The Report of the ACMUI Subcommittee on ^{137}CsCl Irradiators

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Purpose of the Subcommittee

- The National Research Council's report made several assumptions that seemed questionable to the ACMUI.
- This subcommittee investigated the concerns raised by the ACMUI

Concerns Addressed

- The need for $^{137}CsCl$ irradiators
- Liable alternatives
- Current Security

The Need for the Irradiators Blood Products

- The original report assumed that approximately 10% of the blood used in the US was irradiated.
- Discussions with hematologists and oncologists indicated that for these practices, the value ranged between 15% and 40%.
- The patients involved have depressed immune systems and need the irradiated blood.
- The lower number probably comes from a higher fraction of trauma cases, where irradiation is irrelevant.

The Need for the Irradiators Animal Irradiation

- Research on stem cells and other systemic therapies increasingly requires whole-body irradiation of the animals (usually mice) before infusion.
- This research is growing and may soon lead to treatments for currently untreatable conditions.

The Need for the Irradiators Summary

- Without irradiators available, hematology and oncology patients would suffer potential death from the lack of irradiated blood.
- Without irradiators available, much of the stem-cell and systemic drug research would not be able to proceed.

Alternatives to ^{137}CsCl Irradiators

- The alternatives are conventional x-ray units or linear accelerators.
- Both have been and are used for blood, animal and material irradiation.

Conventional X-ray Units Blood Irradiation

- For blood irradiation, only one unit is FDA approve.
- The National Research Council listed the price as $180,000, with $10,000 /y for the service contract.
- The current price is $250,000 with $33,000/y for the service contract.
- A replacement tube is extra, as is calibration and quality management.

Conventional X-ray Units Blood Irradiation

- Throughput is lower for the x-ray unit.
- With 48,000 blood-product units / x-ray tube, a 50-unit per day operation would replace the tube every 3.7 years, adding to the cost of running the unit.

Conventional X-ray Units Animal Irradiation

- About 10 units are available.
- Few provide beams of 200 kV or higher, which limits there use with animals due to lack of penetration.
- Most prices range from $146k - $250k, plus the service contracts of about 10% per year.
- One low energy, short distance, small field size units markets for $43k - $87k.

Conventional X-ray Units Animal Irradiation

Issues with the x-ray units for animal irradiators, other than price, include:

- The different RBE compared with ^{137}Cs – possibly a factor of 2 for the lower energy units.
- The dose rates, which can have an effect on the biological effectiveness as well as make anesthesia more difficult.
- Penetration may require irradiating animals from several directions.

Medical Linear Accelerators

- If the radiotherapy department's accelerator is used, time available for blood or animal irradiation become a problem.
- If not using a radiotherapy department's accelerator, price becomes a problem, at $1.5M to start.

Security

Since the National Research Council report raising the concerns about the security of these units, several things have changed.

- The security of the users has been enhanced through the required background checks and fingerprinting.
- The security of the facility has been enhanced following directives of the Nuclear Regulatory Commission (sometimes at great costs to the facility.)
- The security of the units is being enhanced through a program of the DOE and DHS.

Security

- Following these three security enhancements, the units present little hazard for unauthorized source removal or disruption.
- The lack of such security was a major factor in the original report.

Summary

- Irradiation facilities are essential for irradiation of blood and in research.
- Forced replacement of ^{137}CsCl-based units would force many facilities to stop irradiations because of the large expense, since most of the facilities are non-profit and have few resources for funding a new x-ray unit or maintaining the unit.
- If not leading to the termination of the irradiations, the replacement would place a large financial burden on facilities which usually have little funding.

Summary

- While x-ray units have been used for blood, animal and material irradiation, the difference in the RBE complicates simple replacement of the ^{137}Cs.
- Finally, with the enhanced security programs for the $^{137}CsCl$ units, replacement is unnecessary.