontamination
- Sealing of the reactor containment vessel (which includes the Reactor Pressure Vessel, Steam Generator, Pressurizer, Reactor Coolant Pumps and primary system piping)
- Installing appropriate security, warning signs and monitoring devices
- Remaining radioactivity was contained and has been sealed in safe storage (SAFSTOR) mode for the past 40-plus years
  - Safe storage is a radiological industry practice where radioactive materials are safely stored to allow the shorter-lived radionuclides to decay
- The U.S. Army Corps of Engineers conducts quarterly environmental monitoring to ensure the site does not pose any hazards to the surrounding installation tenants, the community or the environment

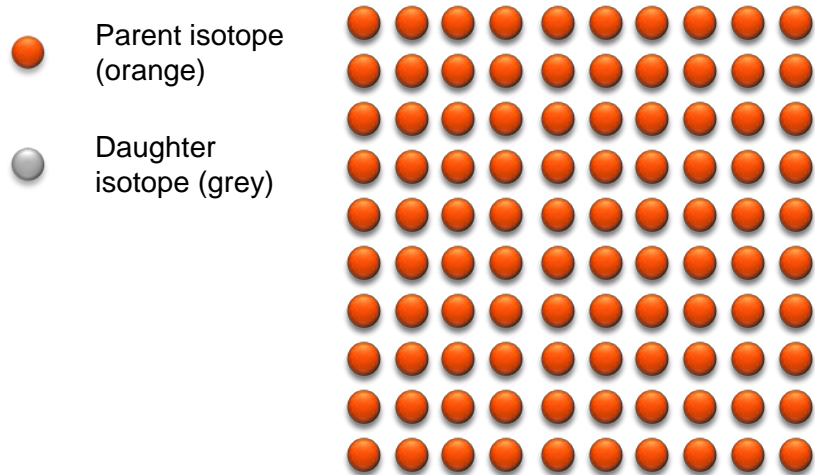


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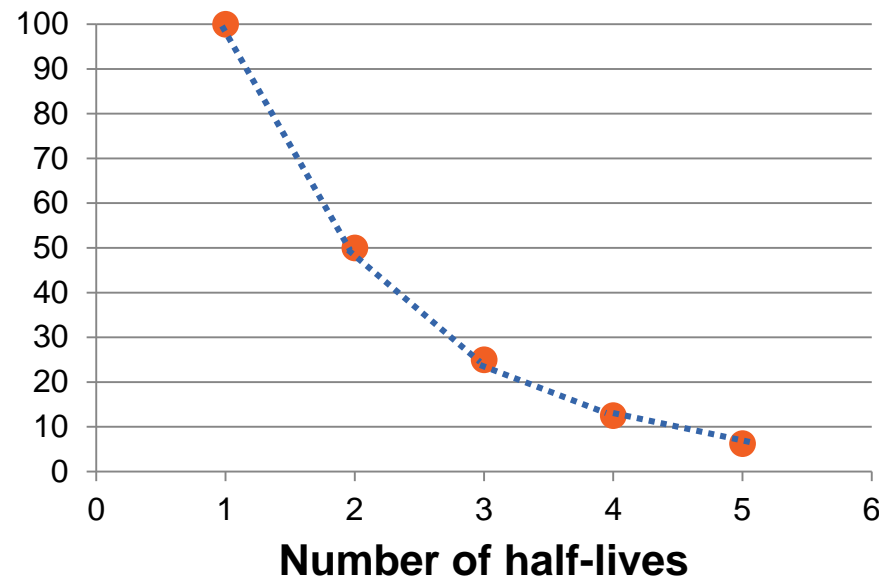




# SAFSTOR ALLOWS FOR RADIOACTIVE DECAY



- Half life is the time it takes for 1/2 of the atoms to decay.
- The half-life of Co-60 is 5.27 yrs.
- The half-life of Ni-63 is 100.1 yrs.

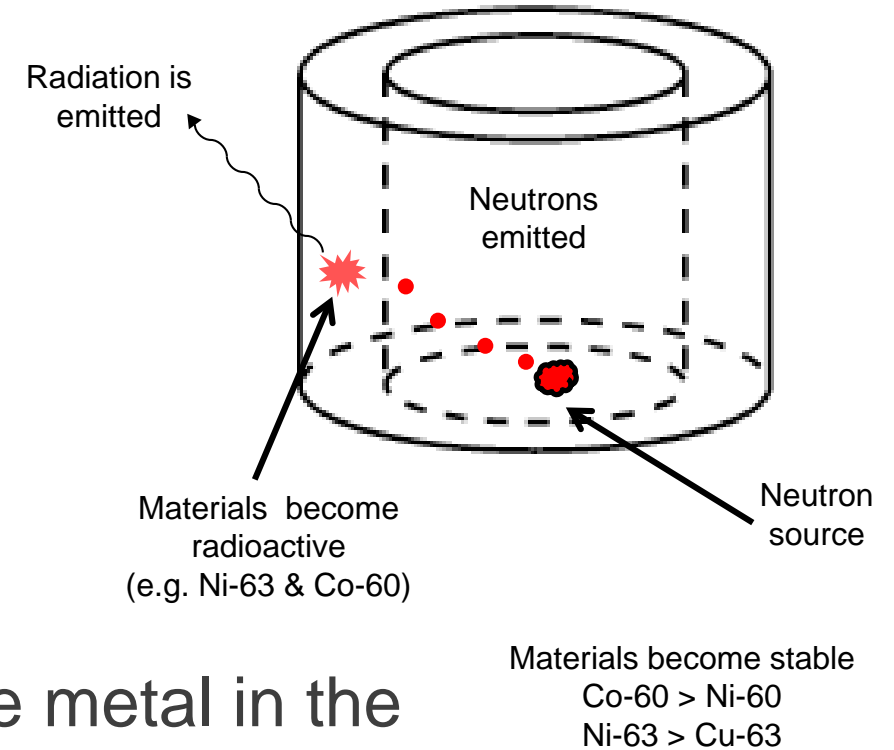


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# SM-1 PRIMARY RADIONUCLIDES

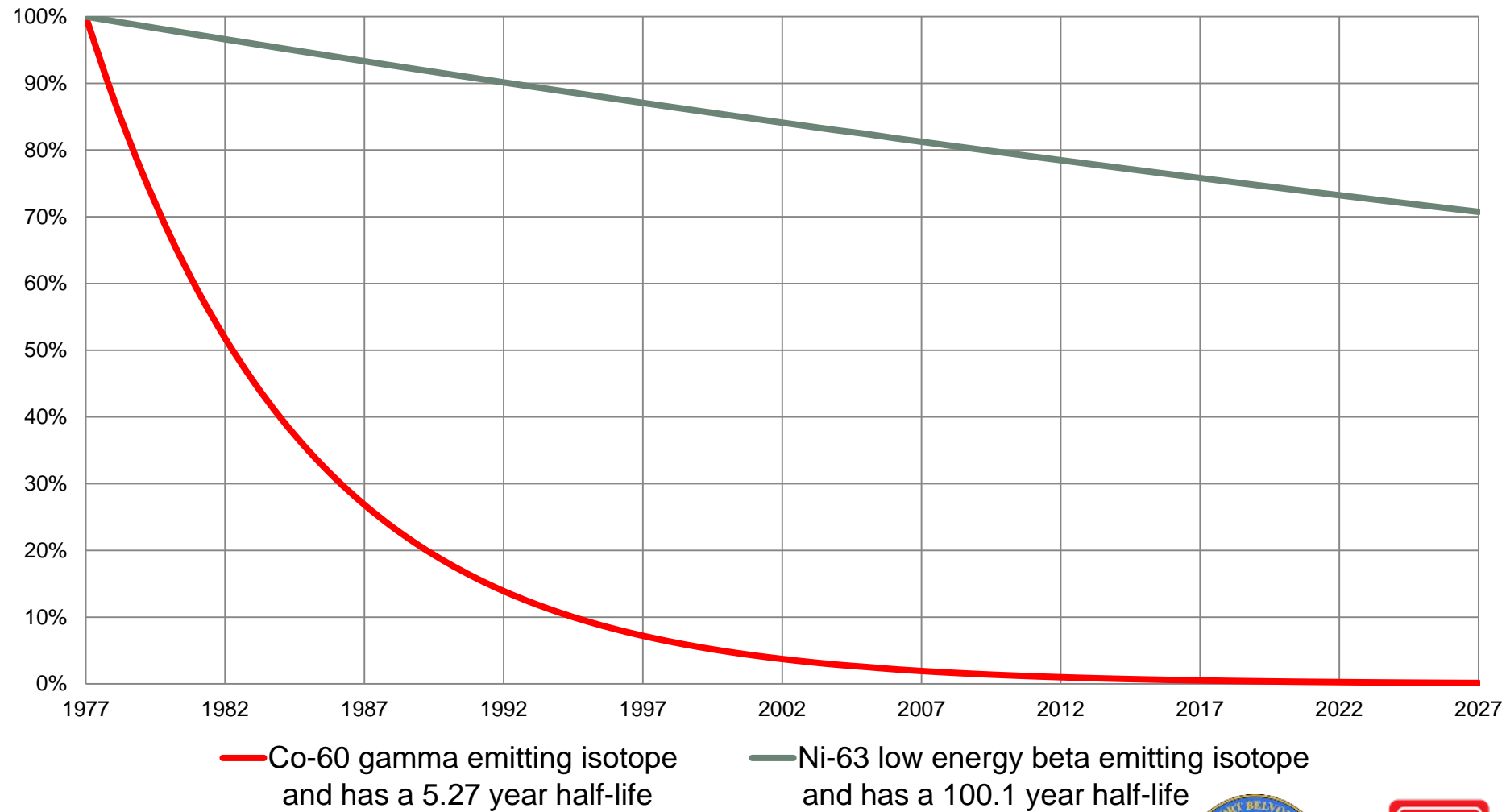
- Primary radionuclides are activation products
  - Co-60 - emits beta and gamma radiation
  - Ni-63 - emits low-energy beta radiation
- Most of the activity is in the form of radioactive metal in the reactor pressure vessel and the primary shield tank
- Small amounts of activity is present in the form of contamination on or within debris and soils (primarily Cs-137 and Sr-90)



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# RADIOACTIVE DECAY SINCE SHUTDOWN

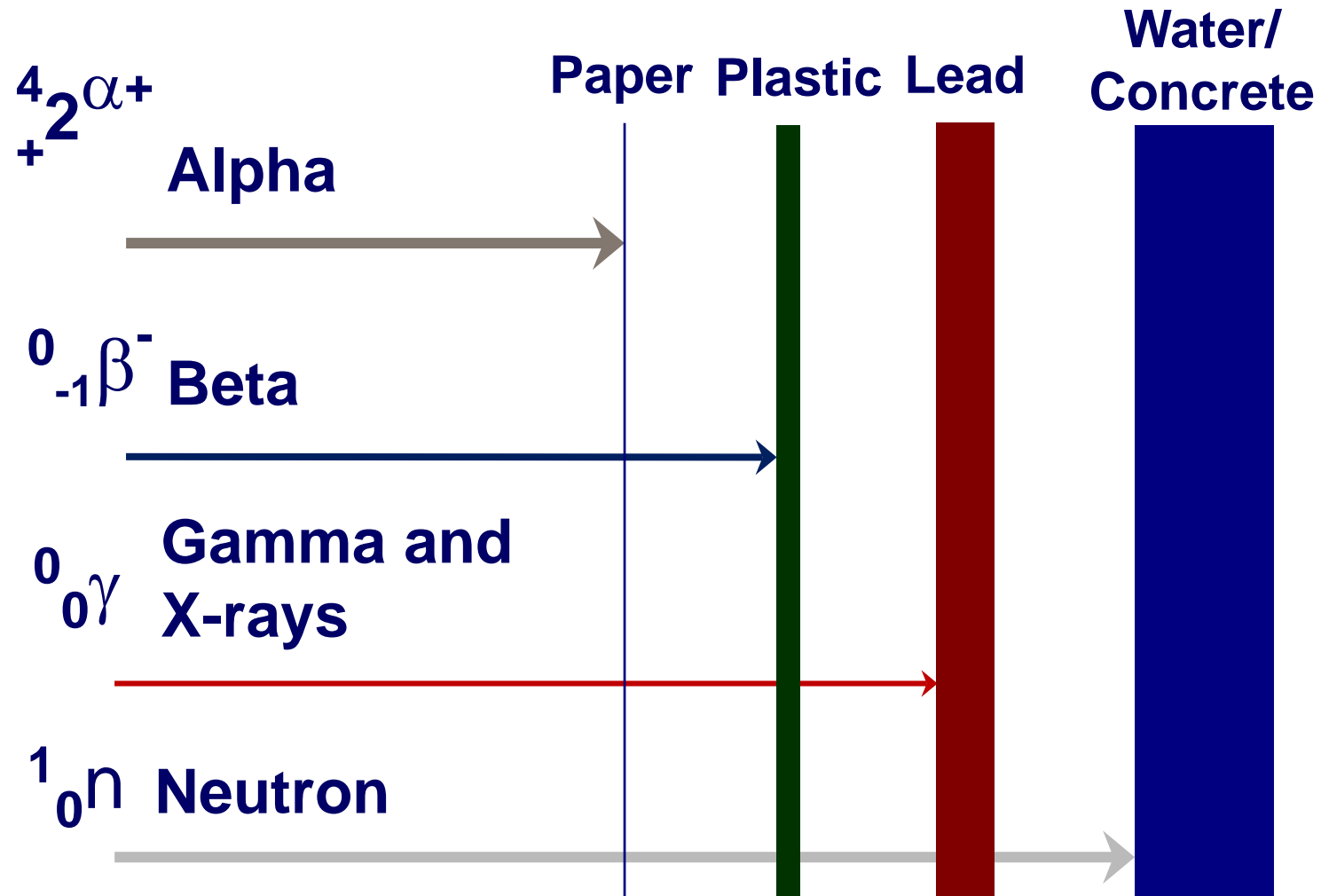


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# BASIC TYPES OF IONIZING RADIATION



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# PRIOR CHARACTERIZATION EFFORTS TO SUPPORT DECOMMISSIONING PLANNING

- 1975 – Army Deactivation and Partial Decommissioning Report
- 1997 - Army Environmental Hygiene Agency Surveys
- USACE - Gamma walkover surveys inside the fenced area
  - Completed in 2009; additional small area surveyed in 2016
- USACE - Biased and systematic soil sampling
  - Executed in 2010 and 2016
- USACE - Characterization surveys of buildings/sites associated with SM-1
  - Completed in 2010



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# PRIOR CHARACTERIZATION EFFORTS TO SUPPORT DECOMMISSIONING PLANNING

- Survey of Gunston Cove sediment
  - 1999 and 2010 Sampling Reports
- Underground pipes
  - All waste pipes and outfall pipes to be removed
  - Geophysical surveys to verify pipes present in 2010 and 2016
  - Investigation of sewer pipes still to be planned/executed
- Soil under and adjacent to SM-1
  - A small amount of soil is assumed to be impacted requiring removal

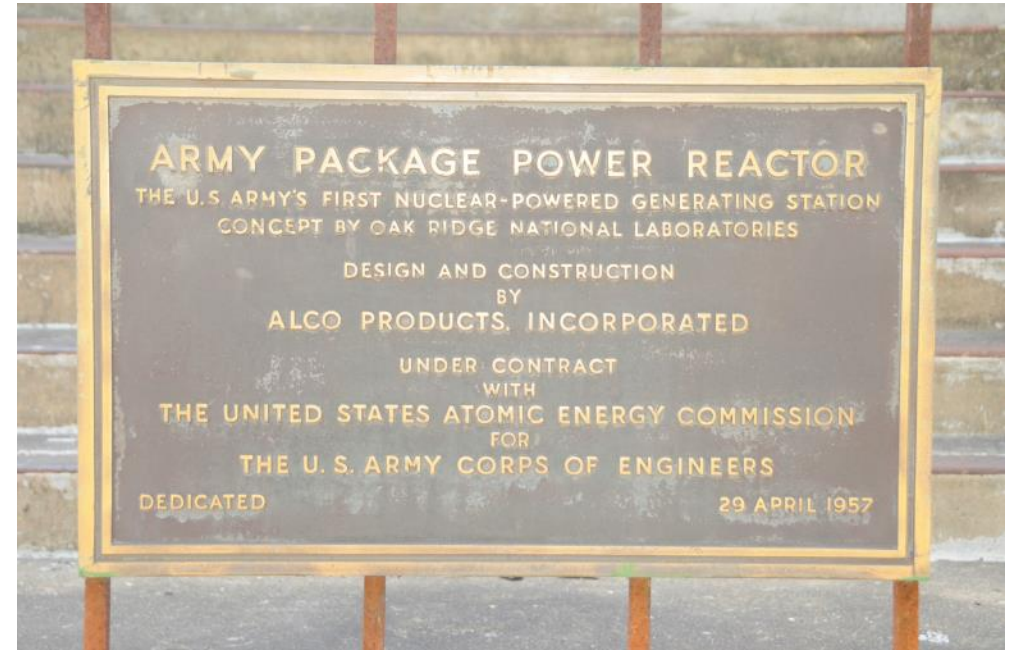


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# FINAL DECOMMISSIONING OF THE SM-1



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# FINAL DECOMMISSIONING PLANNING

- Final Decommissioning Planning Contract Awarded in 2014
  - Planning efforts underway, including development and finalization of plans, environmental compliance and public engagement
- Environmental Compliance
  - A draft Environmental Assessment is being prepared, evaluating potential ecological, cultural, water, public health and safety, and waste management effects associated with the decommissioning of the SM-1 facility at Fort Belvoir
    - » The Army will seek public input regarding this while development is in progress in January 2019 and will seek public comment on the completed draft EA later in the year
- Section 106 Compliance (Historic Preservation)
  - The Army is seeking consultation from the state, historic groups and members of the public to determine the cultural impacts of the project and to mitigate any adverse effects identified in accordance with the National Historic Preservation Act
    - » The Army is committed to preserving the history of the SM-1 facility and making information regarding its legacy available to the public



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# PUBLIC ENGAGEMENT

- The Army is committed to transparently sharing accurate information in a timely manner throughout this project and among all relevant parties, making sure information is coordinated and concerns from stakeholders are quickly addressed
- Multiple opportunities for public engagement are being incorporated into the decommissioning planning, including public information sessions like this one to inform the community of our ongoing planning, and again once the draft Environmental Assessment is available for public review
- Members of the public are invited to sign up for the SM-1 project update e-mail list by sending a request to [CENAB-CC@usace.army.mil](mailto:CENAB-CC@usace.army.mil)



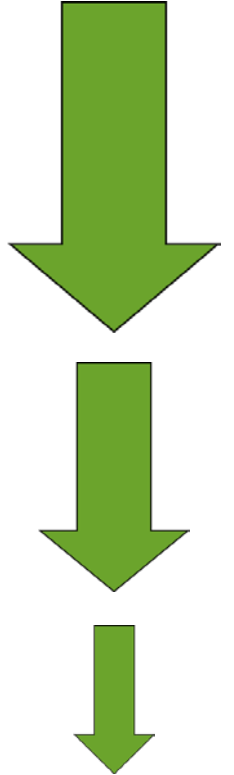
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# DECOMMISSIONING RISKS AND HOW WE REDUCE THEM

- Safety is the Army's number one priority - The safety and health of the community and our workers are paramount to the success of our project
- Trained professionals will use proven techniques and precautions to ensure the safety of the workers and the public
- Work will be completed within containment and all wastes will be properly packaged in compliance with Department of Transportation Guidance



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# SM-1 DECOMMISSIONING IMPLEMENTATION ACTIVITIES

- The selected contractor will prepare plans that will support the decommissioning of the SM-1 in accordance with contract PWS and the Decommissioning Permit issued to the USACE;
- Decommission/dispose of materials in accordance with final plans, decommissioning permits, and relevant Federal and State requirements; and
  - Project management (cost controls, scheduling, manpower resourcing, etc.)
  - Prepare work plans, safety and radiological plans, and prepare complex engineering assessments
  - Removal of all reactor components and radiologically contaminated materials
  - Prepare all radiological waste for proper shipment; then transport and dispose of the waste
  - Perform radiological surveys
  - Perform demolition of non-contaminated equipment and building components
  - Excavate contaminated soils
- Final site restoration

**Adherence to NRC and Army, as well as other Federal standards and guidance where relevant and as required by the Army Reactor Office and USACE.**



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# SM-1 DECOMMISSIONING PATH FORWARD

- Decommissioning planning is underway
  - Next major milestone will be the draft Environmental Assessment, which will be made available for public review and comment later this year (2019)
- Decommissioning Contract
  - Draft Request for Proposals for industry feedback anticipated to be issued in early 2019
  - Formal Request for Proposals later in 2019
  - Anticipate Decommissioning Contract award scheduled for 2020
- This timeline means decommissioning work on site will likely not begin until late 2020 or in 2021 at the earliest



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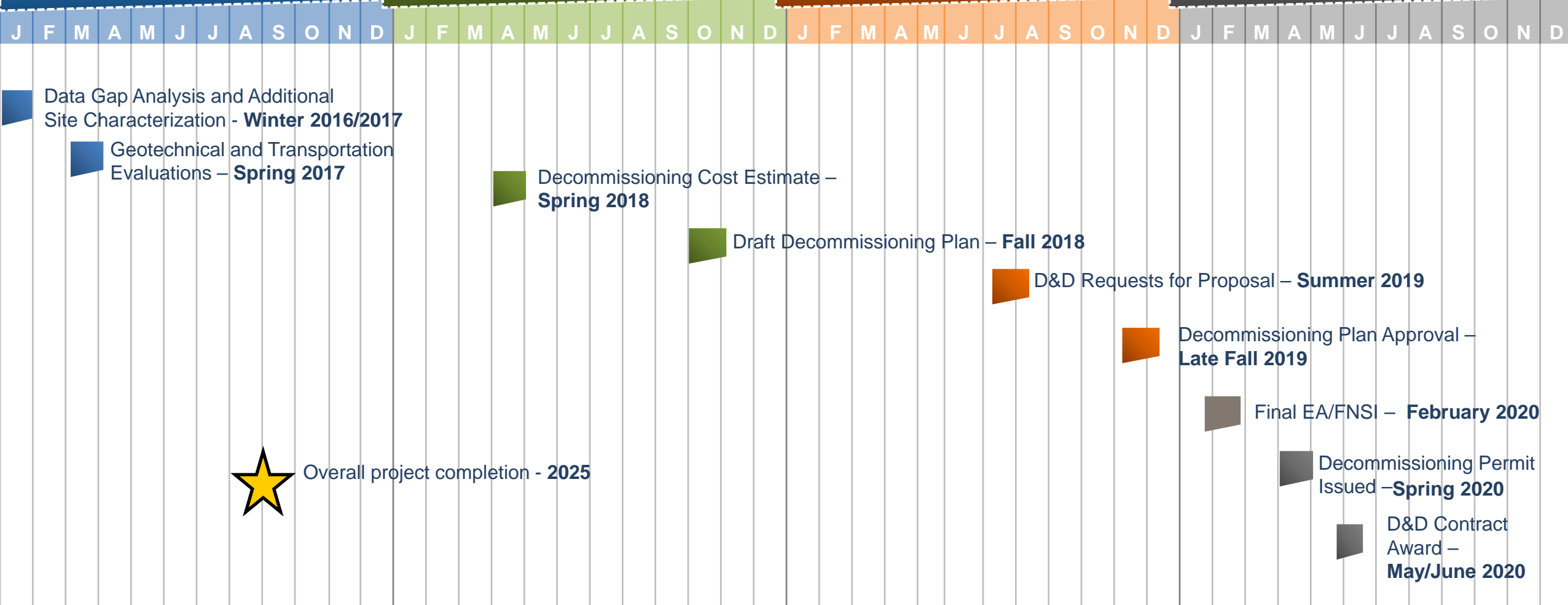
# TIMELINE/SCHEDULE

2017

2018

2019

2020





# WASTE SEGREGATION PROCESS – WHERE DOES IT ALL GO?



**CLEAN MATERIAL & EQUIPMENT (M&E)  
AND DEMOLITION DEBRIS FOR DISPOSAL  
OR RECYCLED**



- ELECTRICAL DISTRIBUTION EQUIPMENT
- CONTROL ROOM CONSOLES
- BUILDING DEBRIS
  - STEEL
  - CONCRETE

**TRUCKS and TRAINS TRANSPORT  
WASTE**



**HAZARDOUS WASTE TO PERMITTED  
LANDFILLS**

- SOIL AND DEBRIS CONTAMINATED WITH VERY LOW LEVELS OF RADIOACTIVITY
- ASBESTOS INSULATION, FLOOR TILES, MASTICS, ETC.
- LEAD-CONTAMINATED SOILS
- UNIVERSAL WASTE



**LOW LEVEL RADIOACTIVE WASTE TO A LICENSED  
DISPOSAL FACILITY**

- **RADIOLOGICALLY ACTIVATED**
  - REACTOR PRESSURE VESSEL (RPV)
  - OTHER REACTOR COMPONENTS
- **RADIOLOGICALLY CONTAMINATED**
  - PRIMARY and SECONDARY REACTOR SYSTEMS
  - LIQUID WASTE MANAGEMENT SYSTEM
  - CONTAMINATED SOIL AND DEBRIS



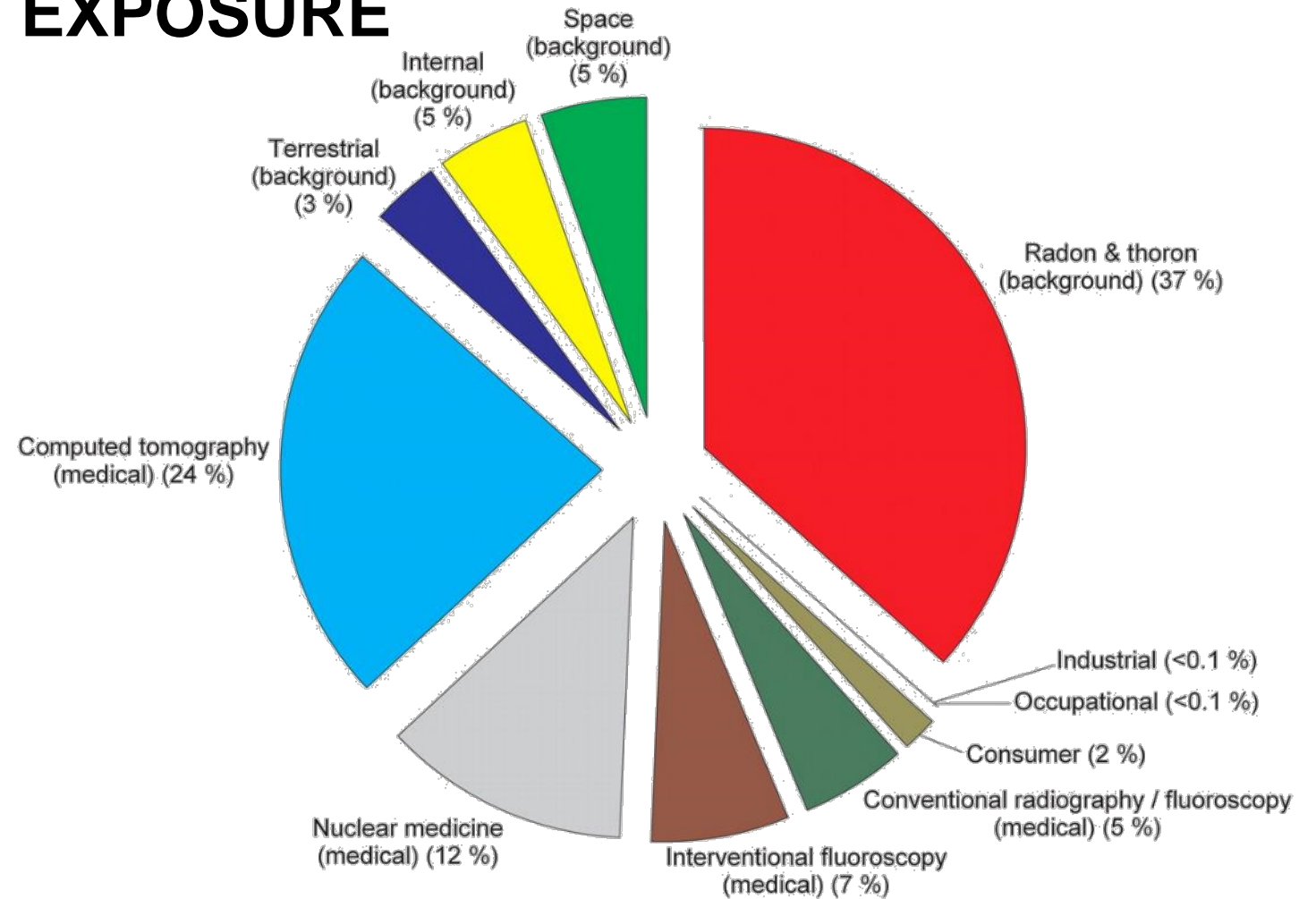
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# RADIOLOGICAL FUNDAMENTALS

## SOURCES OF RADIATION EXPOSURE

- Since the beginning of time, all living creatures have been, and are still being, exposed to radiation.
- Nonetheless, most people are not aware of all the natural and man-made sources of radiation in our environment.



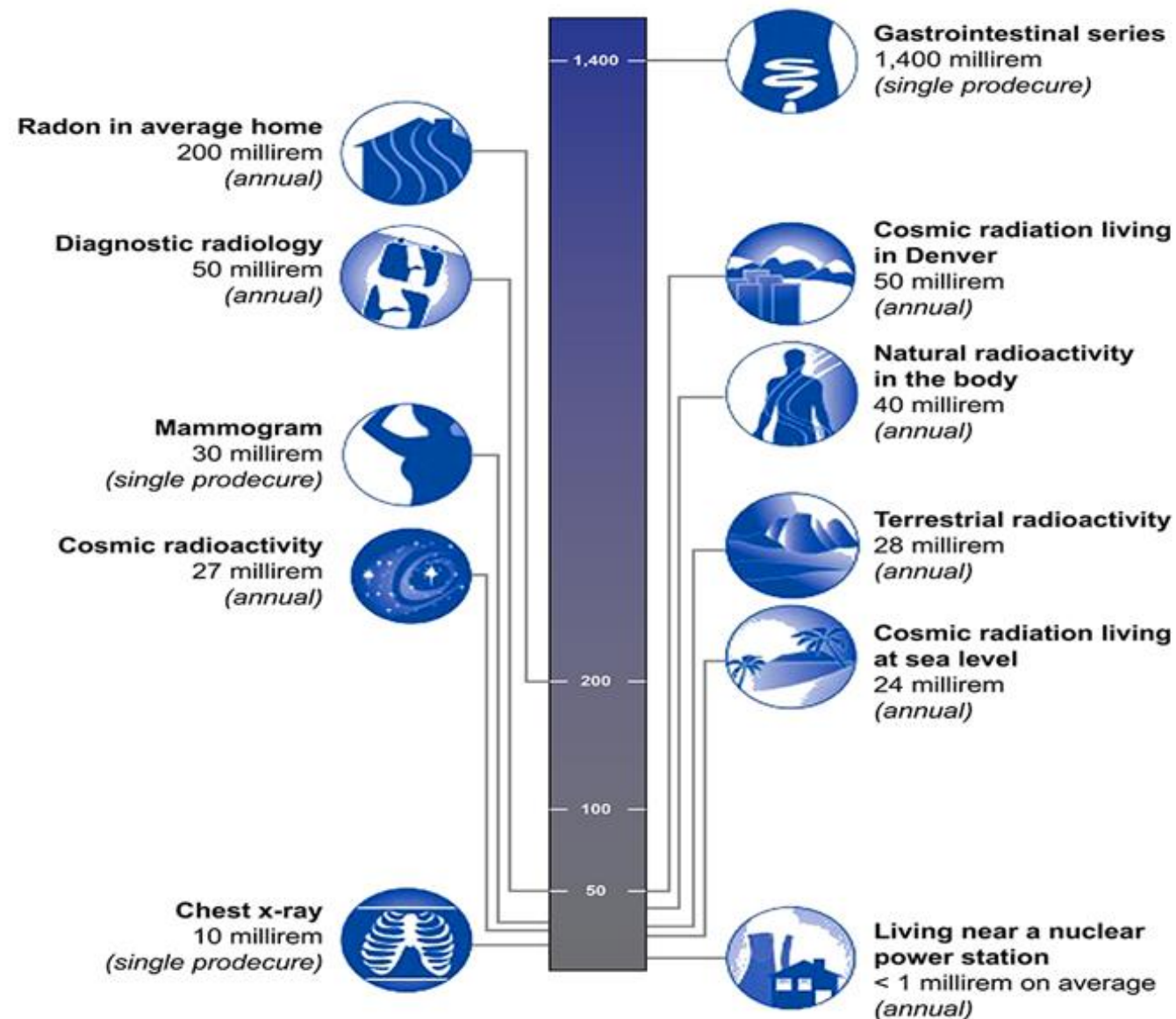
Average dose to individual in US is 620 mrem/yr



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# RELATIVE DOSES FROM RADIATION SOURCES – MILLIREM DOSES

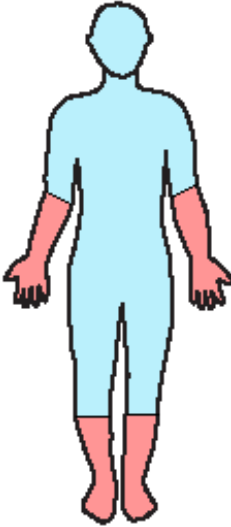


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# RADIATION DOSE LIMITS

- Occupational and Public Dose Limits

Type of exposure	NRC Limits (mrem/y)			
	Adult Worker	Minor Worker	Member of the General Public	
Whole Body	5,000	500	100	
Organ or Tissue	50,000	5,000	N/A	
Lens of the Eye	15,000	1,500	N/A	
Skin or Extremity	50,000	5,000	N/A	
Embryo/Fetus (of a declared pregnant worker)	500	N/A	N/A	

- NRC Decommissioning Criteria to be used for the SM-1 is 25 mrem/y
- Free release of material and equipment for recycle is 1 mrem/y



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# PROJECT TEAM

- Members of the project and oversight team include:
  - Professional Engineers
  - Certified Health Physicists (Radiation Safety)
  - Certified Industrial Hygienists
  - Environmental Scientists
  - Regulatory Specialists
  - Safety Specialists
  - Qualified Technicians



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# FEDERAL OVERSIGHT

- U.S. Army Corps of Engineers will provide quality assurance over the contractor and their quality control program
- Corps of Engineers National Environmental Center of Expertise
- Army Reactor Office and Reactor Council
- Oak Ridge Associated Universities – Independent Review



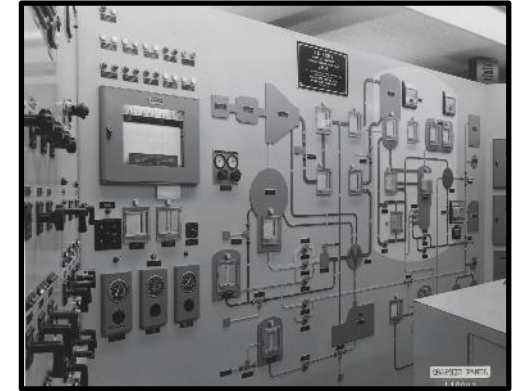
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# QUESTIONS AND HOW TO LEARN MORE

Learn more about the SM-1 Project online at:  
[www.nab.usace.army.mil/SM-1/](http://www.nab.usace.army.mil/SM-1/)

Sign up for the SM-1 stakeholder update e-mail list by  
e-mailing: [CENAB-CC@usace.army.mil](mailto:CENAB-CC@usace.army.mil)



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