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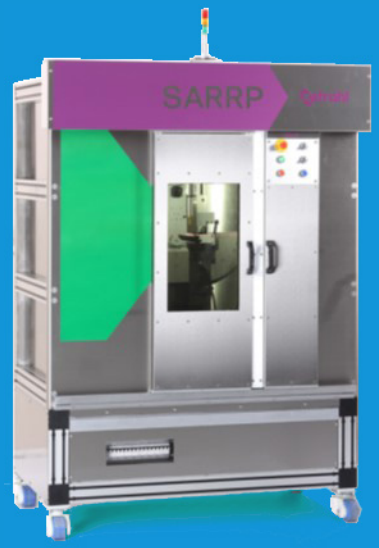
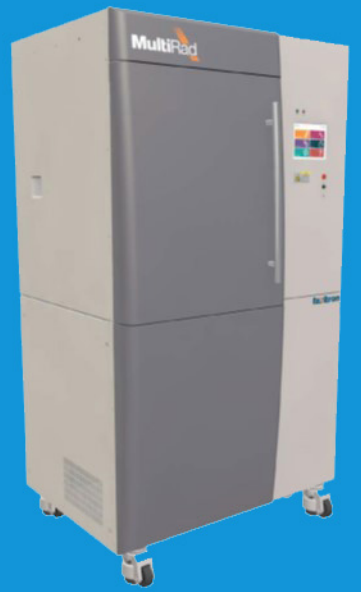
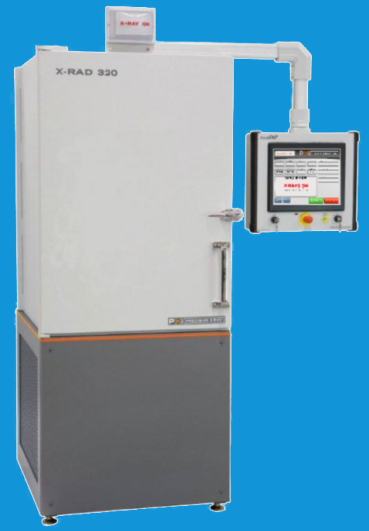
University of California System-wide Approach to Replacement of Cesium Irradiators with Alternative Technologies







Carolyn MacKenzie, Health Physicist

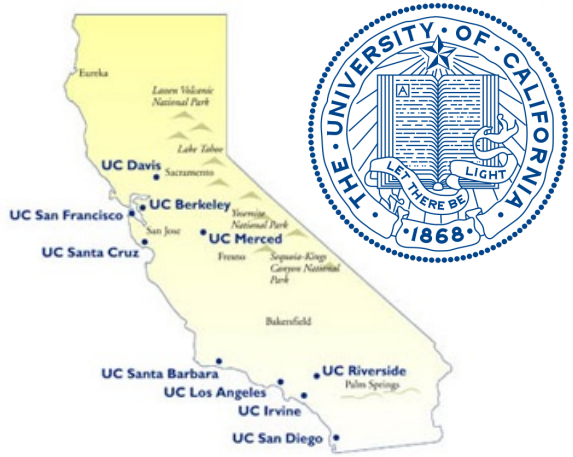
Radiation Safety, Center of Excellence

University of California

March 7th, 2019

The University of California Owns 47 Cesium or Cobalt Irradiators

10 campuses and 5 medical centers



Cesium 137

- Research irradiators – 36
- Medical-blood irradiators – 6

Cobalt 60

- Research – 2
- Medical-gamma knives – 3

~ 223,000 staff and faculty

~ 273,000 students

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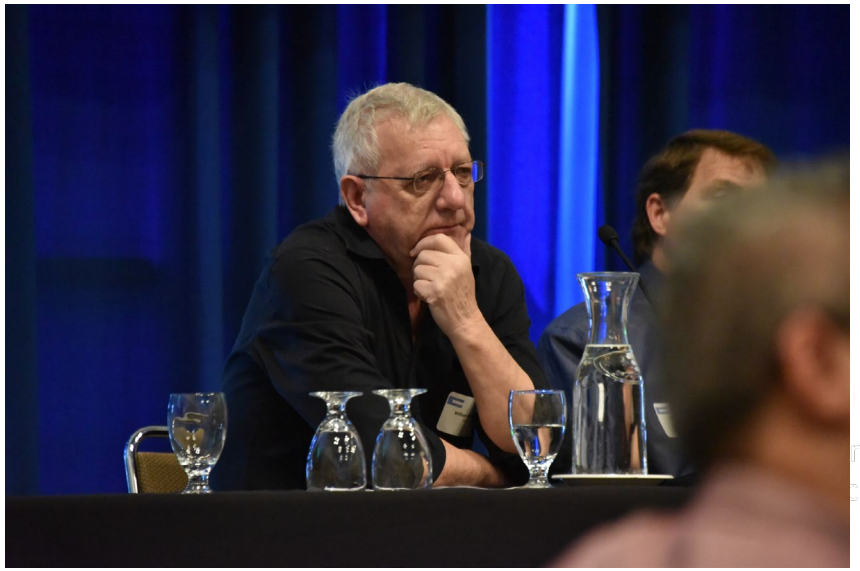
Faculty Technical Working Group studied the issue

- A ***Faculty Radioactive Source Replacement Working Group*** was formed to make technical recommendations to UC on the possibility of converting from cesium irradiators to x-ray irradiators in research.
- Members attended conferences and then met via conference calls.
- Shared published documents and discussed pros and cons. Analyzed existing data, discussed data gaps and summarized existing biological data.

"UC System-wide Radioactive Source Replacement Work Group Recommendations" **report is available**



UC Source Replacement Working Group (WG) Recommendations

- **X-ray irradiators can replace cesium irradiators in many applications**. There are likely ***some exceptions*** though, such as the need for very high radiation doses or radiation exposures over a period of days, and research specifically requiring high-energy gamma radiation.

- **Since x-ray irradiator outputs (energy, dose distributions) are more variable** than for cesium irradiators, standardization may be more difficult with x-ray than with cesium irradiators.

- **Every established laboratory/investigator needs to empirically assess the effects to their studies** of converting from cesium to x-rays specific to their replacement x-ray irradiator with their own comparison studies.

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UC Medical Center Blood Banks

- The UC Medical Center Chief Operating Officers (CEOs) at the 5 medical centers supported the blood banks converting to x-ray irradiators for blood sterilization.
- Federal Drug Administration (FDA) approved x-ray irradiators for blood.
- Volume of blood is **6 times higher** for x-ray irradiators than traditional cesium blood irradiators – big improvement!
- Higher maintenance costs associated with x-ray than cesium

UC blood banks were very receptive to switching to x-ray!

Funding New X-ray Irradiators - Biggest Concern!

- Office of Radiological Security is **funding the removal and disposal** of existing Cesium-137 irradiators – a savings of ***$200K+*** per irradiator; AND
- **UC receives incentive money per Cesium irradiator –** 1 Cesium to 1 x-ray or increased incentives if multiple Cesium irradiators are replaced.
- Each UC campus/hospital needs to pay the balance of the cost of the x-ray irradiator.
- The funding is **NOT coming from research grants –** usually coming from the Chancellors office.

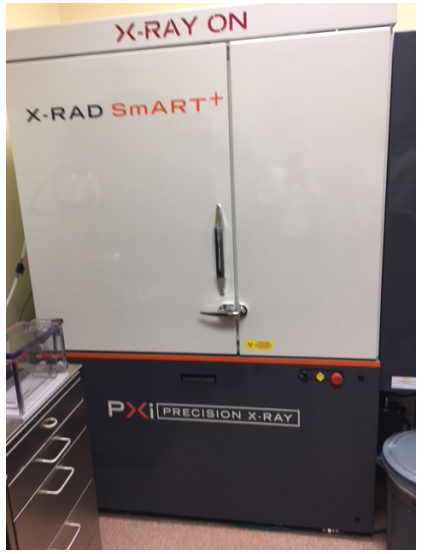
Ideally this should be a technical issue and not a financial issue!

What is the Cost Range for the X-ray Irradiators?

Cell / Animal Irradiators:

Manufacturers: RadSource, X-Strahl, Precision, Kimtron

- Cell/tissue irradiators - 160 keV - Costs range: **$65K-$110K**
- Small animal irradiators - 225 keV - Costs range: **$117K-$147K-$180k**
- Specialty 225-320 keV energy irradiators with imaging/CT scanners: **$250K-$300K-$700K**
- Higher energy irradiators 320-350 keV - Costs range: **~$145K-$246K**



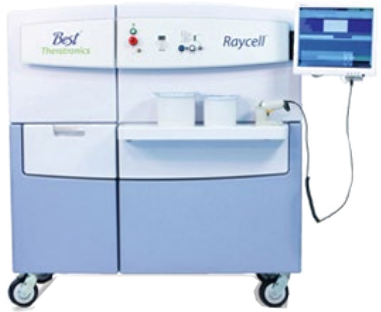
Options: automated shelf movement, automated dosimetry, automated collimation, Imaging, CT, radiation therapy

Blood Irradiators:

Manufacturers: RadSource and Best Theratronics

- Costs range: **~$245K $280K**

Options: Scanning systems, extra canisters, syringe holders



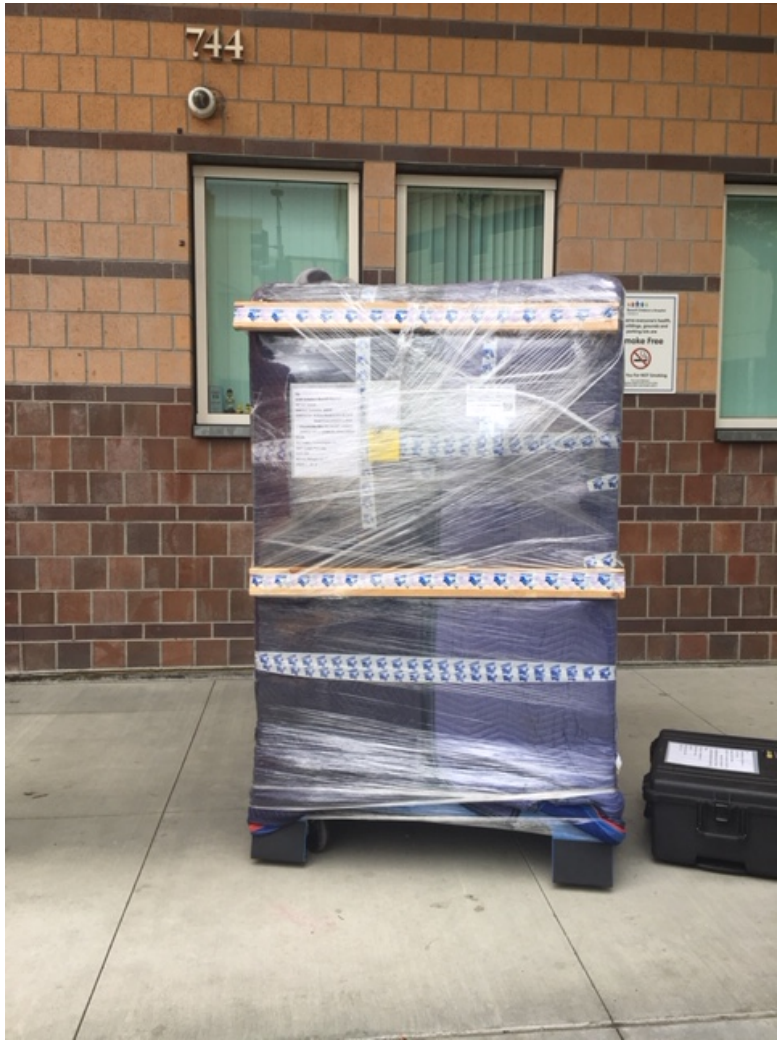
Service Contracts: $6K-$25K/yr

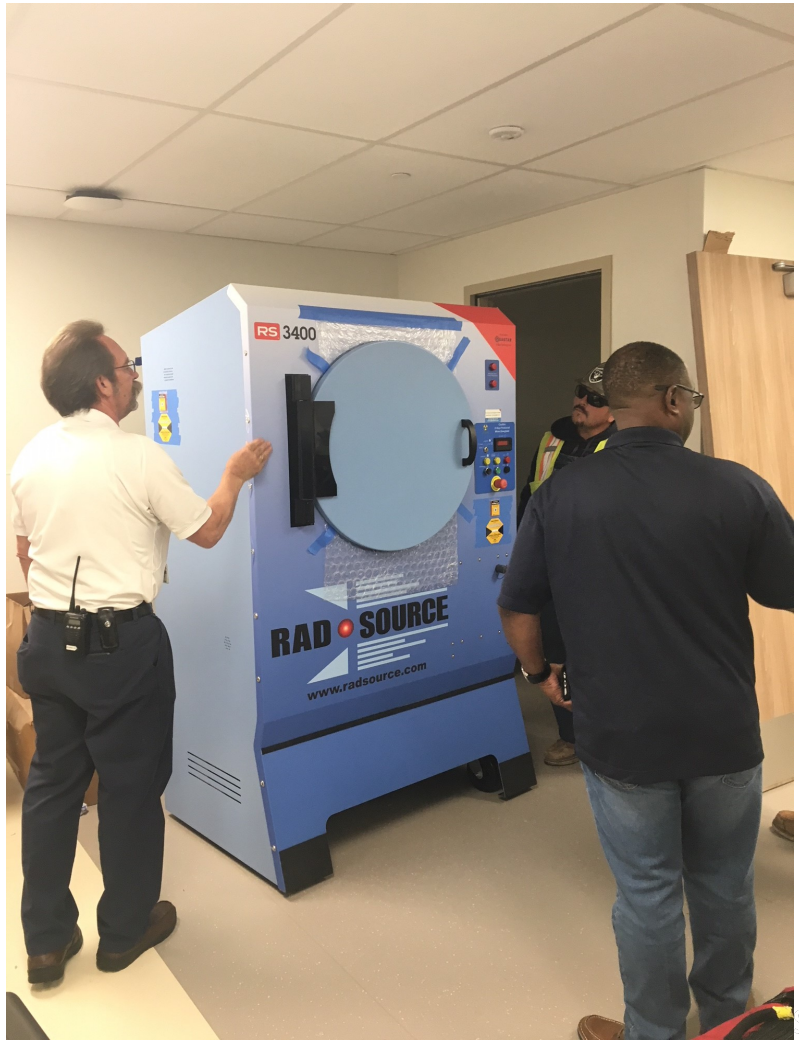
We have established a Cost Comparison Sheet to help with this decision

What are the Lessons Learned so far?

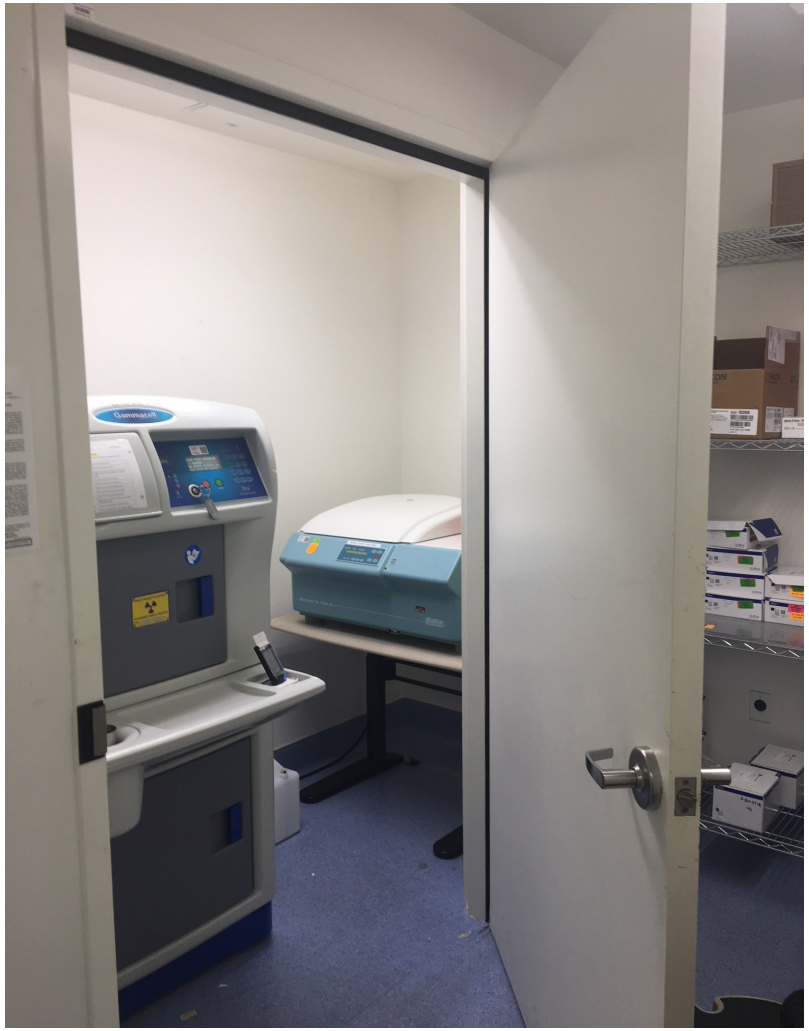
- **A collaborative approach is best!** Do not force researchers to switch to x-ray irradiators from Cesium irradiators – make them a part of the decision making process.
- **Offer money incentives**, options to upgrade research equipment and support for comparison studies.
- **Talk to the researchers** with senior management about their research and the impact they might experience. Do not shut down research but plan for exceptions.
- **Take a phased approach.** X-ray irradiators will gain acceptance with time.
- **No security** is needed with x-ray irradiators – a real bonus!
- **Allow researchers to upgrade their equipment** with automated dosimetry, imaging systems, radiation therapy, etc. – very desirable!

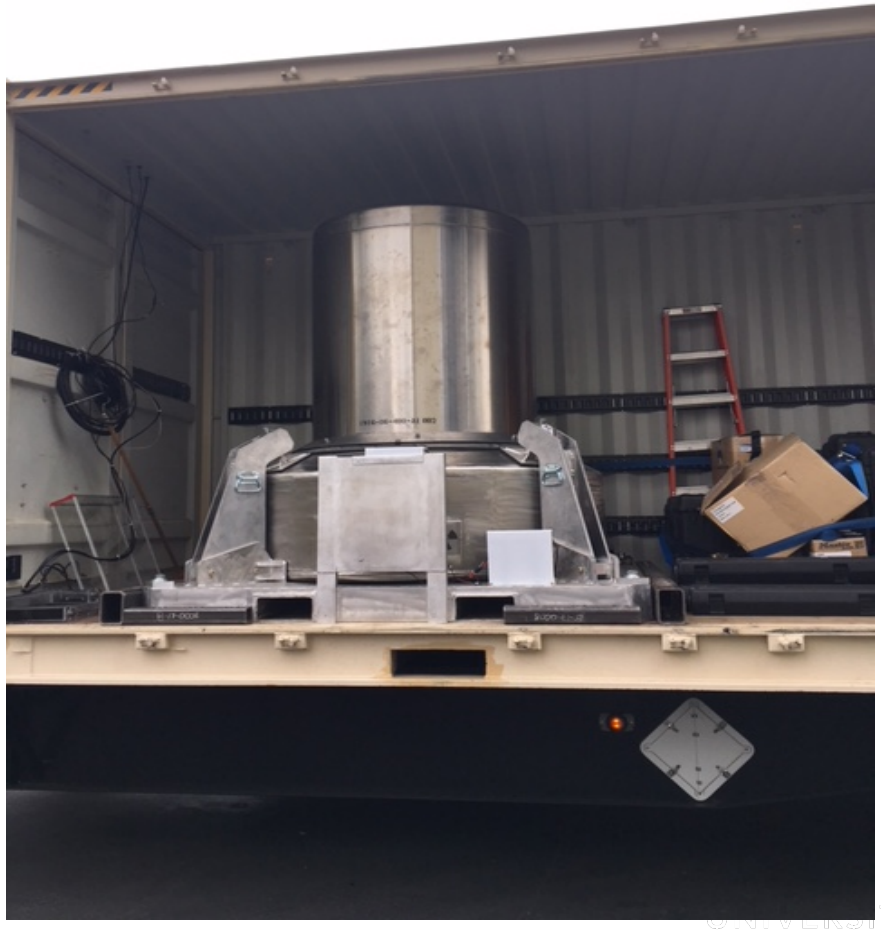
Installation of an X-ray Irradiator



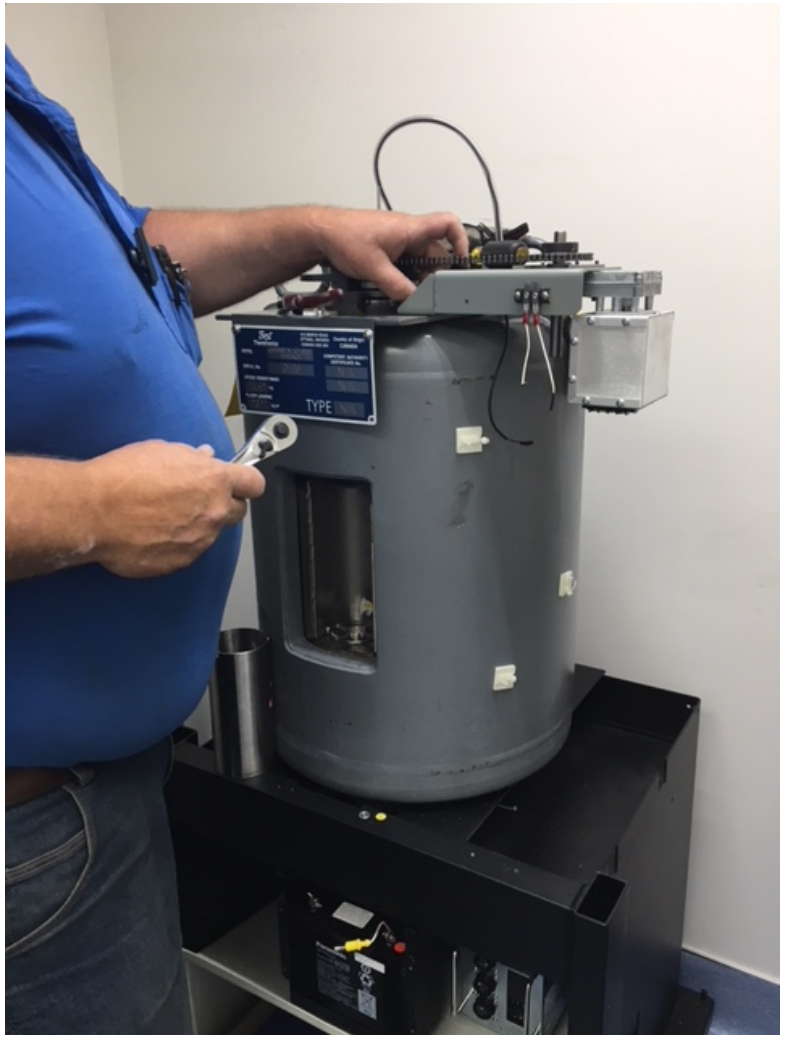


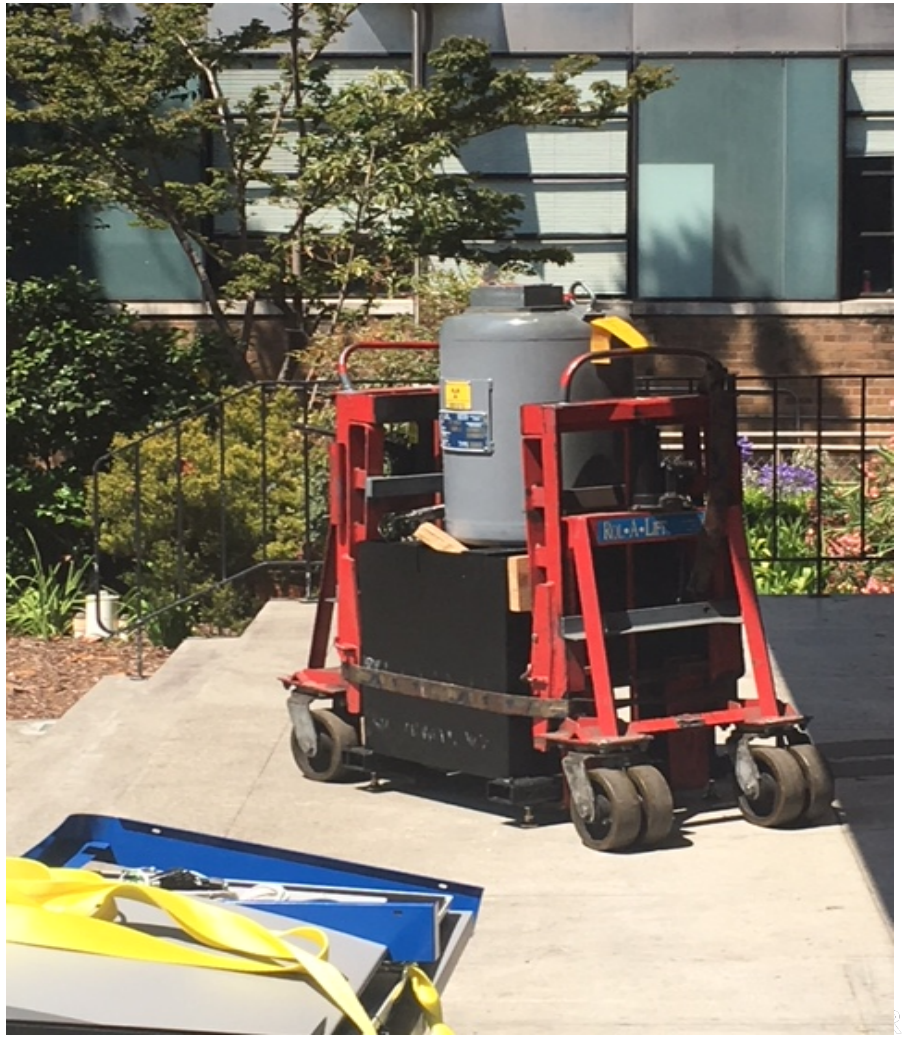
Removal of a Best Gamma Cell via Over Pack to Type B



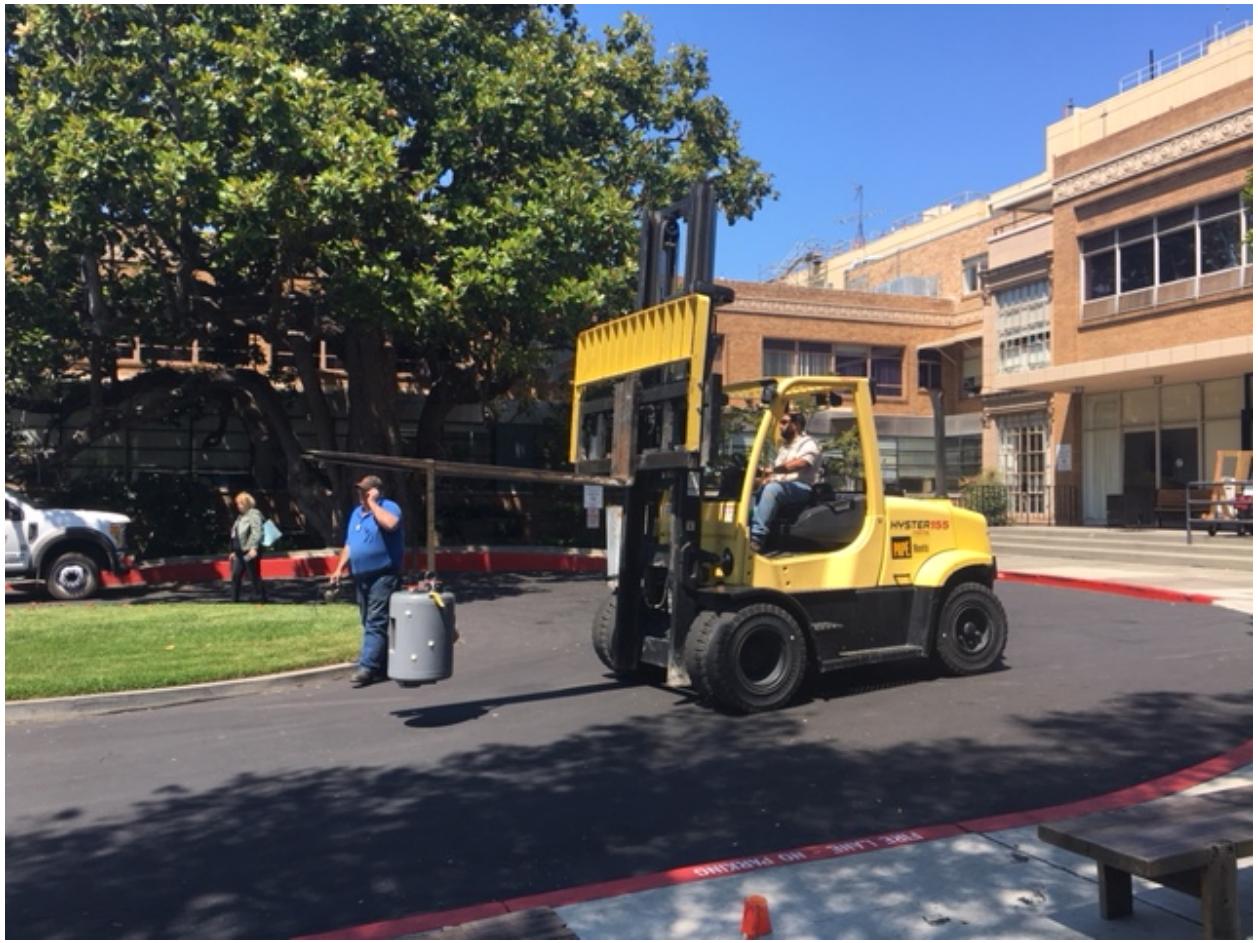


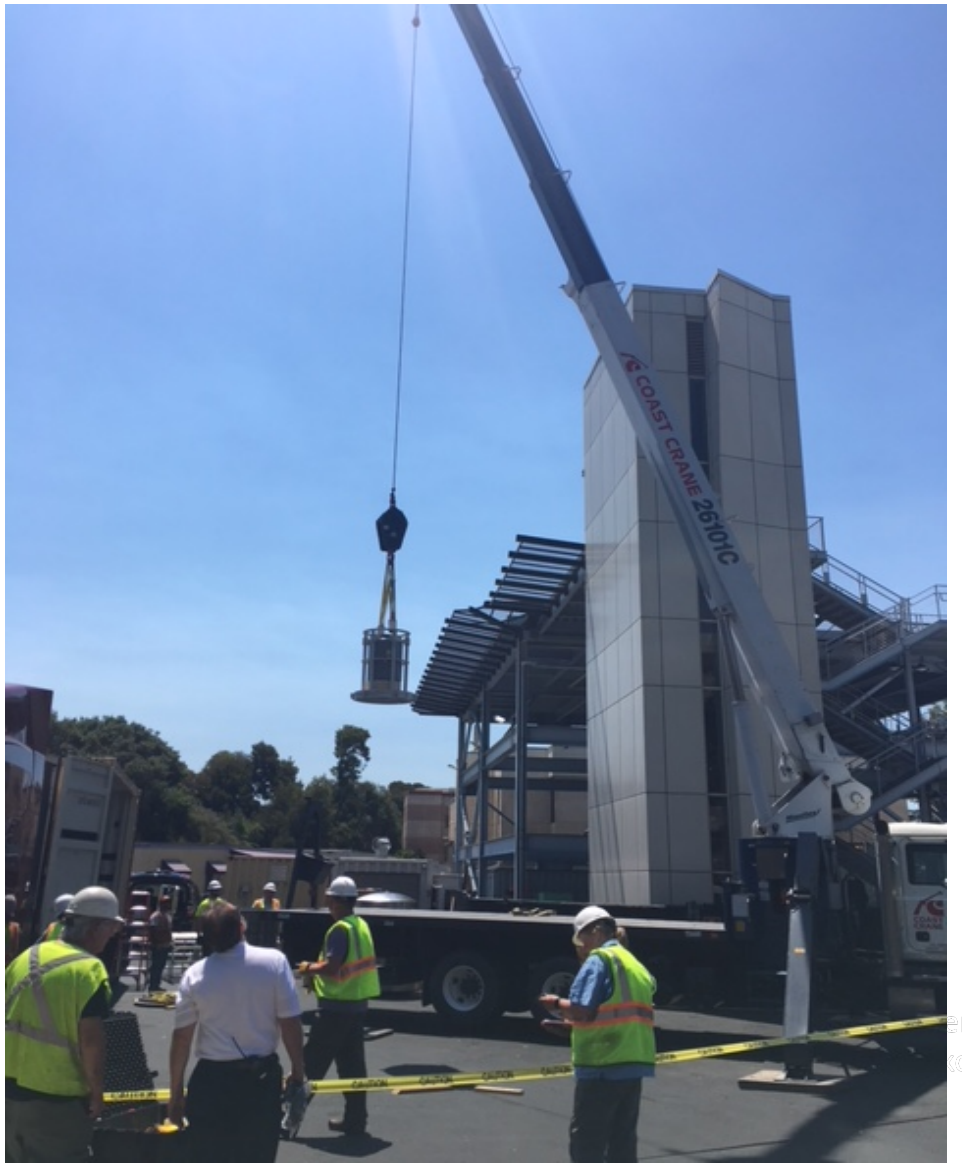
Moving the Cesium Source Outside





Moving the Cesium into the Type B Cask





The UC Cesium Irradiator Replacement Program (UC-CIRP) Decisions Were Due Sept 1, 2018

The UC campuses and hospitals have decided to remove **42 of the 47 Cesium or Cobalt irradiators** completing the work by June 2020.

TOTAL UC Irradiators	REMOVE & REPLACE	REMOVE ONLY	RETAIN
47	31	11	5

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