U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

HRTD Human Resources Training & Development

MEDICAL INSPECTIONS

Medical Inspections

Purpose

- To determine if licensed activities involving the medical use of byproduct material are being conducted in a manner that will protect the health and safety of workers, the general public, and patients.
- To determine if licensed programs are being conducted in accordance with U.S. Nuclear Regulatory Commission requirements.

References

- NUREG-1556, Volume 9: Program-Specific Guidance About Medical Use Licenses
- Manual Chapter 2800, "Materials Inspection Program"
- Inspection Procedures: 87130, 87131, 87132, 87133, 87134

Basic Inspection Process

- Preparation for all inspections (MC2800):
  - License review
  - Trip planning
  - Review Inspection and Enforcement History
  - Review event reports since last inspection

Basic Inspection Process

- Review any notes in license file regarding areas of special emphasis
- Be familiar with the types of uses and the generic requirements applicable to the licensed program.
- Prepare: The time/effort for inspection preparation should be based upon the complexity and scope of licensed activities and on the experience level of the individual inspector.

Conduct of the Inspection

- Meet with management: Entrance and Exit Meetings
- Follow up on previous items
- Obtain general overview of licensed activities
  - Organization
  - Scope of Program

Conduct of the Inspection

- Observe facilities and licensed activities
- Perform confirmatory/independent measurements
- Inspect any special license conditions

Eight Focus Elements of a Medical Inspection

1 - Security and control of licensed material

- Nuclear Medicine - packages, unit doses, Hot Lab locked when unattended
- Brachytherapy – sources locked in hot lab and/or sealed source storage safe
- HDR, gamma knife, teletherapy - room access

Eight Focus Elements of a Medical Inspection

2 - Shielding of licensed materials

- L-blocks, syringe shields, etc.
- Lead “safes” for brachytherapy sources
- Room shielding (HDR, teletherapy, gamma knife suites)
- Unit shielding (HDR, teletherapy, gamma knife units)
- Portable shielding (bedside shields)
- Source carriers

Eight Focus Elements of a Medical Inspection

3 - Comprehensive safety measures

- package integrity
- fire safety
- ventilation
- protection from elements
- special interlocks (shared rooms)

Eight Focus Elements of a Medical Inspection

4 - Radiation dosimetry program

- Whole-body dosimeters
- Ring dosimeters
- Direct-reading dosimeters - nurses

Eight Focus Elements of a Medical Inspection

5 - Radiation instrumentation and surveys

- Nuc Med, Brachy: portable survey instruments
- Nuc Med: swipe counting equipment
- Brachy, Gamma Knife: room monitors

Eight Focus Elements of a Medical Inspection

6 - Radiation safety training & practices

- Initial training
- Annual re-fresher training
- Dry runs on emergency procedures
- Empowered to implement the radiation safety program.

Eight Focus Elements of a Medical Inspection

7 - Management Oversight

- Representatives attend RSC meetings
- Provide financial support for the program
- Conduct audits/reviews of the program (at least annually)
- RSO has sufficient authority to halt unsafe activities
- Interview authorized users, RSC members, facility management representatives

Eight Focus Elements of a Medical Inspection

(8) - New or emerging technologies (extra bonus focus element)

Examples: Seeds Used for Localization of Non-Palpable Lesions, Leksell Gamma Knife® Perfexion™, NeoVista Epi-Rad90 TM Epiretinal Ophthalmic System

- **Review radiation safety practices for these uses**
- **Ensure that the licensee has been approved for such uses.**

Neo Vista Epi-Rad90

The Epi-Rad system handpiece. The surgeon lowers a small strand of Strontium-90 into the tip after insertion into the eye. The brief exposure damages diseased cells preferentially.

Leksell Gamma Knife®
Perfexion™

Unsealed Byproduct Material
10 CFR 35.100-200

- Commonly known as Diagnostic Studies
- Radioactive material use that does not require a written directive

Unsealed Byproduct Material
10 CFR 35.100-200

Hazard Analysis

- **Main Radionuclides**
  - Technetium-99m (“work horse”) (Tc-99m)
  - Thallium-201 (Tl-201)
  - Flourine-18 (F-18)
  - Indium-111 (In-111)
  - Iodine-123 (I-123)
  - Xenon-133 (Xe-133)

Unsealed Byproduct Material
10 CFR 35.100-200

- Relative Hazard - Low
  - Radionuclides have short half-lives (few hours to few days)
  - The material is typically handled in unit dosage quantities (~100 microcuries for I-123 to 20-30 millicurie range for Tc-99m)
  - Unit dosage administrations are not likely to exceed dose thresholds for "medical event" as defined in 10 CFR Part 35 (i.e., 5 rem EDE, 50 rem to organ/tissue or 50 rem SDE to skin)

Unsealed Byproduct Material
10 CFR 35.100-200

- The hazards to workers are minimal, provided shielding is used (syringe and vial shields)
- Spill clean up typically results in minimal doses
- Loss of a unit dosage quantity is not likely to pose a significant radiological hazard to members of the public given the short half-life (provided that the syringe/container is adequately shielded).

Cardiac Stress Test

Xenon Ventilation Study

Tc-99m - Shielding

Positron Emission Tomography (PET) - Shielding

PET Scanning Unit

Unsealed Byproduct Material
10 CFR 35.100-200

- Increased hazard: Some radionuclides can be dispensed in large quantities (Tc-99m, about 200 millicuries and F-18, about 5-10 curies).
  - If Tc-99m is mis-handled, it could result in doses that exceed the dose thresholds for a medical event if enough radioactivity is administered
  - Workers must handle large quantity of material with shields (with lids, if applicable!)

Unsealed Byproduct Material
10 CFR 35.100-200

- Spills of bulk quantities could have higher dose consequences to workers, but are still not likely to be significant
- Losses of large quantities could result in significant radiological hazards to members of the public

Unsealed Byproduct Material
10 CFR 35.100-200

- **Increased Hazard: Use of Mo-99/Tc-99m generators**
  - **Contain 1-20 curies**
  - **Can result in unnecessary worker doses (extremities) if not properly shielded, used, and stored.**
  - **Elutions contain significant quantities of Tc-99m (1 or more curies!)**
  - **Significant doses from dropped/spilled elution vials; usually secure the area and wait 24 hours to clean up (~4 half lives = 1/16th of activity).**
  - **Tests on eluted material to ensure that there is no significant Mo-99 breakthrough**

Isotope Generators

Unsealed Byproduct Material
10 CFR 35.100-200

- What to observe during a diagnostic nuclear medicine inspection using unit dosages:
  - Use of syringe shields to minimize occupational dose
  - Use of monitoring devices and protective clothing
  - Package receipt and return surveys
  - Verification of patient ID before dosage administration

Unsealed Byproduct Material
10 CFR 35.100-200

- Proper control of materials (e.g., material in locked hot lab when unattended, waste in locked storage, radioactive waste only in designated receptacles, return packages handled only by properly identified pharmacy staff)

- Sufficient number of appropriate, calibrated radiation survey & detection instruments (e.g., batteries work, respond appropriately to radiation as compared to inspector's instrument, calibrated at the required frequency by authorized persons)

Unsealed Byproduct Material
10 CFR 35.100-200

- Proper technique to minimize likelihood of spills and staff knowledgeable of proper spill response
- Surveys are conducted in accordance with 10 CFR 20.1501 and 10 CFR 35.70 (as applicable)

Unsealed Byproduct Material
10 CFR 35.100-200

- ensure that the RSO exercises proper oversight of the program and has the authority to do so (i.e., management support); and
- ensure that the program is reviewed at least once each year for content and implementation

Unsealed Byproduct Material
10 CFR 35.100-200

- Dose calibrator calibration in accordance with nationally recognized standards or the manufacturer's instructions (e.g. daily constancy, quarterly linearity over the range of activities used, annual accuracy over the range of energies administered, and initial geometrical variance for all configurations used).

Unsealed Byproduct Material 10 CFR 30.300

- Written Directive Required
- Large quantities of radioactive material used
- Fewer administrations than 10 CFR 35.100 and 200 activities

Unsealed Byproduct Material
10 CFR 30.300

- **Written directive:**

- **A document(s) that must be generated prior to an administration if an authorized user wants administer iodine-131 greater than 30 microcuries or any therapeutic dose of unsealed byproduct material.**

Unsealed Byproduct Material
10 CFR 35.300

Hazard Analysis

- Some Radionuclides
  - Iodine-131 (I-131) (thyroid diseases)
  - Phosphorus-32 (P-32) (rare use, for bone marrow, and cavity cysts/tumors)
  - Strontium-89 (Sr-89) (bone pain)
  - Samarium-153 (Sm-153) (bone pain)
- Relative Hazard - High

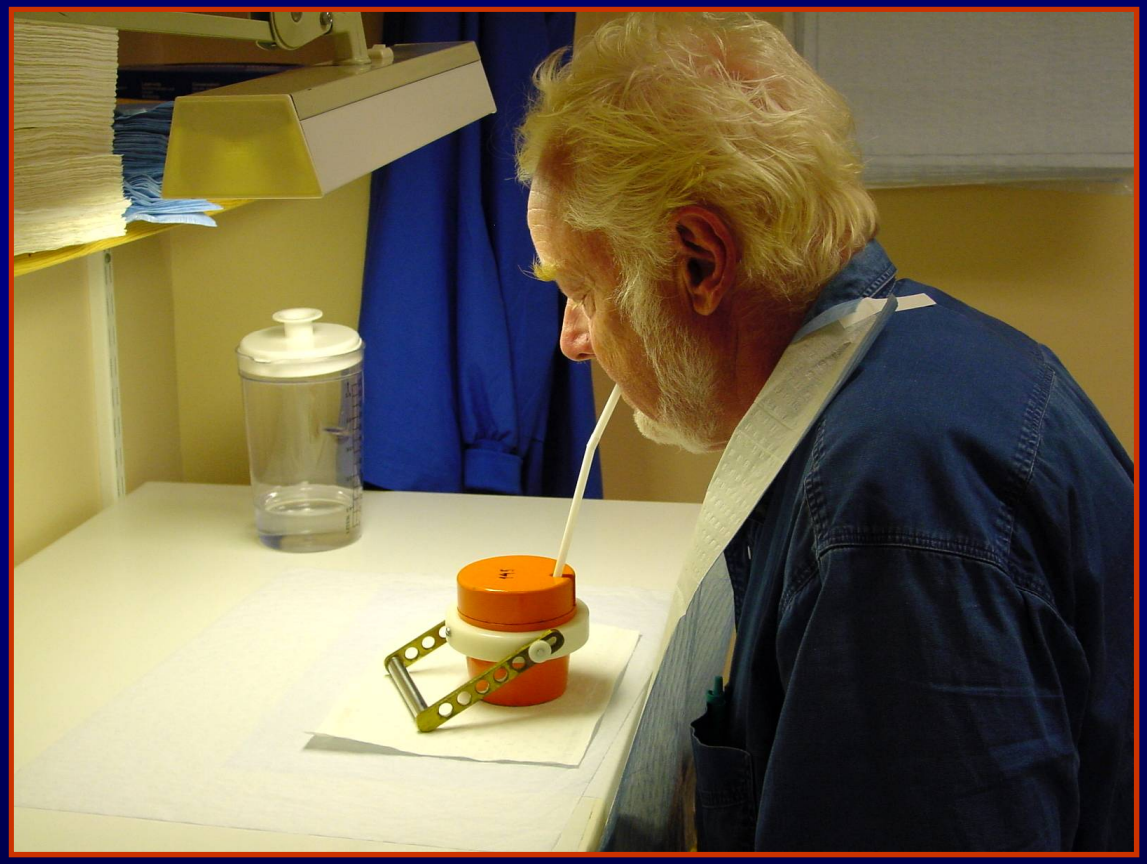
Unsealed Byproduct Material
10 CFR 35.300

- Radionuclide half-lives of days to weeks; and are intended to deliver high doses/dose rates with a high specific activity. Single dosages can include hundreds of millicuries.
- The dose thresholds for "medical event" can be easily exceeded due to errors.
- Spill clean up could result in significantly higher doses, especially from intakes of volatile materials.
- Loss of a unit dosage quantity can pose a radiological hazard to members of the public.

Unsealed Byproduct Material
10 CFR 35.300

- Inspection guidance for therapeutic nuclear medicine is the same as diagnostic activities, plus:
  - Selected written directives contain the required information (patient name, nuclide, form, amount, AU sign and dated)
  - Staff understands the procedures for administering radiopharmaceuticals requiring a written directive (verifying patient identification, verifying that the dosage is administered in accordance with the written directive)

Thyroid Ablation



Unsealed Byproduct Material
10 CFR 35.300

- Patients are released under 10 CFR 35.75 (calculations and methodologies)
- Staff who care for patients hospitalized under 10 CFR 35.75 are properly trained (e.g., patient and visitor control, contamination control, waste control, medical emergency/death response).
- Patients hospitalized under 10 CFR 35.75 are provided with private facilities
- Waste generated by patients hospitalized under 10 CFR 35.75 is handled as radwaste

Unsealed Byproduct Material
10 CFR 35.300

- Licensee assessment of internal dose:
  - Bioassays are performed at the appropriate frequency
  - Bioassay results are compared to established and appropriate administrative action levels.
  - Action plans are available and implemented if administrative action levels are exceeded.

Unsealed Byproduct Material
10 CFR 35.300

- Proper radioactive waste storage:
  - Packaged, labeled, and contained
  - Licensee maintains radioactive waste inventory.
  - Secure storage area.

Manual Brachytherapy
10 CFR 35.400

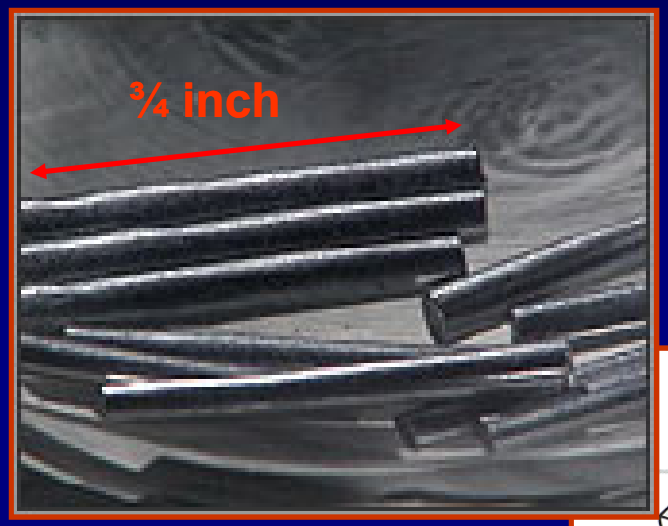
- Sealed sources using high activity to treat cancer
- Complicated Treatment Planning – take your time inspecting

Manual Brachytherapy
10 CFR 35.400

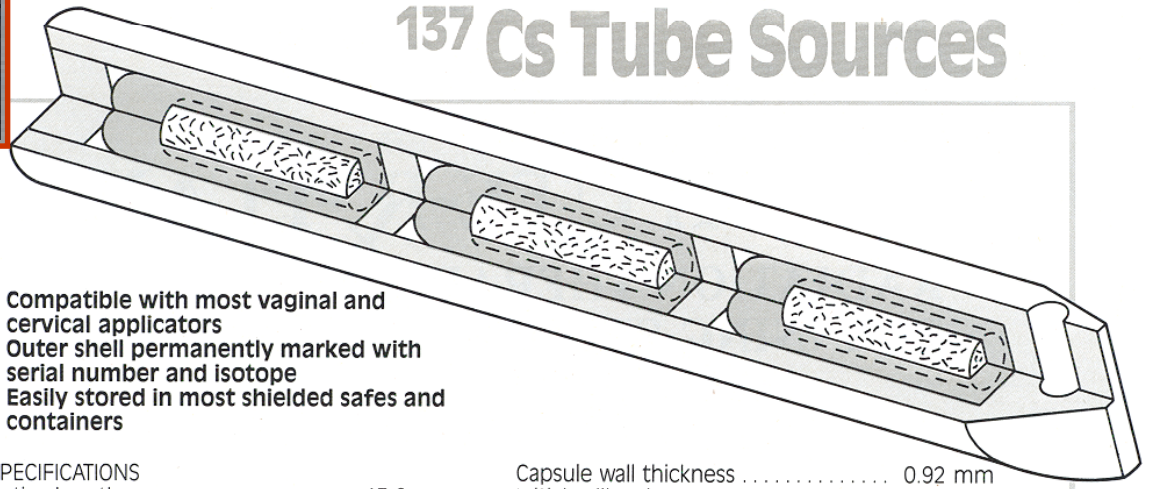
Hazard Analysis

- **Modalities:**
  - **Manually Afterloaded Brachytherapy**
    - **Cesium-137 (Cs-137) "tube" sources**
    - **Iridium-192 (Ir-192) seeds in nylon ribbon**
    - **Paladium-103 (Pd-103) seeds**
    - **Iodine-125 (I-125) seeds**
  - **Remotely Afterloaded Brachytherapy (10 CFR 35.600)**
    - **Ir-192 (HDR)**

Low Dose Rate Source



^{137}Cs Tube Sources

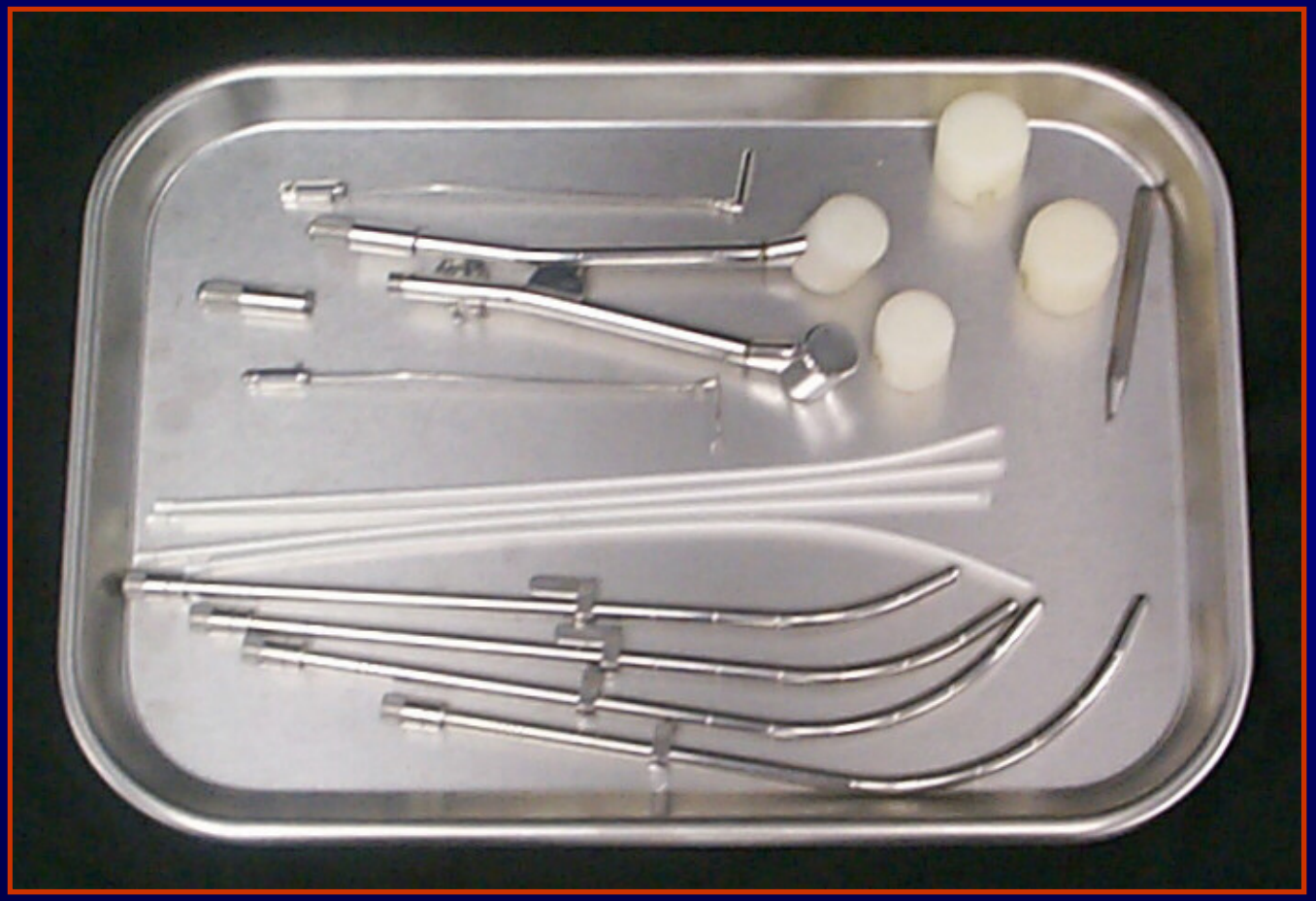


- Compatible with most vaginal and cervical applicators
- Outer shell permanently marked with serial number and isotope
- Easily stored in most shielded safes and containers

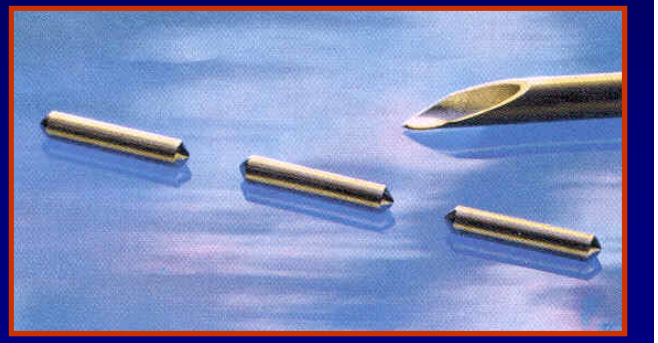
SPECIFICATIONS

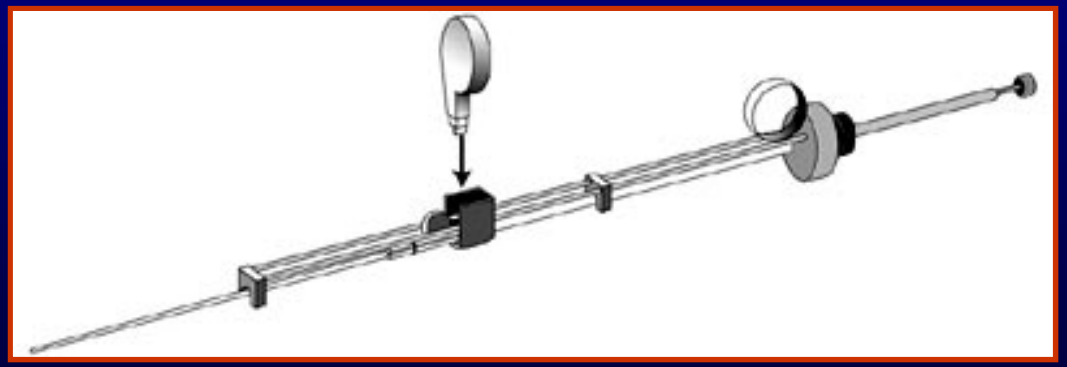
Active length	15.6 mm	Capsule wall thickness	0.92 mm
Active diameter	0.8 mm	Initial calibration accuracy	±2.0%
Total length	20.3 mm	Linear activity uniformity	2.0% dev.
Total diameter	2.65 mm	Maximum Non-Removable contamination	$<5\times10^{-9}$ Ci

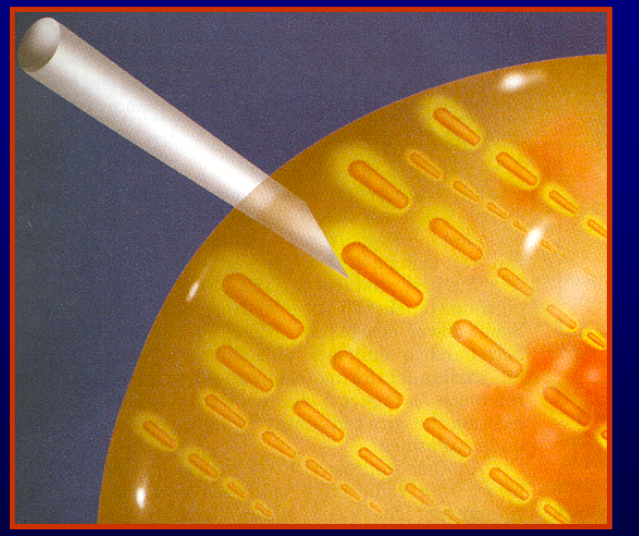
Applicators



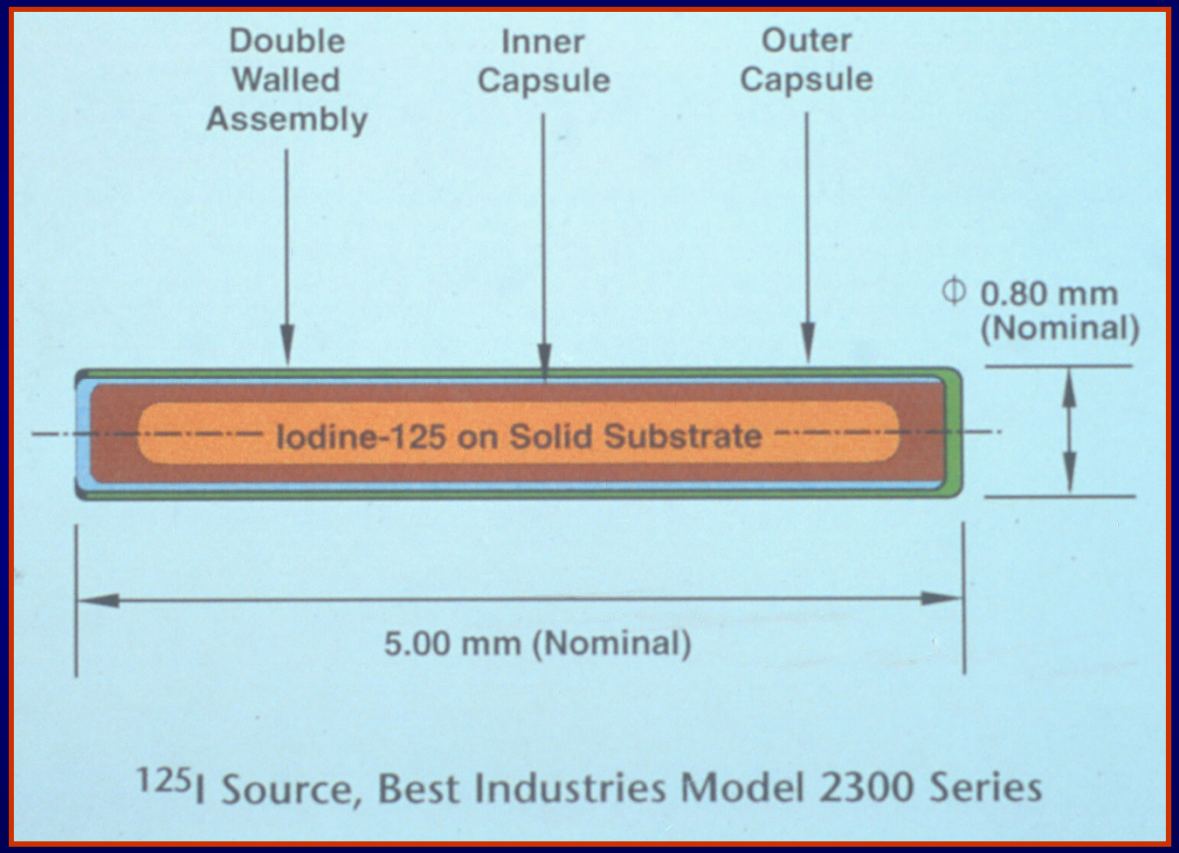
Seeds





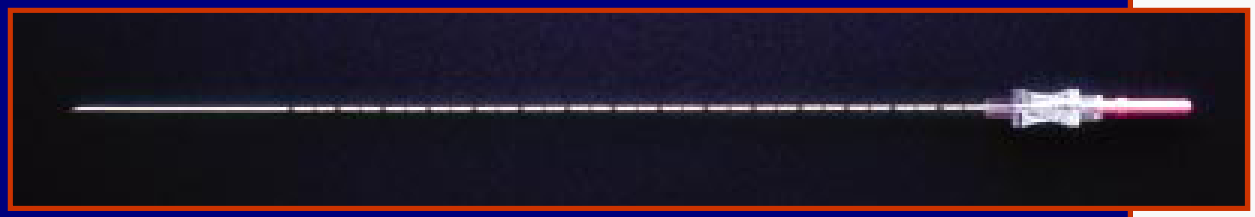


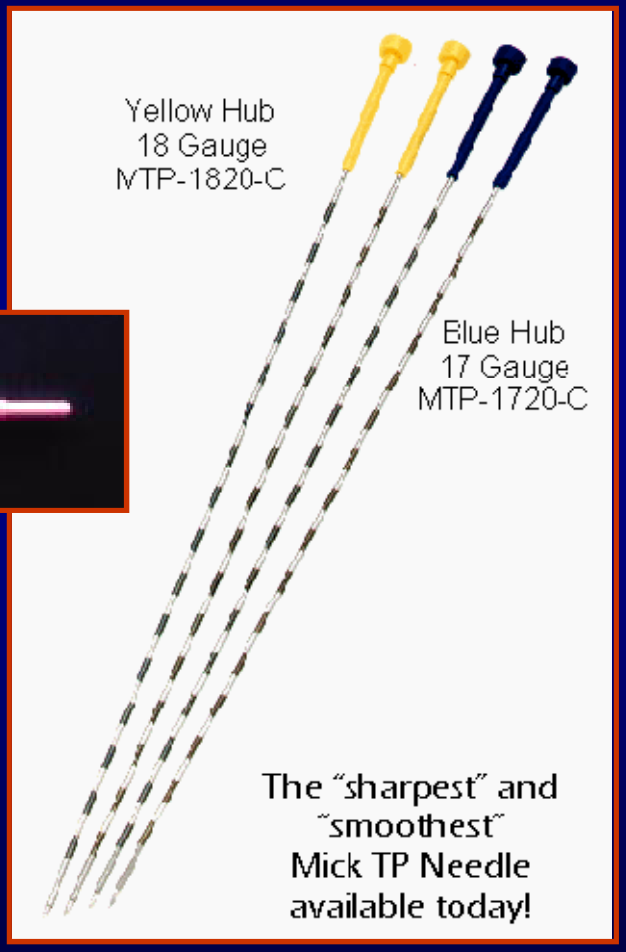
I-125 Seed



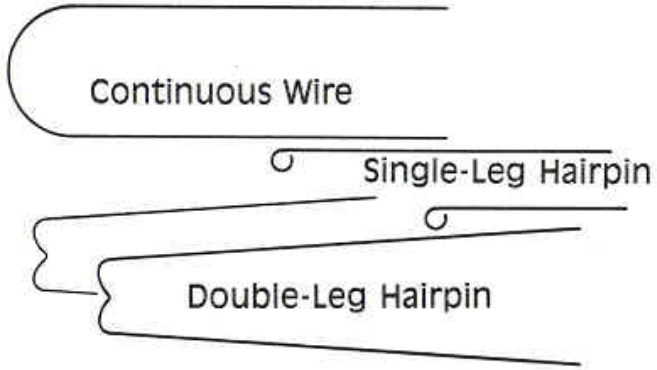
Small seeds can be crushed or broken

Needles




Yellow Hub
18 Gauge
MTP-1820-C
Blue Hub
17 Gauge
MTP-1720-C
The "sharpest" and
"smoothest"
Mick TP Needle
available today!

Wires

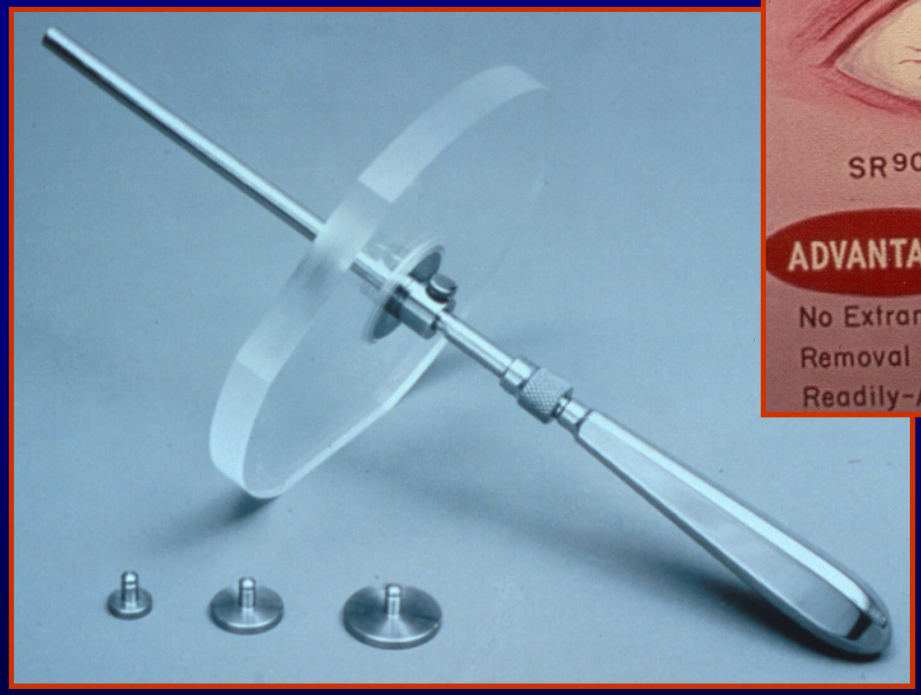


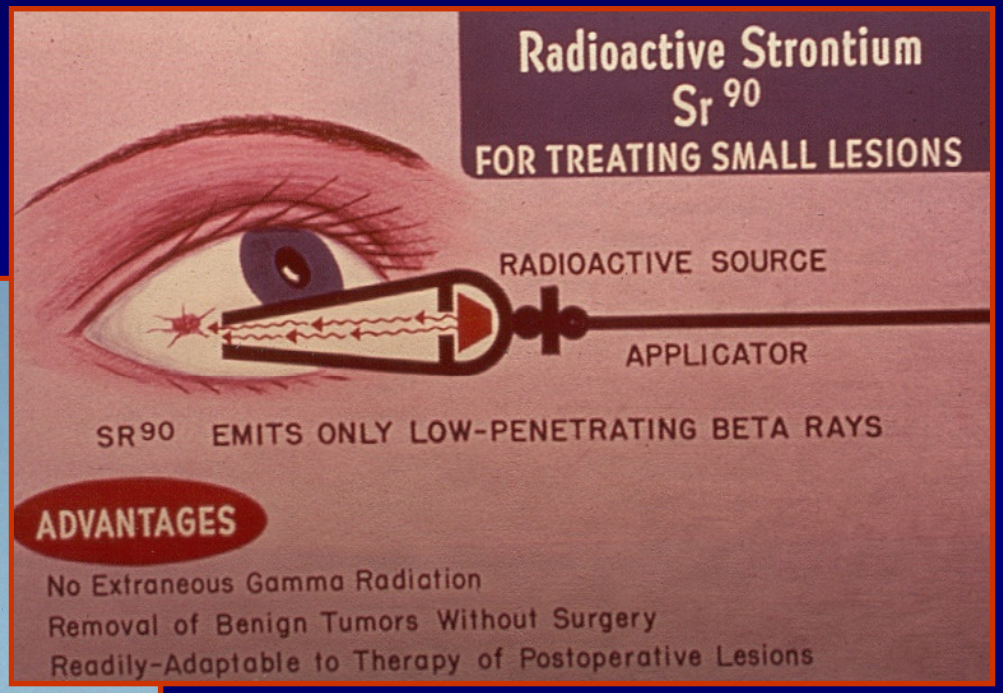
192 Iridium Wires

- Uniform quality with reliable calibration
- Usable throughout entire active life
- Individually packaged in lead shielded containers
- Compatible with *all* currently used interstitial implant accessories

Not commonly used in current treatment programs

Strontium-90 Beta Eye Applicator





Strontium-90 Beta Eye Applicator

Verify licensee possesses and uses a certificate of calibration, or data from manufacturer-supplied source identification plate

Certificates of calibration supplied by manufacturer/vendor or calibration laboratory with established traceability to the NIST for performing Sr-90 ophthalmic applicator calibrations

Strontium-90 Beta Eye Applicator

Certificate of calibration or source identification plate, must match, by source serial number, the source for which its data are being used.

Determine if source output (dose rate) is being properly corrected for source decay (T1/2 is 29.1 years).

Strontium-90 Beta Eye Applicator

Sample records of exposure times to verify that the calculated administered doses correspond to the prescribed doses.

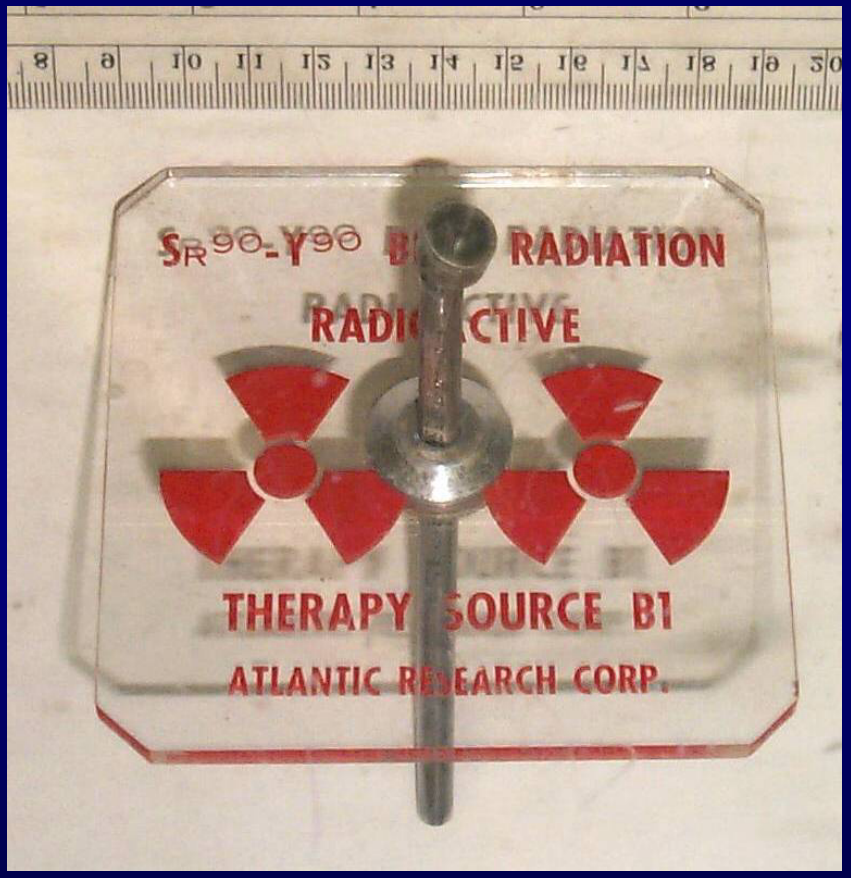
Verify leak tests at intervals not exceeding 6 months or other approved intervals

Survey source storage area

Sr-90 Eye Applicator
Typical Storage Boxes

Sr-90 Eye Applicator in Storage Box

Sr-90 Eye Applicator



(reversed for legibility)

Manual Brachytherapy
10 CFR 35.400

- Hazards - High.
  - Half-lives of days to years; intended to deliver relatively high doses in a short time with a small source. Single sources can range from microcuries (Pd-103 & I-125) to curies (Ir-192 HDR).
  - Medical events (10 CFR 35.2) can occur if the sources are mispositioned and/or applied for too long or short of a time

Manual Brachytherapy
10 CFR 35.400

- The hazards to workers are dependent on the source/device.
  - For single sources, workers must use forceps during handling. Sources should only be handled behind shielding.
  - For HDR devices, the hazards to workers are greatly reduced, provided that the devices function properly and they are used as designed.

Manual Brachytherapy
10 CFR 35.400

- Key concerns with individual sources is control:
  - small size, especially Pd and I seeds
  - dose rates vary - most individual seeds are <1 millirem/hour at one meter, but some sources generate a few millirem per hour at one meter - in comparison, a new HDR source can generate more than 5 R/hr at one meter

Manual Brachytherapy
10 CFR 35.400

- Inspection guidance for sealed source implant therapy:
  - Selected written directives contain the required information

Manual Brachytherapy
10 CFR 35.400

- Staff understands the procedures for administering sealed source implant therapy
  - verifying patient identification
  - verifying that the administration is in accordance with the treatment plan/written directive (e.g., for cesium-137 implants, how do the staff verify the loading sequence of sources?)

Manual Brachytherapy
10 CFR 35.400

- checking both manual and computer-generated dose calculations
- verifying that any computer-generated dose calculations are correctly transferred into the consoles of therapeutic medical units (e.g., HDR)

- Patients are released in accordance with 10 CFR 35.75 and that associated calculations and methodologies are reasonable (e.g., permanent implants)

Manual Brachytherapy
10 CFR 35.400

- Patient care staff who attend to patients hospitalized in accordance with 10 CFR 35.75 are properly trained (e.g., size and appearance of sources, safe handling and shielding of sources, patient and visitor control, and medical emergency/death response) (Review responses to such emergencies)
- Verify source inventory for individual sources and the radiation levels in and adjacent to the source storage room
- Verify access control to source storage room
- Verify that sources are calibrated

Manual Brachytherapy
10 CFR 35.400

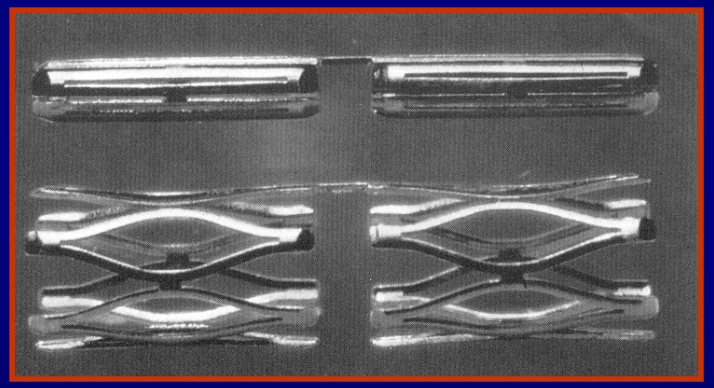
- **Survey instruments:**
  - **Should be adequate for the types of radiation involved**
  - **Should be operational (i.e., it passes the battery check and it responds appropriately to radiation (compared to inspector's instrument)**
  - **Should be calibrated as required**

Manual Brachytherapy
10 CFR 35.400

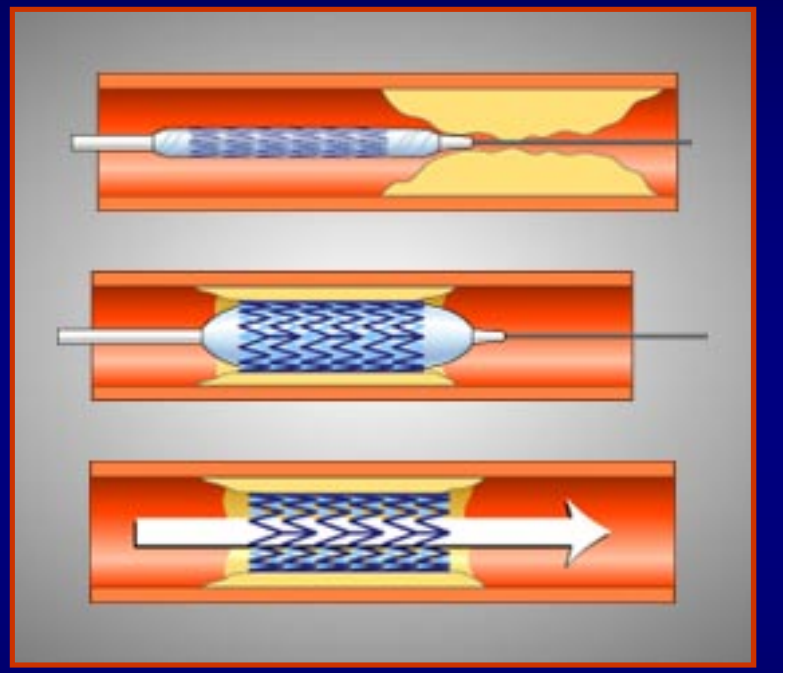
- **Waste disposal:**
  - **Sources are transferred to an authorized person**
  - **Source exchanges are conducted by authorized persons**
  - **Sources are properly prepared for shipment**

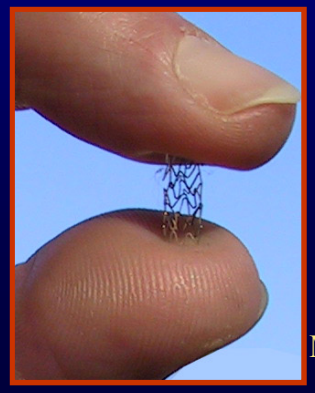
Stents Using Beta Radiation

Before Expansion



After Expansion





Manual Brachytherapy
10 CFR 35.400

- Evaluate how the staff would respond to emergency situations (e.g., patient medical emergency during treatment, source retraction failure, treatment interruption)
- Review previous response to emergencies

- Determine if the RSC is involved with sealed source implant therapy (e.g., events, audits)

Sealed Sources for Diagnosis 10 CFR 35.500

- Not common in today's medical institutions
- Replaced by X-ray units capable of similar measurements

Sealed Sources for Diagnosis
10 CFR 35.500

I-125 for a
"quick x-ray"

Gd-153 for
bone mineral density
study (osteoporosis)

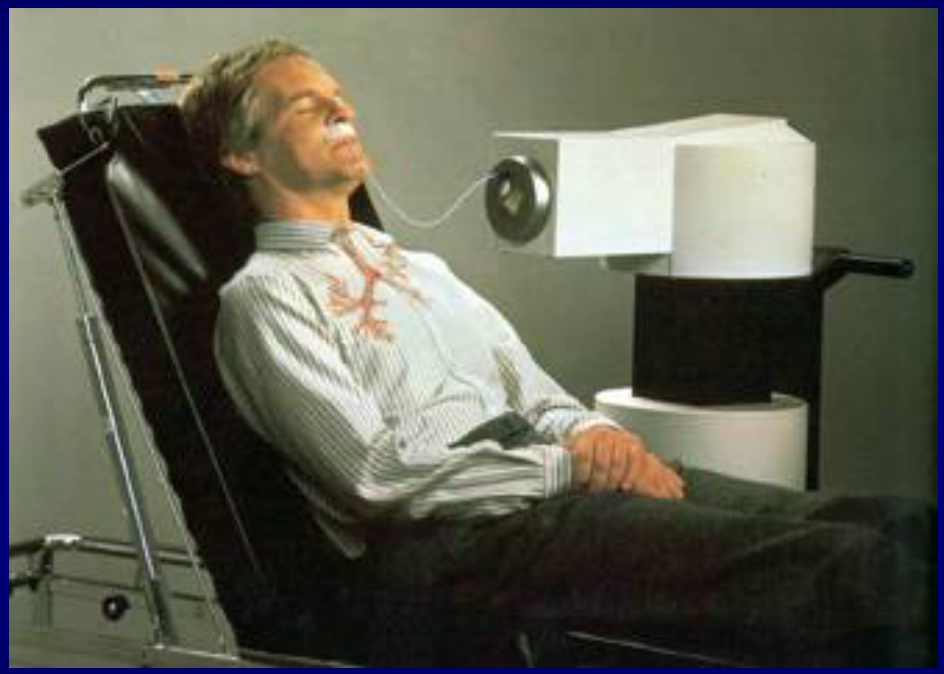
Photon Emitting Units
10 CFR 35.600

- Consists of:
  - Remote Afterloader Units (HDR's)
  - Gamma Stereotactic Radiosurgery units (Gamma Knife)
  - Teletherapy Units

Photon Emitting Units
10 CFR 35.600

- For HDR:
  - Review device safety checks, including response to failed checks (e.g., interlock failure, emergency stop failure, radiation monitor failure)
  - Review previous response to failed operability checks
  - Verify that device maintenance and service is conducted by authorized persons

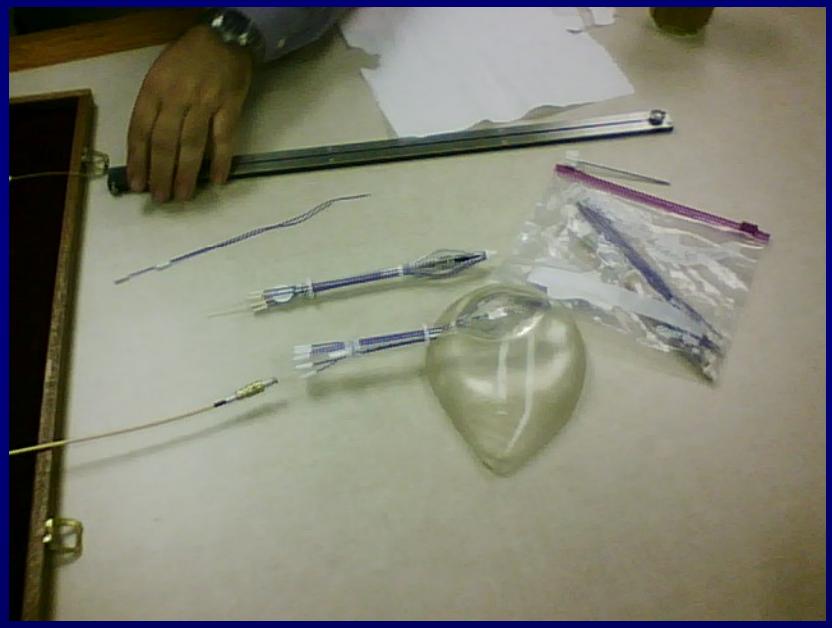
High Dose Remote Afterloading (HDR)



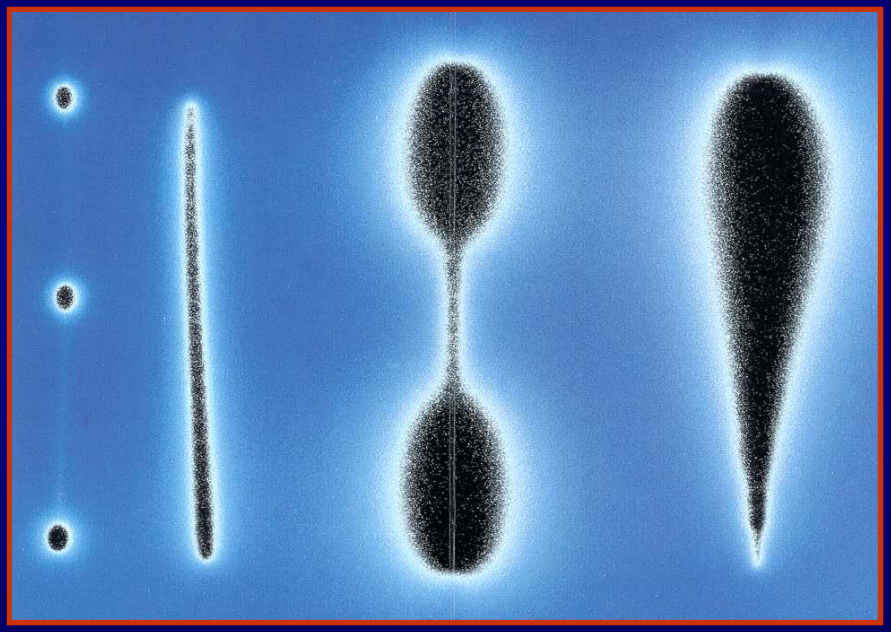
Source travels from unit, through catheter (plastic guide tube) into patient

HDR Source

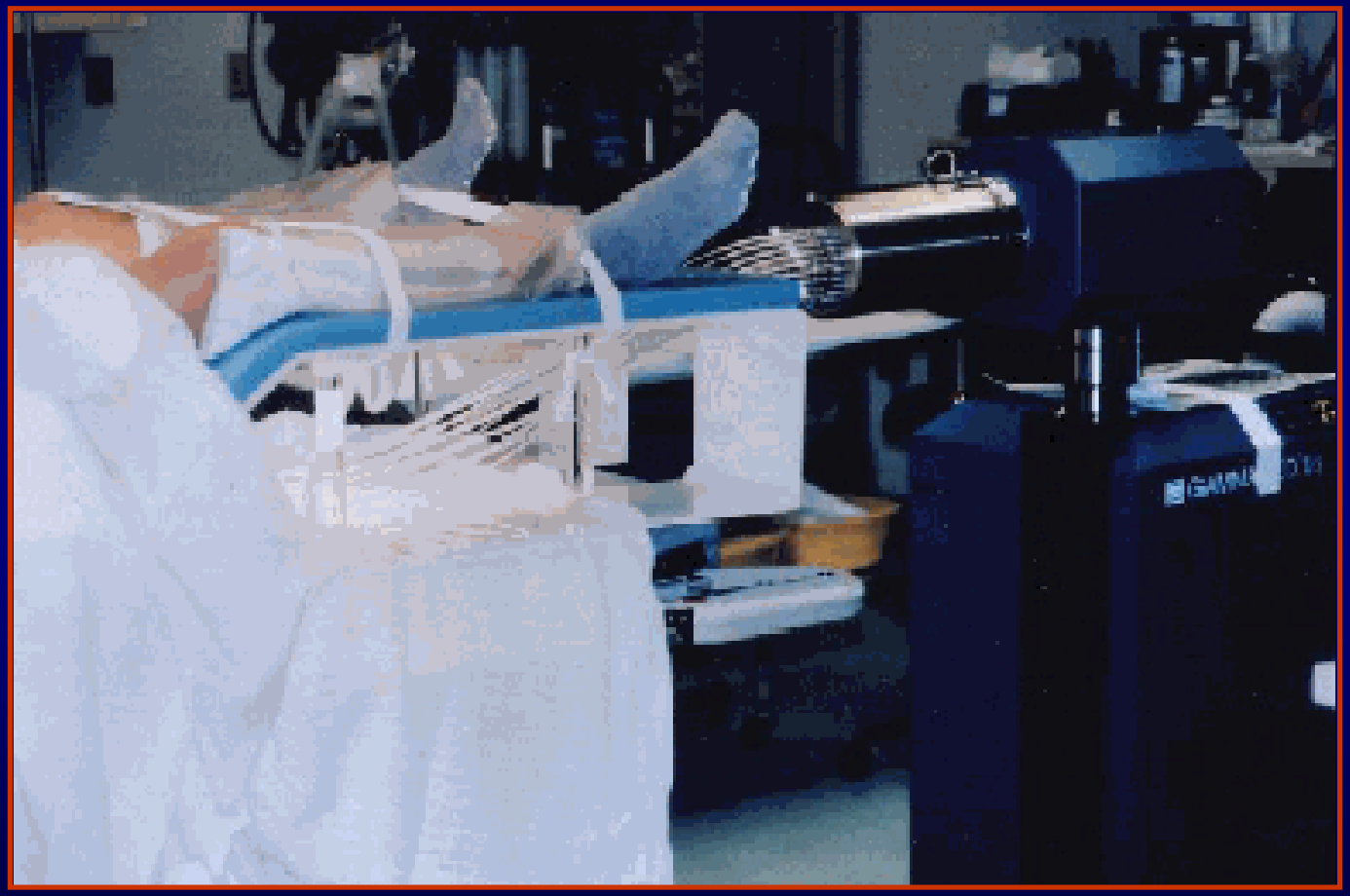
Breast Applicator



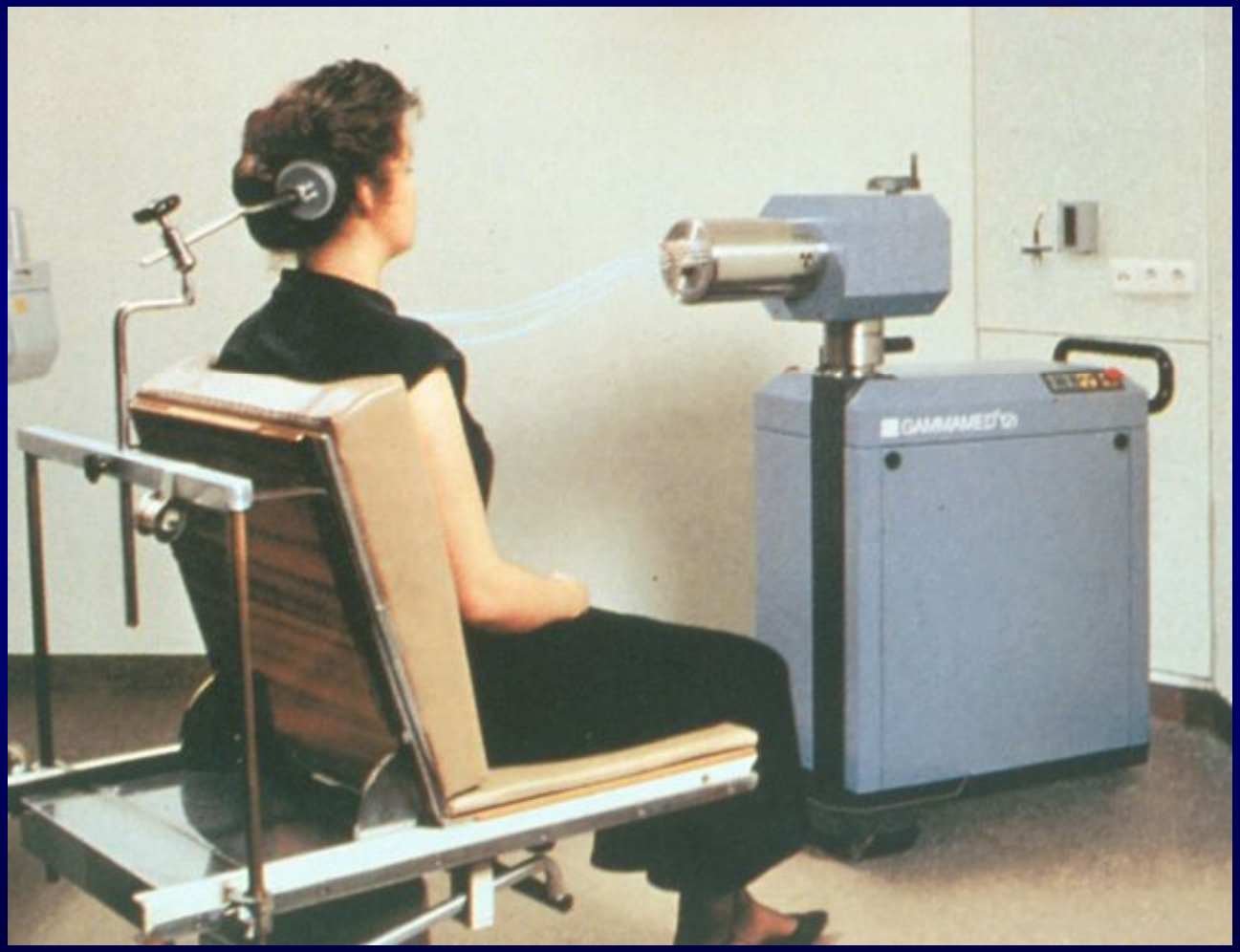
Effect of Different Dwell Times



Prostate HDR



HDR Breast Treatment



HDR Video Clip

- http://www.cancercenter.com/video/treatments-technology/radiation-therapy/brachytherapy

High Dose Remote Afterloading (HDR)

- Patient release surveys
- Observe spot checks

High Dose Remote Afterloading (HDR)

- Written directives
- Associated procedures
- Review selected patient cases including, as applicable, simulation images, treatment planning records (e.g., is dose curves), and pre- and post-treatment HDR unit printouts to compare planned and implemented treatment actions

High Dose Remote Afterloading (HDR)

- 10 CFR 35.41: Verify that any computer-generated dose calculations are correctly transferred into the consoles of therapeutic medical units authorized by 10 CFR 35.600

High Dose Remote Afterloading (HDR)

- Observe the licensee conduct or demonstrate how treatment planning and administration is conducted
- What is done to verify that the treatment is in accordance with the written directive/treatment plan before administration?

High Dose Remote Afterloading (HDR)

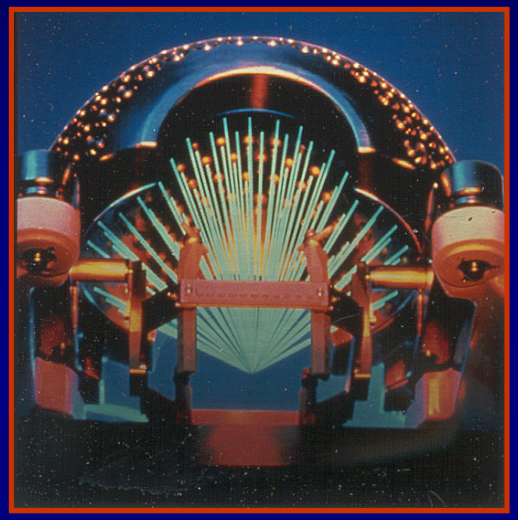
- What is done to verify that the administered treatment was in accordance with the written directive/treatment plan?

Photon Emitting Units
10 CFR 35.600

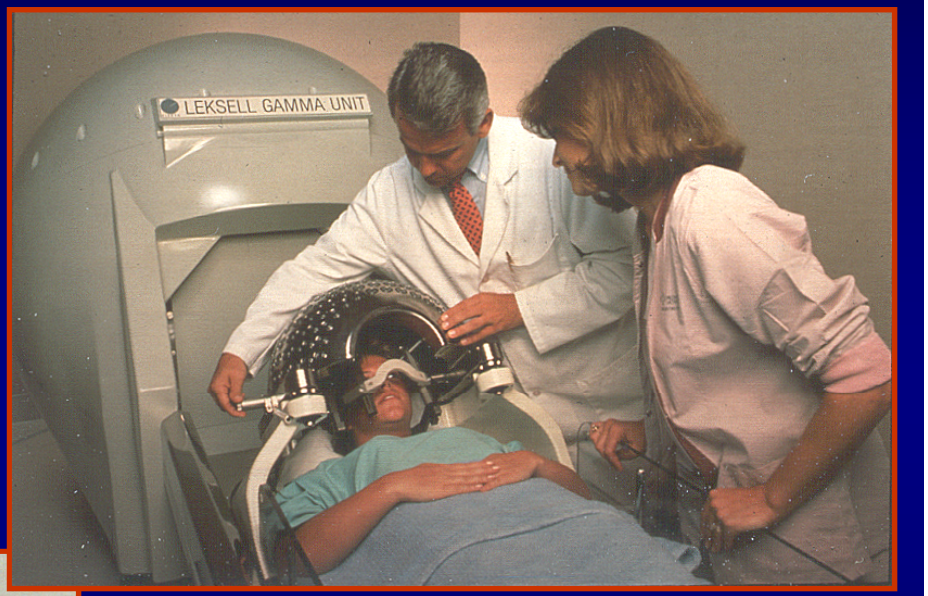
Hazard Analysis

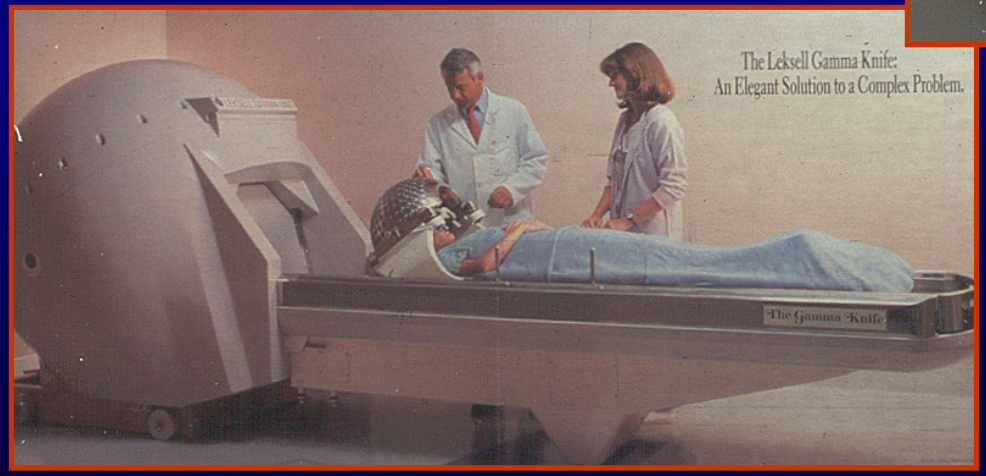
- **Modality**
  - **Gamma Stereotactic Radiosurgery (e.g. Gamma Knife)**
    - **~201 cobalt-60 sources in a hemispherical array, intersect to create a very high dose rate to a small volume, and the dose rate is significantly reduced outside of the small volume**

Gamma Stereotactic Radiosurgery



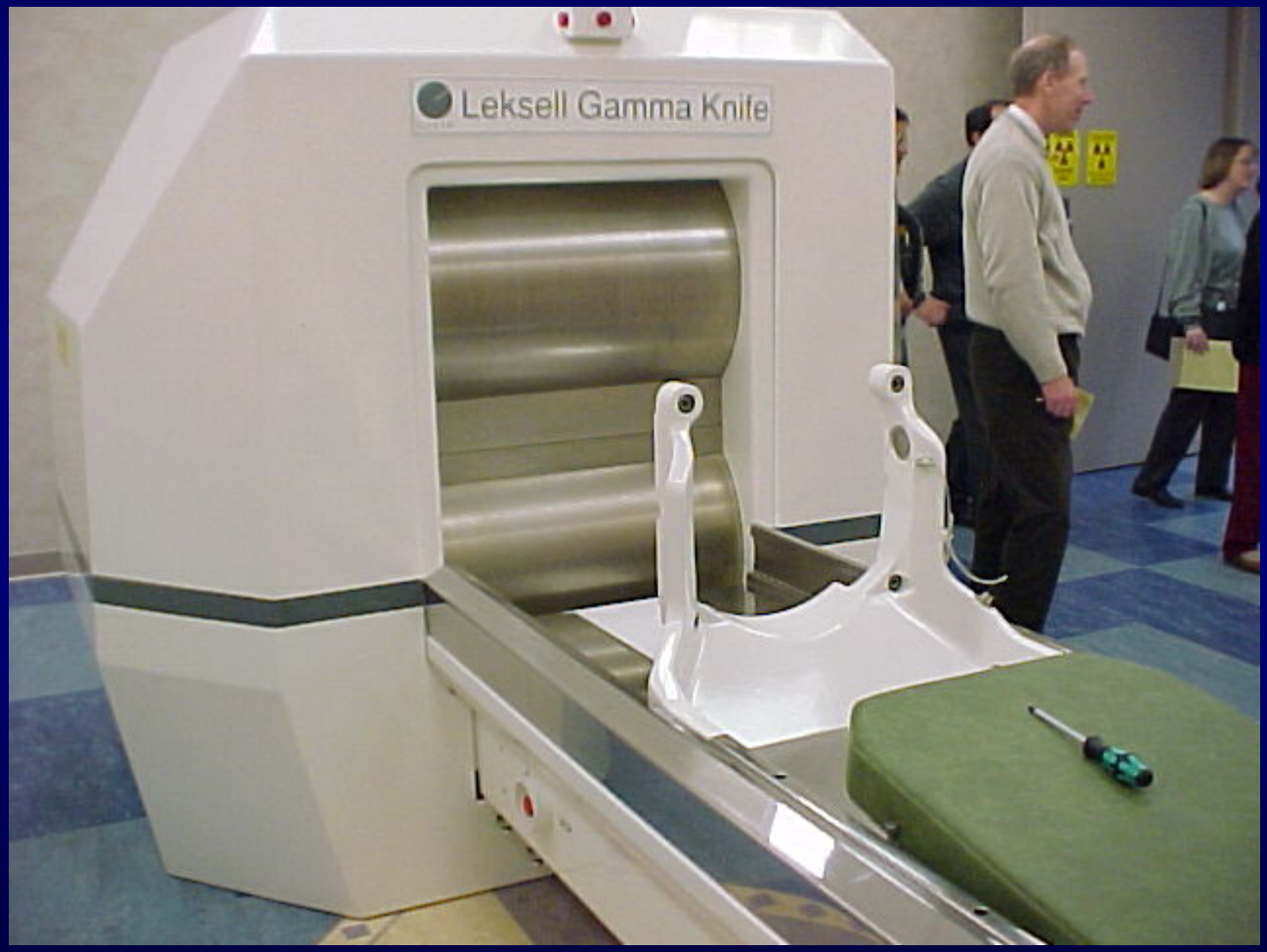
201 Co-60 sources about 33 Curies each





Gamma Knife

Gamma Knife



Gamma Knife

Gamma Knife Head Set

Gamma Knife Video

- www.radonc.jhmi.edu/radiosurgery/gammaknife/Gamma_Knife_Surgery_dsl.mov

Gamma Knife

Photon Emitting Units
10 CFR 35.600

- Patient positioned on a couch and the treatment site is positioned in the small volume (i.e., the patient moves rather than the sources)
- Treatment parameters include coordinates (x,y,z), gamma angle (tilt of head), helmet size, and time
- Frame fixed to patient's head (screws into skull), and images (CT and MRI) are taken for treatment planning

Photon Emitting Units
10 CFR 35.600

- Hazards - Low
  - The sources are fixed in device. Loss is not a credible concern
  - The dose to workers is minimal because they are not exposed to unshielded sources. The typical ambient dose rate in the treatment room is <0.5 mrem/hour, and there are no staff in the room during treatment
  - There is no real potential for public dose

Photon Emitting Units
10 CFR 35.600

- The main concern is medical events. Previous medical events involved:
  - using wrong treatment plan
  - wrong treatment site (e.g., transposing coordinates)
  - not verifying treatment time
- There is a small margin for error with GSR (e.g., treatment time and patient position accuracy), so focus on verification of treatment time and patient position accuracy

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- Inspection guidance for gamma stereotactic radiosurgery:
  - Selected written directives contain the required information
  - Staff understands the procedures for administering gamma stereotactic radiosurgery
    - verifying patient identification

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- verifying that the administration is in accordance with the treatment plan/written directive (e.g., verifying that the coordinates, gamma angle, helmet size, and treatment time are accurate for each “shot”)
- checking both manual and computer-generated dose calculations
- verifying that any computer-generated dose calculations are correctly transferred into the consoles of therapeutic medical units

Photon Emitting Units
10 CFR 35.600

Things to Consider:

- **Is GSR X, Y, and Z hardware labeled properly?**
- **Is fiducial box properly positioned on the stereotactic frame prior to imaging?**
- **Is fiducial box marked legibly**

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- Did licensee verify that configuration files were not corrupted by following service?
- Does licensee prevent equipment interference?

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35.615 Safety precautions

A licensee shall control access to the treatment room by a door at each entrance.

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35.615 Safety precautions

Use appropriate radiation monitors when entering the treatment room to assure that radiation levels have returned to ambient levels.

Use viewing and intercom systems to permit continuous observation of patient patient

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35.615 Safety precautions

For GSR, must have an authorized user and an authorized medical physicist to be physically present throughout all patient treatments.

Notify RSO and an authorized user as ASAP if patient has a medical emergency or dies.

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35.615 Safety precautions

Shall have applicable emergency response equipment available near each treatment room to respond to a source remaining in the unshielded position;

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10 CFR 35.600

35.645 Spot-checks for GSR

Must be done monthly; before the first use of the unit on a given day; and after each source installation.

Assure proper operation of –

Treatment table retraction mechanism, using backup battery power or hydraulic backups with the unit off;

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10 CFR 35.600

35.645 Spot-checks for GSR

- **Electrical interlocks at each room entrance;**
- **Source exposure indicator lights on the GSR unit, the control console, and in the facility;**
- **Viewing and intercom systems;**

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35.645 Spot-checks for GSR

- **Timer termination;**
- **Radiation monitors used to indicate room exposures; and**
- **Emergency off buttons.**

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10 CFR 35.600

- Review licensee response to failed checks (e.g., interlock failure, emergency stop failure, radiation monitor failure)
- Review previous response to equipment malfunctions (potential medical event, overexposure)
- Review treatments that did not go according to plan (potential medical event, overexposure)

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Survey instruments:

- **Should be adequate for the type of radiation**
- **Should be operational**
- **Should be calibrated as required (annually)**

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Servicing the unit:

- **If the next source exchange is scheduled, discuss it with licensee and regional management for the opportunity to conduct a special inspection.**
- **Verify if the source exchange and device maintenance are conducted by authorized persons.**

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- Verify that the sources transferred to an authorized person
- Verify that sources properly prepared for shipment

Photon Emitting Units
10 CFR 35.600

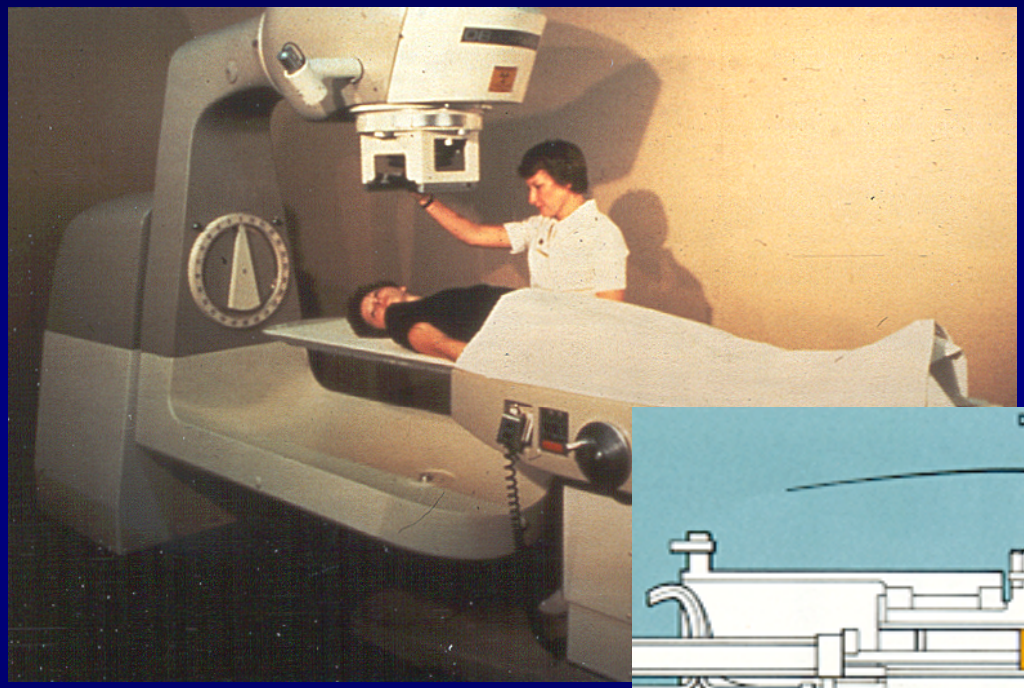
- Evaluate how the staff would respond to emergency situations (e.g., patient medical emergency during treatment, source shielding failure, treatment interruption)
- Review previous response to emergencies
- Verify that the sources are calibrated

Teletherapy

Teletherapy Modality (Few Remain)

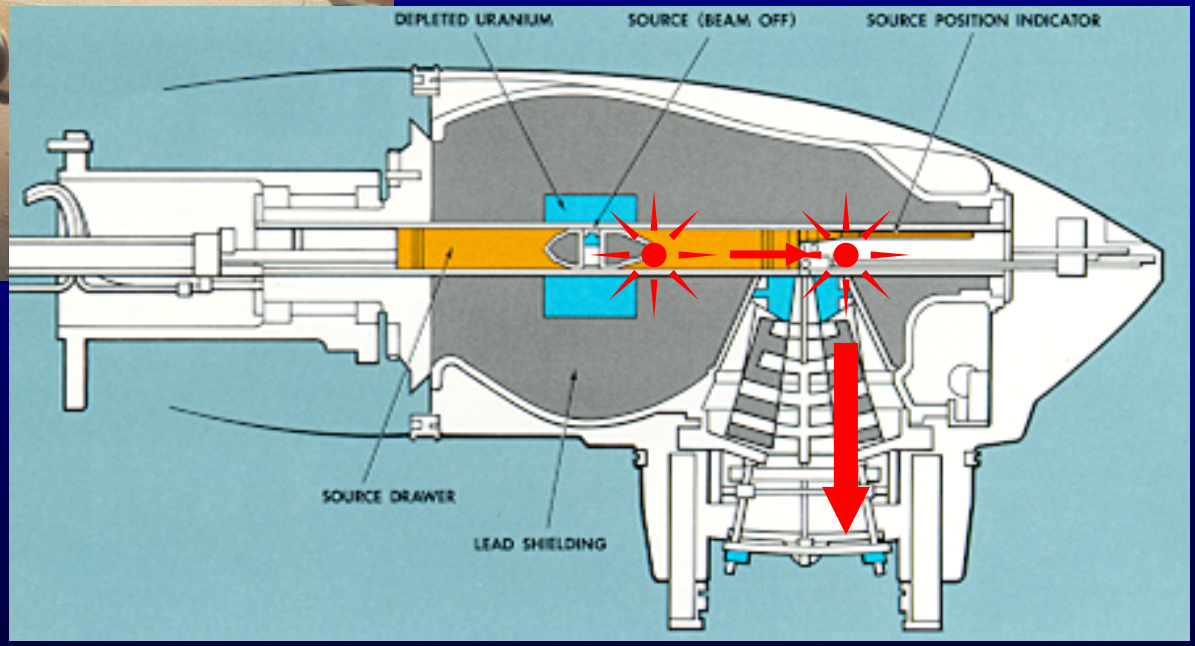
- 1 cobalt-60 source, typically 3,000 to 10,000 curies
- Patient positioned on table and source gantry rotates around patient. Can be either fixed position(s) or rotational treatment

Teletherapy

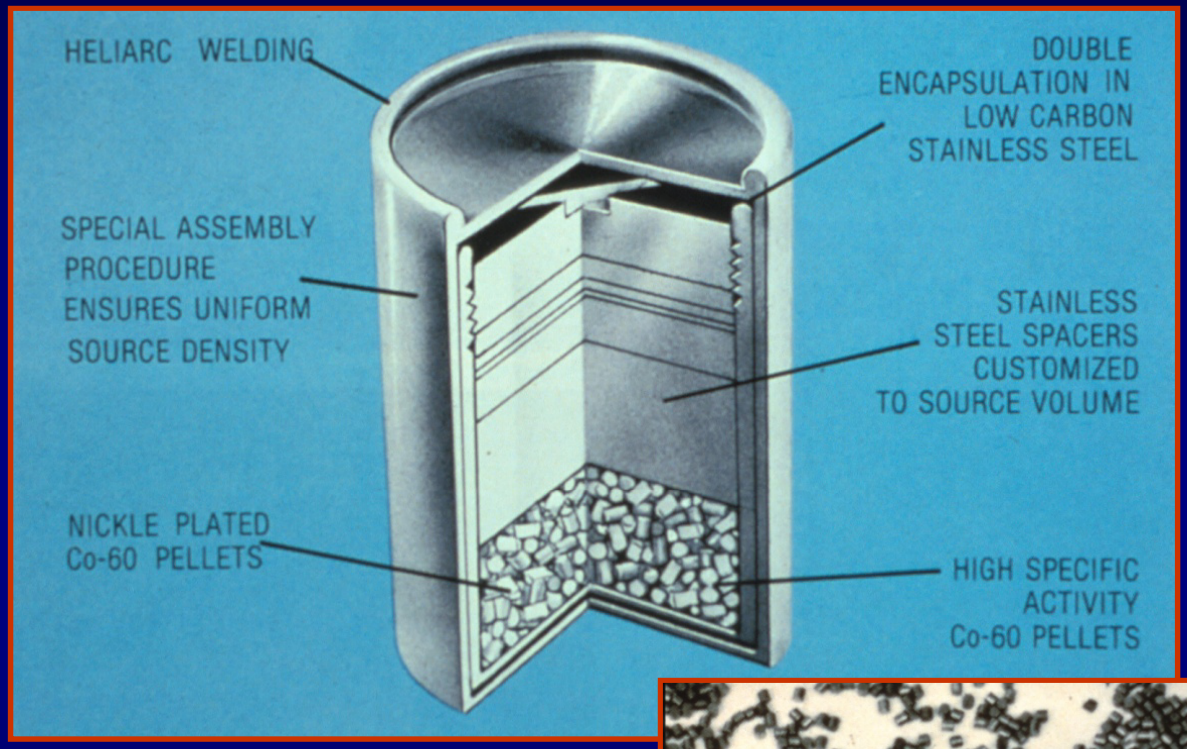


Unit

Source Head

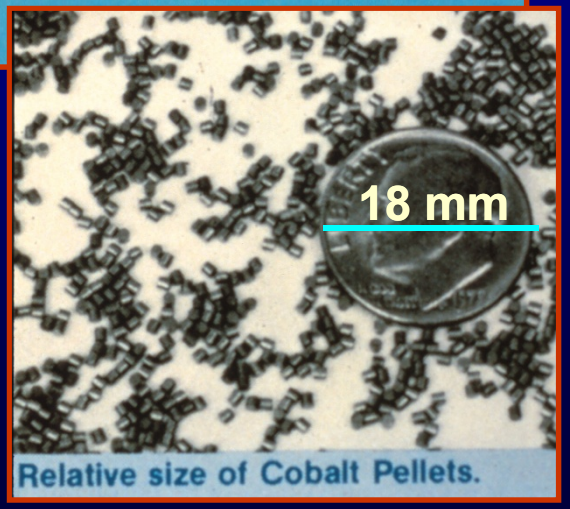


Teletherapy Source



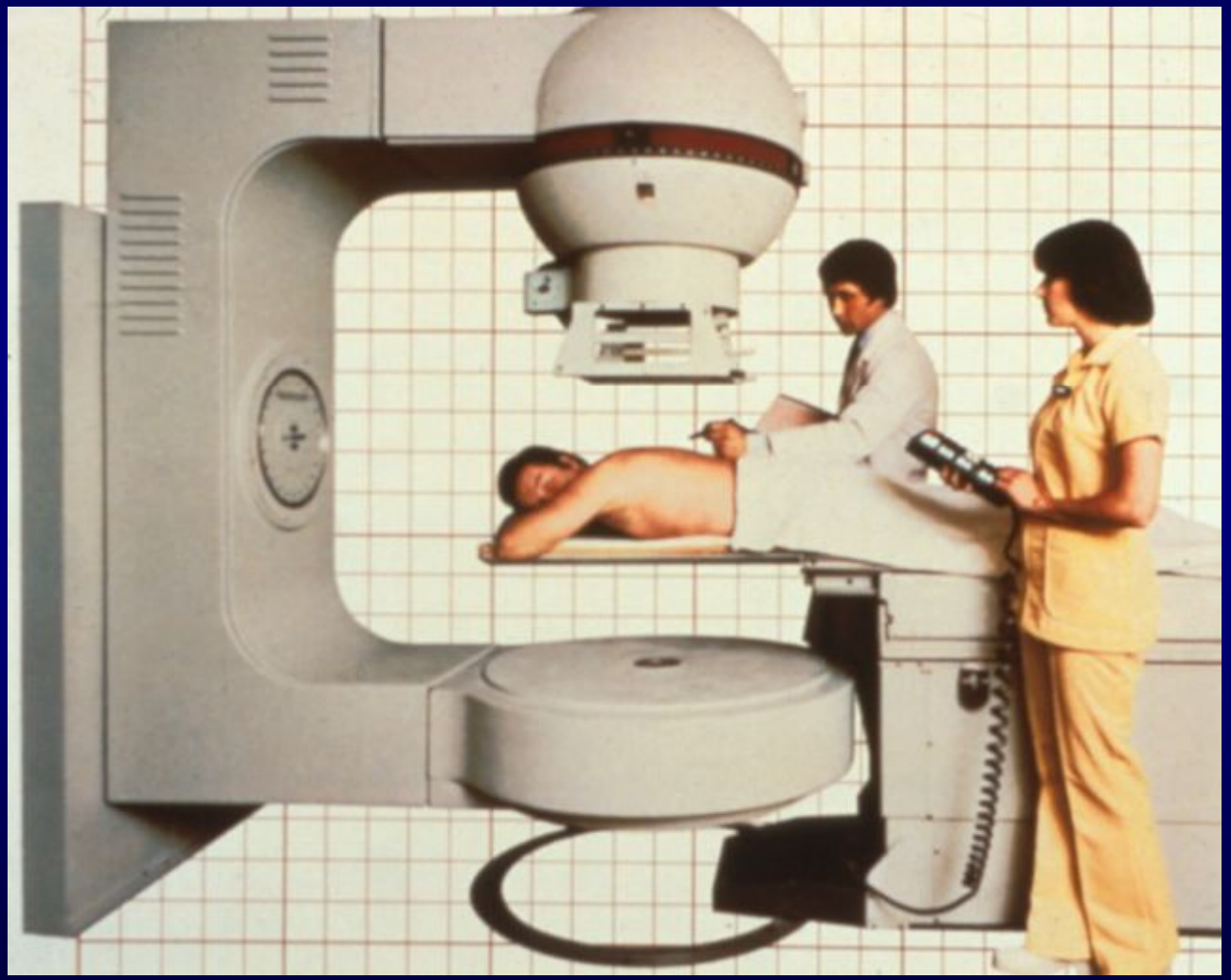
Capsule
(~ 6,000 Ci)

Cobalt-60 Pellets



Relative size of Cobalt Pellets.

Picker Teletherapy Unit



Other Medical Uses
10 CFR 35.1000

- Focus on the new therapeutic procedures/ modalities
- Follow the general inspection guidance provided for the most appropriate modality
- Take time to review the manufacturer's/distributer's operating and emergency procedures (or package insert for radiopharmaceuticals) - attempt to identify areas for potential human error or device malfunction
- Take time to learn

Plutonium Pacemaker

Potential Pitfalls
Medical Use Inspections

- Avoid discussing your observations and conducting interviews with the workers during the preparation for, or delivery of medical treatment, if possible
- Use discretion when interviewing licensee staff in the presence of patients so that the discussions do not interfere with licensee staff administering patient care

Potential Pitfalls
Medical Use Inspections

- Do not interfere with patient care or a patient's privacy
- Obtain patient/physician permission before observing treatments and dose/dosage administrations

THE END

of the standard presentation

Previously Identified Problems

- Authorized user signs written directive
- Problem: AU not on the license
- What should you do?

Previously Identified Problems

- During routine inventory audit, inspector found unknown source
- Licensee finally identified it as Ra-226
- What should you do?

Previously Identified Problems

Medical Event:

- Licensee called in a medical event
- Three patients received burns to inner thigh due to brachytherapy source in inserted into patient
- What should you do?

Previously Identified Problems

Security Issue:

- **Licensee left a Moly/Tc generator in an unsecured environment**
- **Next inspection, left a second Moly/Tc generator in an unsecured environment**

- **What should you do?**

Previously Identified Problems

- Licensee had a medical event involving a brachytherapy source
  - Authorized user claims all permanent seed implants were done appropriately and patients are doing well
  - NRC review of written directives show numerous seeds outside of implant area
  - What should you do?