Cesium and X-ray Irradiator Use

1. Dear Colleagues:

You are invited to participate in our survey related to the use of ^{137}cesium chloride (^{137}CsCl) and X-ray irradiators.

Your participation in this study is completely voluntary. There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. It is very important for us to learn your opinions and that we receive only one response per institution or facility.

Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential.

In the 2005 Energy Policy Act, Congress required that the National Academies of Science (NAS) issue a report on ^{137}cesium chloride. That report was published in 2008 and recommended the replacement of cesium. One possibility for replacing cesium was to use non-radioactive replacements. The Energy Policy Act also set up an interagency Task Force that is responsible for submitting a Radiation Source Protection and Security Task Force Report ("Task Force Report") every four years. The next report is due in 2014. Since it has been 5 years since the NAS report, AAPM in conjunction with the Health Physics Society (HPS) Radiation Safety Officer (RSO) and Medical Sections is conducting research on the current state of alternative non-radioactive technology. In general, trying to find out what the current state of technology is (e.g., are people actively switching?) We know from colleagues in other countries that there has been a shift towards non-radioactive alternatives in general and we have been reaching out to foreign counterparts to learn more.

As you may know, commercial disposition has opened up in the past year for most sources under 30 Ci. However, despite the Conference of Radiation Control Directors' (CRCPD's) financial incentives and assistance navigating the disposal process, some sites are still holding onto their eligible disused sources. Some of the survey questions will also focus on this issue.

The survey is being distributed to all US AAPM Members, two HPS Sections (the RSO and Medical Sections) and the Campus Radiation Safety Officers organization. Please confer with colleagues within your organization who might also be receiving this request to ensure only one survey is completed per institution.

The survey cannot be stopped and restarted at a later time. You will need to complete the survey in one session and will not be able to go back and change an answer once selected. Prior to initiating this survey it is strongly suggested that you assemble some key pieces of information that you may need to adequately answer the questions.

Before taking the survey it is recommended that you open the link to the PDF version of the survey, print it, and review all the questions in advance of taking the survey. This will allow you to determine the necessary information that you will need to assemble and prepare prior to completing the on-line survey.

The following information about your irradiators should be available at the time the survey is initiated.

Irradiator device manufacture(s)/model(s)/serial numbers(s)
Financial information about
Start Up/Purchase/Acquisition costs
Annualized operational and maintenance costs
Security enhancements costs
Security system maintenance costs
Facility modification costs

T&R program costs
Part 37 implementation costs
LLE/transportation/licensing costs
Irradiator down-time/costs
Disposal options/costs

Operational information about:
Irradiator usage (materials/cycles/loads/times)
Materials irradiated
Types of facilities
Licensing
Service contracts

Please assemble and review this information in advance of taking the survey to ensure the accuracy of the information being provided.

We would like to have the survey completed on or before October 25th. We know this is only a few weeks but the information is important and your timely submission will ensure we can assemble and present the results prior to the 2014 Task Force review.

If you have any questions please contact either of the following individuals.

AAPM – Lynne Fairobent – lynne@aapm.org
HPS – Rusty Lorenzen – William.Lorenzen@childrens.harvard.edu

Thank you very much for your time and support. Please start with the survey now by clicking on the Continue button below.

2. Please specify your location from the list below:

- ○ US
- ○ Canada
- ○ Europe
- ○ Africa
- ○ Latin America
- ○ Asia/Pacific Islands
- ○ Australia
- ○ Middle East
- ○ Other, specify:

3. Do you own a ^{137}Cesium chloride (^{137}CsCl) or X-ray irradiator*?*
Note: hereafter a cesium chloride irradiator will be referred to as a cesium irradiator.

- ○ Yes
- ○ No

4. Choose the one which fits best:
I plan to PURCHASE (NOT REPLACE) one or more cesium irradiators

- ○ within the next 6 months.
- ○ within the next 12 months.
- ○ within the next 24 months.
- ○ between 2 and 5 years from now.
- ○ only if required.
- ○ at some undetermined point in the future.
- ○ No plans/not applicable.

5. When/If an irradiator is obtained who is/are the key decision makers regarding what type, X-ray or cesium, was/is obtained? (Check all that apply.)

- ☐ RSO
- ☐ Medical Physicist (non-RSO)
- ☐ Researcher(s)
- ☐ Blood Bank
- ☐ Other(s) (Specify)

6. Choose the one which fits best:
I plan to REPLACE one or more cesium irradiators

- within the next 6 months.
- within the next 12 months.
- within the next 24 months.
- between 2 and 5 years from now.
- only if required.
- at some undetermined point in the future.
- No plans / Not applicable.

7. If cost was/is not a factor who would decide on converting existing cesium irradiators to X-ray based units? (Check all that apply)

- RSO
- Medical Physicist (Non-RSO)
- Researcher(s)
- Blood Bank
- Other(s) (Specify)

8. What incentives would (might) motivate your facility to switch or purchase an X-ray based irradiator rather than a cesium irradiator? (Check all that apply.)

- Purchase and/or maintenance subsidy
- Disposal subsidy for cesium sources
- Both purchase & disposal subsidies
- Other(s)

9. If replacing the cesium irradiator, do you have a disposal option?

- No
- Not applicable.
- If yes, specify disposal option

10. What factors most strongly influence your facility to purchase X-ray irradiators and/or convert from cesium to X-ray irradiators? (Check all that apply.)

- Relief from regulatory financial burdens.
- Relief from regulatory compliance burdens.
- X-ray is a more reliable/sustainable alternative.
- Limited disposal options for Cs-137
- X-ray units are/would be more acceptable to end users
- Other, specify.

11. What factors most strongly prevent your facility from purchasing X-ray irradiators and/or converting from cesium to X-ray irradiators? (Check all that apply.)

- Acceptance by user community
- Reliability/sustainability
- Quality of beam (depth dose considerations and need for constant radiation over a long period of time)
- Limited availability (too few manufacturers)
- Facility limitations (space/infrastructure)
- Ease of operation (too complicated)

- [ ] Cost of purchase/operation of X-ray
- [ ] Cost of Disposal of Cs-137
- [ ] Other, specify.

12. What factors do/could influence and/or facilitate the purchase of or conversion to X-ray based irradiators? (Check all that apply.)

- [ ] Implementation of U.S. Nuclear Regulatory Commission (NRC) or Agreement State security regulations (e.g., 10 CFR Part 37)
- [ ] Access to better quality X-ray devices
- [ ] Better/more scientific data/studies regarding X-ray irradiation
- [ ] Access to government funding
- [ ] Access to affordable disposal options for Cs-137
- [ ] Reduced licensing/regulatory fees
- [ ] Other, specify.

13. Assume purchase/operating costs are not factors. What would the benefit(s) be to converting existing cesium to X-ray irradiators? (Check all that apply.)

- [ ] X-ray would be more acceptable to the end users
- [ ] X-ray would be more reliable and sustainable
- [ ] X-ray would reduce regulatory burdens
- [ ] X-ray would increase productivity
- [ ] No benefit
- [ ] Other, specify.

14. Do you currently have one or more cesium irradiators?

- ( ) Yes
- ( ) No

15. How many cesium irradiators, excluding calibration sources do you currently have?

16. Specify the manufacturer of your cesium irradiator(s). If you have more than one irradiator, check all manufacturers that you have.

- [ ] JL Shepherd
- [ ] CIS (also include IBL which was manufactured by CIS)
- [ ] MDS Nordion (now Best Theratronics)
- [ ] Atomic Energy of Canada, Ltd. (AECL)
- [ ] Hopewell
- [ ] ISOMEDIX
- [ ] Picker
- [ ] FEMA
- [ ] ORNL
- [ ] Others, Specify Manufacturer here: [specify model]

17. Specify the model(s). If you have more than one irradiator, specify the model number for each irradiator separated by a comma.

18. Enter your cesium irradiator serial number. If you have more than one irradiator, specify the serial number for each irradiator separated by a comma. (Note this information is only to determine that the response is for a unique irradiator not to identify the facility or respondent.)

19. Of the total number of cesium irradiators you have how many are used for medical products? (e.g., Blood)

20. Of the total number of cesium irradiators you have how many are used for research? (e.g., animals, cells, tissue)?

21. Of the total number of cesium irradiators you have how many are used for calibration, electronics, other commodities?

22. Of the total number of cesium irradiators you have how many are NOT in use at this time?

23. Location of use of your cesium irradiator(s), type of facility. (Check all that apply.)

- [ ] Blood donor center within a hospital
- [ ] Freestanding blood donor center
- [ ] Transfusion Service within a hospital
- [ ] Research laboratory
- [ ] University
- [ ] Other, specify

24. For blood irradiation only, specify:

Typical irradiation time (in minutes)

Number of irradiations per week

Number of samples per irradiation

25. Do you provide contracted irradiation services for others?

- ○ Yes
- ○ No

26. Do you have service contracts for maintenance of any of your cesium irradiators?

- ○ Yes
- ○ No

27. You indicated that you have a service contract for maintenance. What is the annual cost of the service contract (yearly preventive maintenance and dosimetry)?

28. You indicated that you do not have a service contract for maintenance. Do you have an in-house engineering group that provides preventive maintenance?

- Yes
- No

29. Have you experienced unplanned downtime with any of your cesium irradiator(s) in the last five years?

- Yes
- No

30. You indicated that you had experienced unplanned downtime with your cesium irradiator in the past five year. How many total incidences have occurred?

- 1
- >1- 5
- >5 - 10
- >10 or more

31. On average, how long was the unplanned downtime for your cesium irradiator?

- Less than 24 hours
- Between 1 and 7 days
- More than 7 days
- Other, specify:

32. What was the estimated total cost associated with the downtime of your cesium irradiator if no service contract?

- Less than $1,000
- Between $1,000 and $5,000
- Greater than $5,000 but less than $10,000
- Greater than $10,000
- No cost

33. If any of your cesium irradiators are unexpectedly not available for which use(s) do you NOT have a contingency plan? (Check all that apply.)

- [ ] Blood/medial products/clinical research material
- [ ] Non-clinical research cells/tissues
- [ ] Research animals
- [ ] Other, specify.

34. Do you have a separate U.S. Nuclear Regulatory Commission or an Agreement State license for your cesium irradiator(s), i.e., no other radioactive material(s) on the license?

other radioactive material(s) on the license?

- Yes
- No

35. If the scope of your license covers only your cesium irradiator(s) and not other radioactive materials, what is the license fee?

36. Regulatory Cost – Annual Cost to maintain increased controls under orders issued by the U.S. Nuclear Regulatory Commission or an Agreement State. This is intended for facilties that have implemented increased controls under orders not U.S. Nuclear Regulatory Commission regulations (10 CFR Part 37) or equivalent Agreement State regulations.

Facility/equipment/maintenance cost	
Number of individuals granted unescorted access	
Cost for fingerprinting per individual	
Cost for determining Trustworthiness and Reliability per individual	
Not applicable.	

37. Annual cost to maintain security-related equipment such as key card readers, (e.g., biometric readers, cameras):

- Less than $1,000
- Between $1,000 and $5,000
- Greater than $5,000 but less than $10,000
- Greater than $10,000 but less than $20,000
- Greater than $20,000

38. Do you have one or more X-ray irradiators?

- Yes
- No

39. How many X-ray irradiators do you have?

40. Specify the manufacturer of your X-ray irradiator(s). If you have more than one X-ray irradiator, select all manufacturers that you have.

- MDS Nordion Raycell, (now Best Theratronics)
- Rad Source Technologies, Inc.
- Gilardoni under the name Radgil
- Hitachi Corporation of Japan, MBR-1520A-3
- Hopewell Designs, Inc.
- Precision X-ray
- Faxitron
- Others, specify manufacturer here:

41. What is the model of your X-ray irradiator(s)? If you have more than one X-ray irradiator, specify the model number for each X-ray irradiator separated by a comma.

42. What is the serial number of your X-ray irradiator(s)? (In order to prevent multiple accounting of the same X-ray irradiator). If you have more than one X-ray irradiator, specify the serial number for each X-ray irradiator separated by a comma.

43. Of the total number of X-ray irradiators you have how many are used for medical products? (e.g., Blood)

44. Of the total number of X-ray irradiators you have how many are used for research (e.g., animals, cells, tissue)?

45. Of the total number of X-ray irradiators you have how many are used for calibration, electronics, other commodities?

46. Of the total number of X-ray irradiators you have how many are NOT in use at this time?

47. Location of use for your X-ray irradiator(s), type of facility. (Check all that apply.)

- [ ] Blood donor center within a hospital
- [ ] Freestanding blood donor center
- [ ] Transfusion Service within a hospital
- [ ] Research laboratory
- [ ] University
- [ ] Other, specify

48. For blood irradiation with an X-ray irradiator only, specify:

Typical irradiation time	
Number of irradiations per week	
Number of samples per irradiation	

49. For other than blood products irradiated with an X-ray irradiator, specify:

Typical irradiation time	
Number of irradiations per week	
Products irradiated - Electronics	
Products irradiated - Other commodities	

50. Average number of samples per irradiation:

- 1
- 2
- 3
- >3

51. Choose the one which fits best:
I plan to REPLACE one or more X-ray irradiators

- within the next 6 months.
- within the next 12 months.
- within the next 24 months.
- between 2 and 5 years from now.
- only if required.
- not sure at this time.
- No plans / Not applicable.

52. Is your X-ray irradiator(s) licensed or registered with the state?

- Yes
- No

53. What is the annual license/registration cost for your X-ray irradiator(s)?

54. Do you provide contracted irradiation services for others?

- Yes
- No

55. Do you have a service contract for maintenance of any of your X-ray irradiator(s)?

- Yes
- No

56. You indicated that you have a service contract for maintenance for 1 or more X-ray irradiator(s). What is the annual cost of the service contract (yearly preventive maintenance and dosimetry).

57. You indicated that you do not have a service contract for maintenance of any of your X-ray irradiator(s). Do you have an in-house engineering group that provides preventive maintenance?

- Yes

- ○ No

58. Have you experienced unplanned downtime with your X-ray irradiator(s) in the last five years?

- ○ Yes
- ○ No

59. If yes to previous question, how many incidences have occurred? If you have more than one X-ray irradiator that has had unplanned downtime, please respond based on the average unplanned downtime per irradiator.

- ○ 1
- ○ >1- 5
- ○ >5 - 10
- ○ >10 or more

60. How long was the unplanned downtime for your X-ray irradiator? If you have more than one X-ray irradiator that has had unplanned downtime, please respond based on the average unplanned downtime per irradiator.

- ○ Less than 24 hours
- ○ Between 1 and 7 days
- ○ More than 7 days
- ○ Other, specify:

61. What was the cost associated with the unplanned downtime for your X-ray irradiator(s) if no service contract? If you have more than one X-ray irradiator that has had unplanned downtime, please respond based on the average cost per irradiator.

- ○ Less than $1,000
- ○ Between $1,000 and $5,000
- ○ Greater than $5,000 but less than $10,000
- ○ Greater than $10,000

62. If any of your X-ray irradiators are unexpectedly not available for which use(s) do you NOT have a contingency plan? (Check all that apply.)

- ☐ Blood/medial products/clinical research material
- ☐ Non-clinical research cells/tissues
- ☐ Research animals
- ☐ Other, specify.

63. If you had to replace the tube on average how long did it take to get a replacement tube?

- ○ Less than 24 hours
- ○ Between 1 and 7 days
- ○ More than 7 days
- ○ Other, specify

64. If you had to replace the High Voltage Power Supply how long did it take to get a replacement power supply?

- ○ Less than 24 hours
- ○ Between 1 and 7 days
- ○ More than 7 days
- ○ Other, specify

65. What was the cost to modify your facility to add an X-ray irradiator? Select "Not Applicable" if the modification was part of new construction or a new facility.

- ○ Less than $1,000
- ○ Between $1,000 and $5,000
- ○ Greater than $5,000 but less than $10,000
- ○ Greater than $10,000 but less than $20,000
- ○ Greater than $20,000 but less than $30,000
- ○ Greater than $30,000 but less than $40,000
- ○ Greater than $40,000 but less than $50,000
- ○ Greater than $50,000
- ○ Not applicable.

66. Have you identified total operating costs over the life expectancy of your current irradiator either cesium, X-ray or both?

- ○ Yes
- ○ No

67. What are Costs to Initiate/Operate/ Dispose of Equipment? (Please fill in the information for the type of irradiator(s) you have. If you have more than one of each type, use average values.)

68. Start Up Costs

	^{137}Cs	X-ray
Purchase Price from Vendor		
Site Preparation (Engineering/Construction)		
Installation/Setup/Commissioning/Shielding design considerations		
Transportation of Device		
Transportation Security (State & Local)		
Setup Costs (IT, Radiation Safety, Security, HR, Operations, Training, Management, Physics support)		
Initial Legal/Licensing		
GTRI Security Equipment/Installation		
Financial Bond for source disposal (does not currently exist for irradiators in most states) i.e., pay cost of disposal up front.		
Import permit for source		
Regulatory framework		

69. Annual Costs

	^{137}Cs	X-ray
Repair/Maintenance Labor		
Repair/Maintenance Parts		

Cost of using replacement device or service when a device is in repair		
Replacement parts		
Insurance		
Legal/Licensing		
Calibration (e.g., dosimetry)		
Warranty		
Annual Costs (IT, Radiation Safety, Security, HR, Operations, Training, Management, physics support and annual surveys)		
Utilities		

70. Disposal Costs

	137Cs	X-ray
GTRI Sustainability		
Device Replacement Frequency		
Import/export Fee		
Storage		
Transportation, container rental fee		
Site to Vendor disposal Fee		
Site to Orphan Source Recovery Program (OSRP) disposal Fee		
OSRP Cost (unloading device from container, de-sourcing device, loading disposal flask)		
Local Law Enforcement escort/security fees		