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# CIRP Implementation at the University of California

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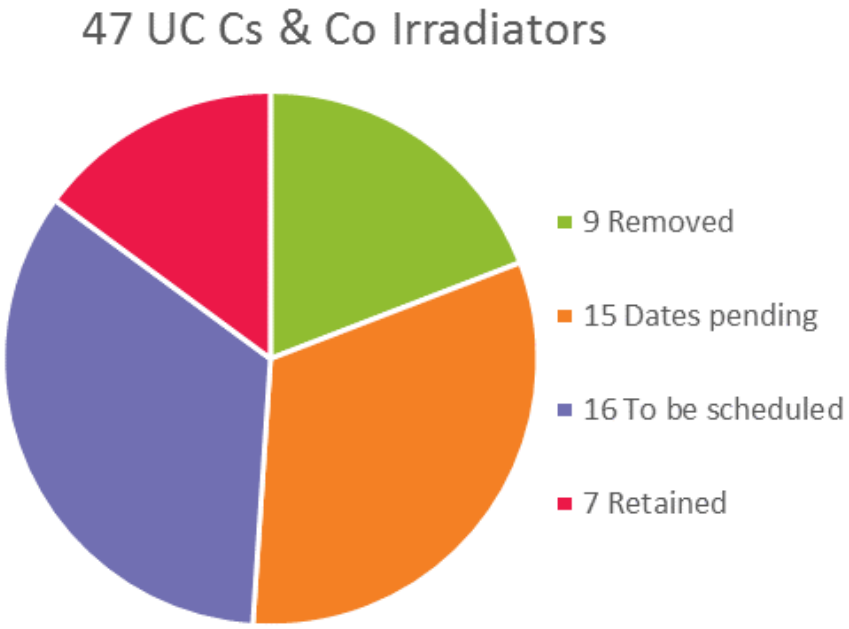
8/21/2019

# Irradiators in the University of California System

- There are 10 campuses in the UC System, including 5 academic medical centers
- 47 Cs & Co Irradiators, with a quarter of them at UCSF


- In 2017, the Office of Radiologic Security (ORS) introduced the Cesium Irradiator Replacement Project (CIRP) to the UC
- In February 2018, UC Chancellor Janet Napolitano heartily encouraged CIRP support in letters to the UC Chancellors and Hospital CEOs. She asked UC removals/replacements to be completed by June 2020.

# Current Status of Irradiators in the UC System




- To get to this point, we have encountered challenges in two general areas which may be helpful for discussion:
  - Researcher concerns regarding comparability
  - Irradiator removal preparations and contingency planning

# Researcher concerns: Polling of irradiator uses

- Medical: blood, vaccines, Gamma Knife therapy
- Research: primarily cell and mouse, but also nematode, fruit fly, cancer vaccine trials, bone sterilization, physical and chemical effects, food, degradation studies, etc.
  - Predominant purpose for irradiating cells is to expose feeder cells and to induce DNA damage responses in cell culture
  - Common animal uses are bone marrow ablation/chimeras



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# Researcher concerns: UC Workgroup

- A workgroup of researchers and physicists across the UC evaluated irradiator applications, concerns and recommendations for conversion from cesium to x-ray
  - UC Workgroup recommendations in April 2018
  - Health Physics Society paper in January 2020
- Overview summary and recommendations:
  - Transition should prove smooth, with some exceptions
  - X-ray irradiator outputs (energy, dose distributions) are more variable than for cesium
  - Standardization may be more difficult with x-ray than cesium
  - Labs needs to empirically assess the effects to their studies of converting from cesium to their specific x-ray irradiator
  - Labs starting studies needing irradiation should seriously consider using x-ray from the outset

# Researcher concerns: selected key points

- Compared to cesium energy deposition in animal models, the depth dose curve for x-ray energy deposition is higher on the surface, similar for 160 kVp down to 2 cm, and similar for 320 kVp x-ray down to 4 cm. Higher energy machines with filters to block lower energy photons will permit decent penetration while sparing surface tissue.
- X-ray irradiation has better collimation & advanced features
- Wide variation of Relative Biological Effectiveness (RBE) values for x-ray compared to cesium, depending on specific x-ray machines, energy settings, filtration, etc.
- RBE is more important for sensitive animal tumor models than for inactivating feeder cells or bone marrow ablation
- Cost for 36 animal comparison study may be as high as $5k
- Facilitate communication between researchers

# Irradiator removal preparation & coordination

- Extensive coordination among many stakeholders
  - Police, facilities, radiation safety, emergency management, public affairs/communications, regulators, FBI, NNSA, vendors for removal, rigging, transportation, etc.
  - UCSF has developed a 16 page institution-specific checklist over the course of our 5 removals.


# Irradiator removal contingency planning

- Expecting the unexpected
- UCSF had a stuck cesium source during our blood bank irradiator removal
- After 4 hours of trying to extract the source, the decision was made to return the irradiator to secure location
- Came back a month later and removed by overpack
- Learning from each other


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