GT-CIPR
31 Mars 2004

- Comité 3 : Chairman Fred Mettler
- Secrétaire : Keith Harding
- Rapport sur les travaux des « Task Groups »
- TG 53 ; « HDR » L. Pinillos
- TG 57 ; « Prostate Brachytherapy » JM. Cosset
- TG 46 ; « Digital radiology » E. Vano

ICRP

Committee 3

Prevention of High-Dose-Rate Brachytherapy Accidents

Task group 53

Luis Pinillos, MD

Main Points

- High dose rate (HDR) brachytherapy is a rapidly growing technique replacing Low Dose Rate (LDR) procedures over the last few years in both industrialized and developing countries.
- LDR equipment has been discontinued by many manufacturers since the year 2000 leaving HDR as the major alternative for brachytherapy.
- HDR techniques deliver a very high dose in a few minutes so mistakes can lead to under- or over-dosage with the potential for clinical adverse effects.

Main Points

- Accidents have been reported along the entire chain of procedures from source packing to transport to delivery of dose.
- Over 10,000 HDR sources are transported annually.
- It is estimated that about 1/2 million procedures (administrations of treatment) are performed by HDR units annually.
- Trained personnel following strict quality assurance (QA) procedures are mandatory.
- Human error is the prime cause of radiation events.

2.1 What's HDR?

HDR: > 12.0 Gy per hour

Usual dose rate in HDR is 100-300 Gy per hour


microSelectron HDR

9. Recommendations

9.1 General

- Written comprehensive QA programme is essential.
- Following QA procedures thoroughly contributes to minimize errors.
- A Hospital Radiation Safety committee [QA committee] needs to exist and interact with regulatory authorities.
- Maintenance is an indispensable component of QA.
- External audits of procedures reinforce good and safe practice and identify potential causes of errors.
- Double checks of all activities from prescription to final delivery are required.
- Peer review of each case improves quality

9. Recommendations

9.1 Specific (1)

- Training in HDR should commence prior to machine acquisition and should include the specific techniques to be used.
- Training should be directed towards a team approach involving clinician, physicist and nurse.
- Training and introduction of techniques should be sequential, commencing with simpler techniques before attempting more complex activities [eg multiple plane flexible implant is not the way to start!]
- Transport regulations must be adhered to. On site the container must be inspected for damage. Removal of the old source to the container and installation of the new one into the safe should be performed by a factory-trained and certified operator.

9. Recommendations

9.1 Specific (2)

- New sources should be measured in a calibrated well chamber to verify the manufacturers reported activity and then entered immediately into the software. At this time it is advisable to do full physics and mechanical QA checks.
- Fixed geometry applicators and implants are less likely to result in errors.
- All systems of delivery must be closed ended, needles and fine tubes included.
- Keeping all tubes outside of the body as distant as possible from the patient's skin would contribute to minimising unintended doses.
- Dedicated self-contained Brachytherapy suite housing all requirements is highly advisable.

9. Recommendations

9.1 Specific (3)

- Applicator positioning should be verified before each treatment for this reason a C-arm is considered to be an indispensable part of a HDR suite.
- So-called 'false alarms' and interlock 'failures' should be thoroughly investigated and repaired. Failure to do so may encourage the staff to ignore valid alarm signals.
- Survey of patient by portable radiation monitor after each treatment is essential.
- An emergency plan must be prepared and practiced with commencement of operations.
- A list of emergency procedures [include both medical and radiation] should be posted within the suite; all items required must be readily available. And regularly repeated especially when new personnel are introduced to the team.
- The person performing the emergency procedure must remain during the entire treatment. In some countries it is a requirement that both clinician and physicist remain.

10. Annex
Examples of Reported Events (1)

10.1 The most severe case

10.2 Transport and package

10.2.1 Source placed outside the transport safe

10.2.2 Source not secured

10.2.3 Returned source not inserted in safe: failure to survey

10.2.4 Damage in transit

10.3 Exposure to personnel and public

10.3.1 Inadequate shielding to bunker

10.3.2 Faulty connection from transport container to HDR safe

10. Annex
Examples of Reported Events (2)

10.4 Mechanical events

1. *Source cable separated from drive unit*
2. *Source stuck (unknown reason)*
3. *Undersized transfer cable diameter*
4. *Treatment planning software error/or human*
5. *Kink in the applicator (needle)*
6. *Failure of retraction system*
7. *Loss of connection between control panel and HDR unit*
8. *Optical interlock*
9. *Open-ended source carrier*

10. Annex
Examples of Reported Events (3)

10.5 Human errors

1 Wrong patient: Identification problem
2 Reverse order of entry of dwell positions
3 Inadequate default position for start of dwell sites
4 Diameter confused with radius
5 Kink in catheter
6 Dwell position error
7 Wrong catheter
8 Wrong length catheter
9 Confused orifice
10 Wrong transfer tube
11 Failure to recalibrate
12 Dislodged applicator

ICRP Committee 3

Task Group N° 57

Initial title : « Release of patients after therapy with permanently implanted sealed radioactive sources »

Now replaced by :

« Radiation safety aspects of brachytherapy for prostate cancer using permanently implanted sources »

A short history of this project :

- **September 2002 ; Committee 3 meeting in Chiba (Japan)**
- **Keith Harding presented the conclusions of Task Group N°42, on a tentative ICRP recommendation entitled :**

« Patient release after therapy by unsealed sources and by permanent radioactive implants »

Actually , TG 42 observed that ;

- The problems related to unsealed and permanently implanted sealed sources were (very !) different
- The physicians involved are different : Nuclear Medicine specialists in the first case, Radiation Oncologists in the second
- While a consensus could be rapidly reached for unsealed sources, this was not the case for permanently implanted sources …

Some problems with permanently implanted sources :

- **Small amount of data** available in the literature (particularly concerning the dose received from the patients and the attitude towards cremation …)
- Large variations in the strategies adopted in the various countries (!)

Consequently, Committee 3 decided to finalize a document only dealing with « unsealed sources »

- **And *to activate a new Task Group* (N°57), in charge of preparing a specific document on**
- **« Release of patients after therapy with permanently implanted sealed radioactive sources »**

ICRP Committee 3 TG 57 :

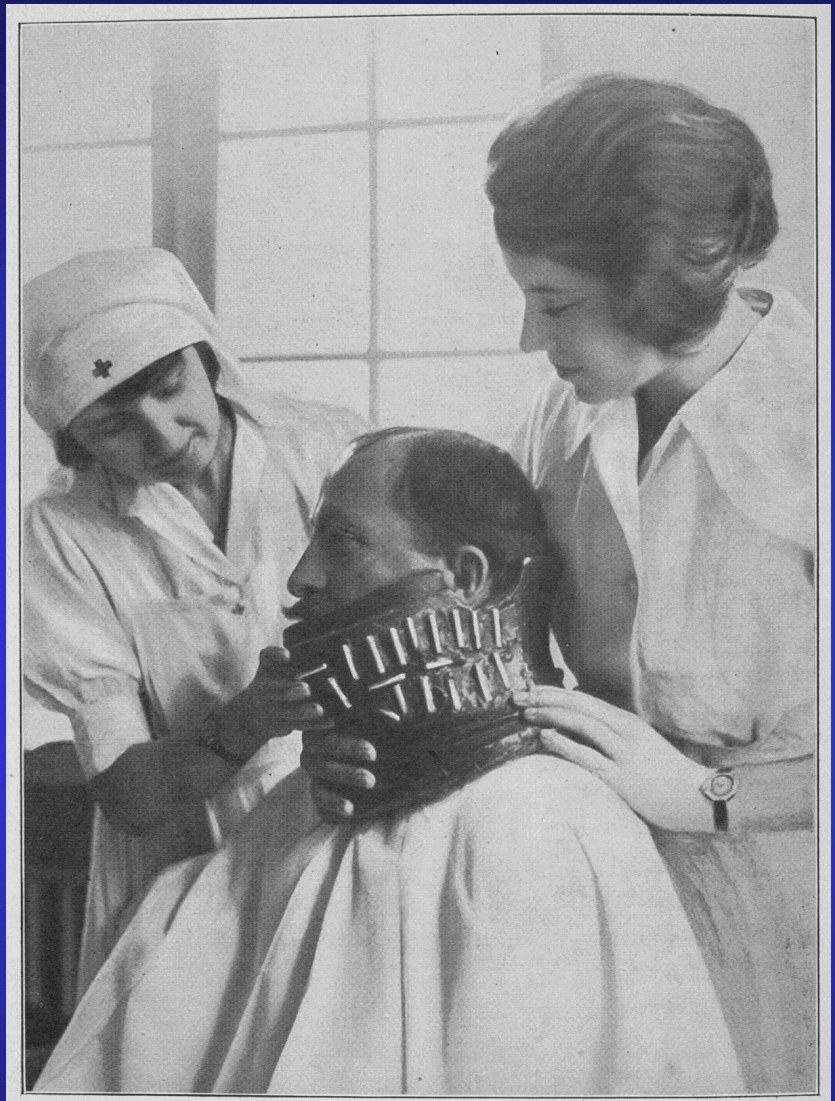
- *Chairman* **: JM. COSSET (Paris, France)**
- *Full members* **: D.ASH (Leeds, UK)**
  L.PINILLOS-ASHTON (Lima, Peru)
  T.McKENNA (IAEA)
  M.ZELEFSKY (New-York, USA)
  M.HIRAOKA (Kyoto, Japan)
- *Corresponding members* **: W.YIN (Beijing, China)**
  L.DAUER (New-York, USA)
  C.PEREZ (USA)
  JC. ROSENWALD (Paris, France)

Task Group agenda :

- October 2002 ; writing of a first draft (JMC)
- January-August 2003 :
  - Complementary dose measurements (UK, USA, France)
  - Comments on first draft
- September 1-2 , 2003 ; first Meeting of the group in Vienna
- October , 2003 ; redaction of Draft N°2
- December 10, 2003 ; Meeting D.Ash-JM.Cosset (London)
- Spring 2004 ; Second meeting of the TG (New-York ?)
- Definitive version expected for Summer 2004

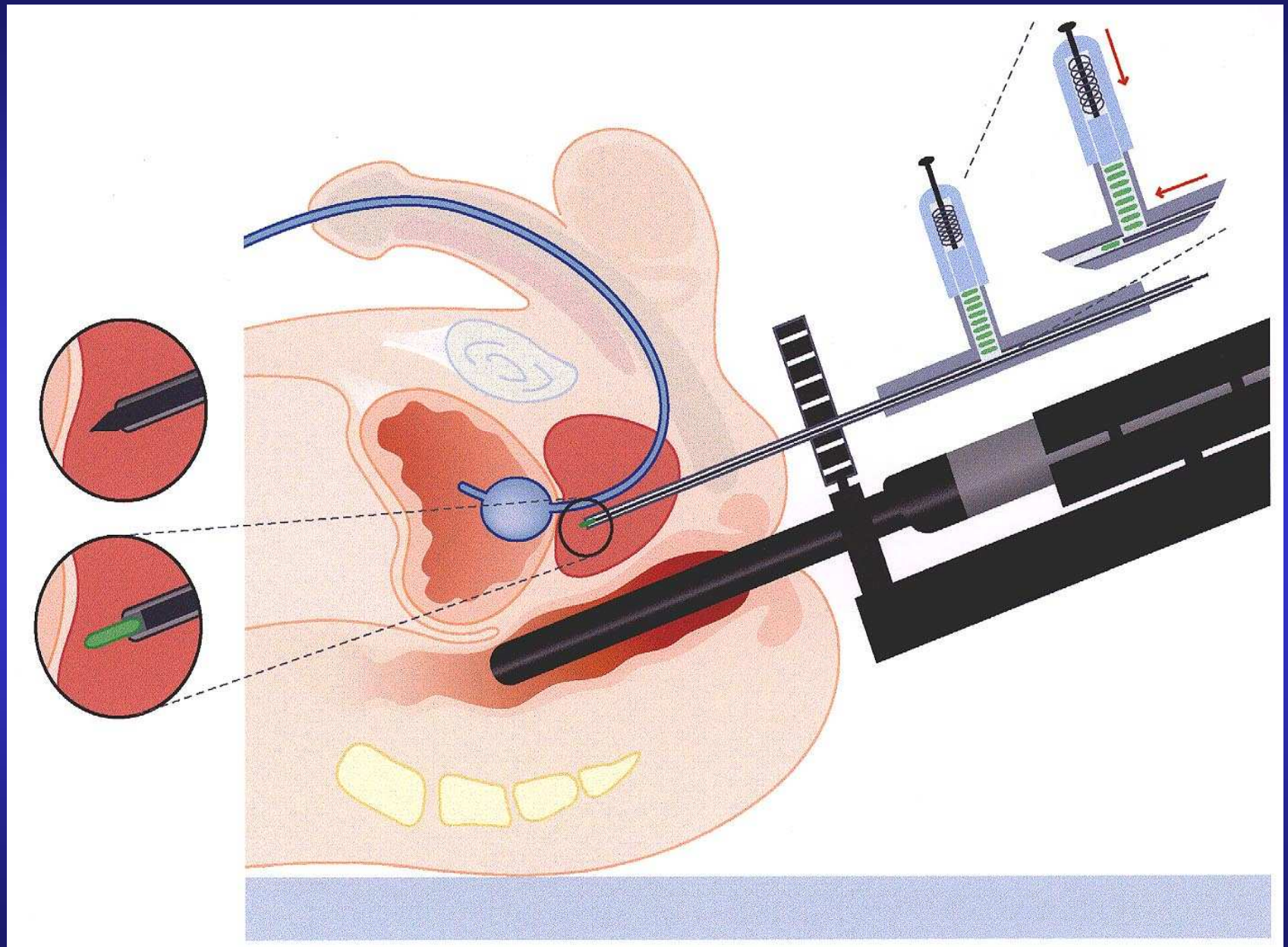
Introduction

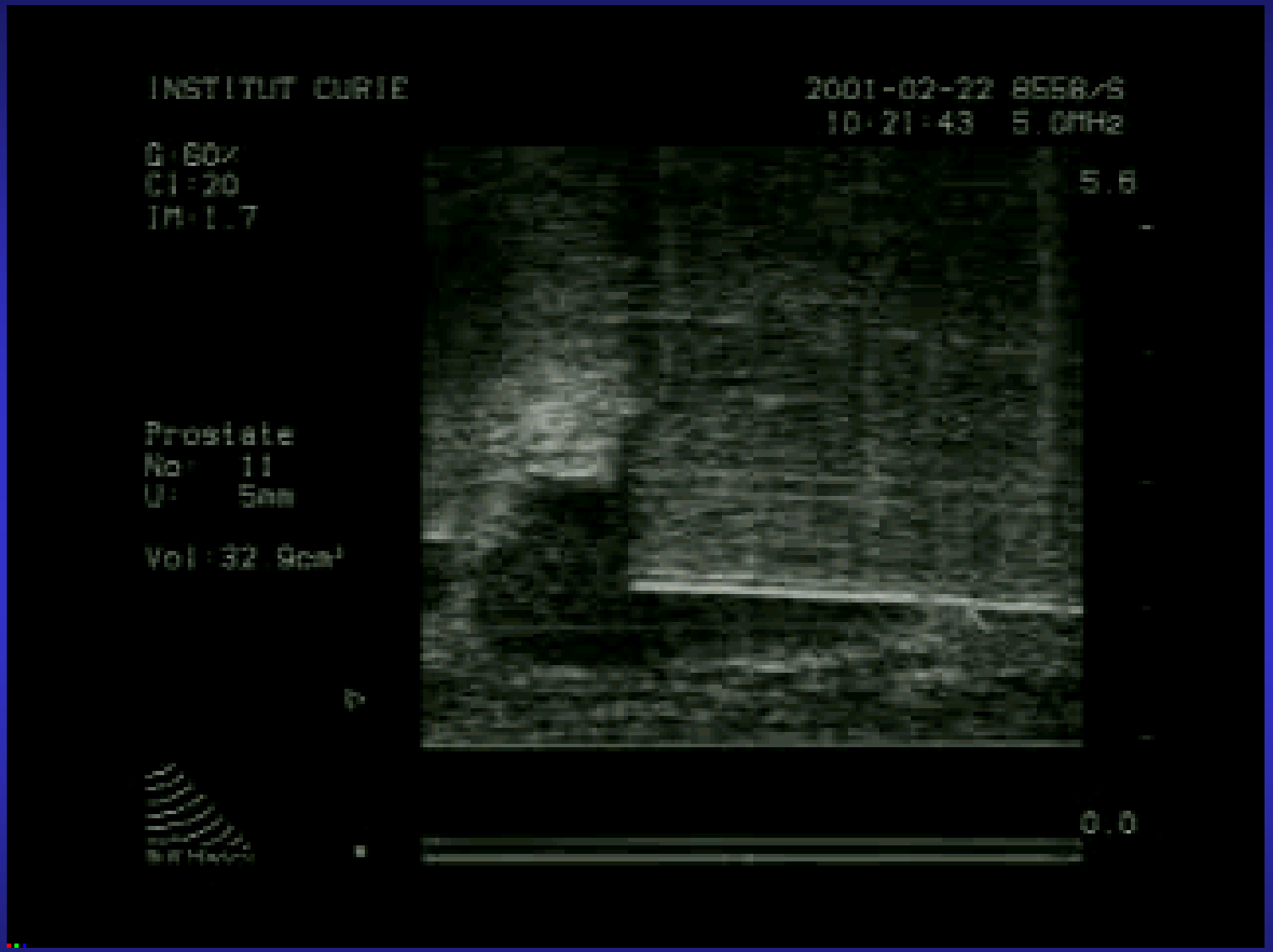
- A short history of Brachytherapy …



APPLICATION THÉRAPEUTIQUE DU RADIUM

On moule sur la règion à traiter un appareil que l'on garnit de petits tubes métalliques contenant chacun une dose de radium, puis on applique sur le malade. On cherche ainsi à guérir le cancer. Pour traiter l'intérieur des tissus, le radium est mis dans des aiguilles creuses. Cl. Je Sais Tout.

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IM:1.7
5.6
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Vol:32.9cm³
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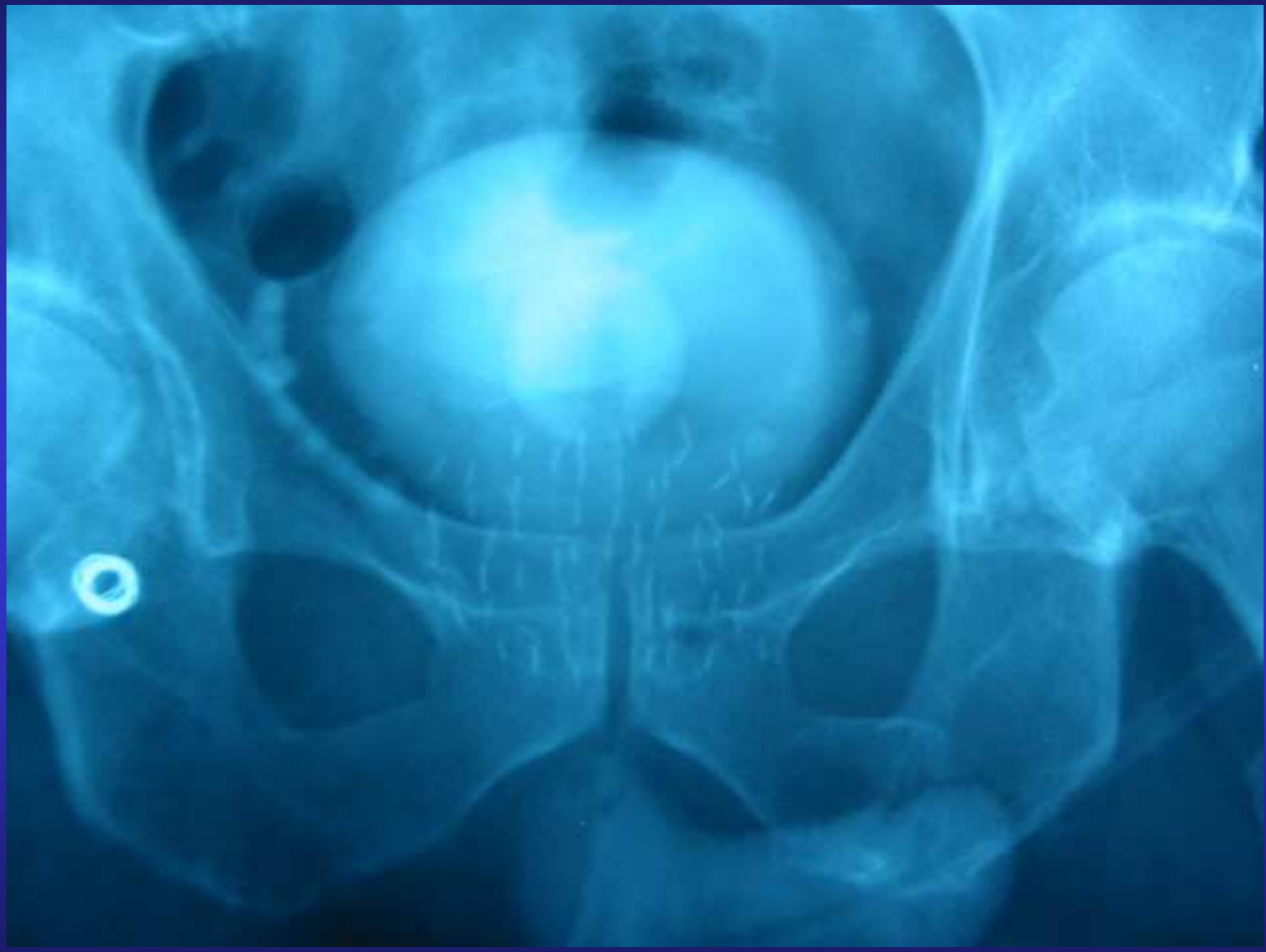
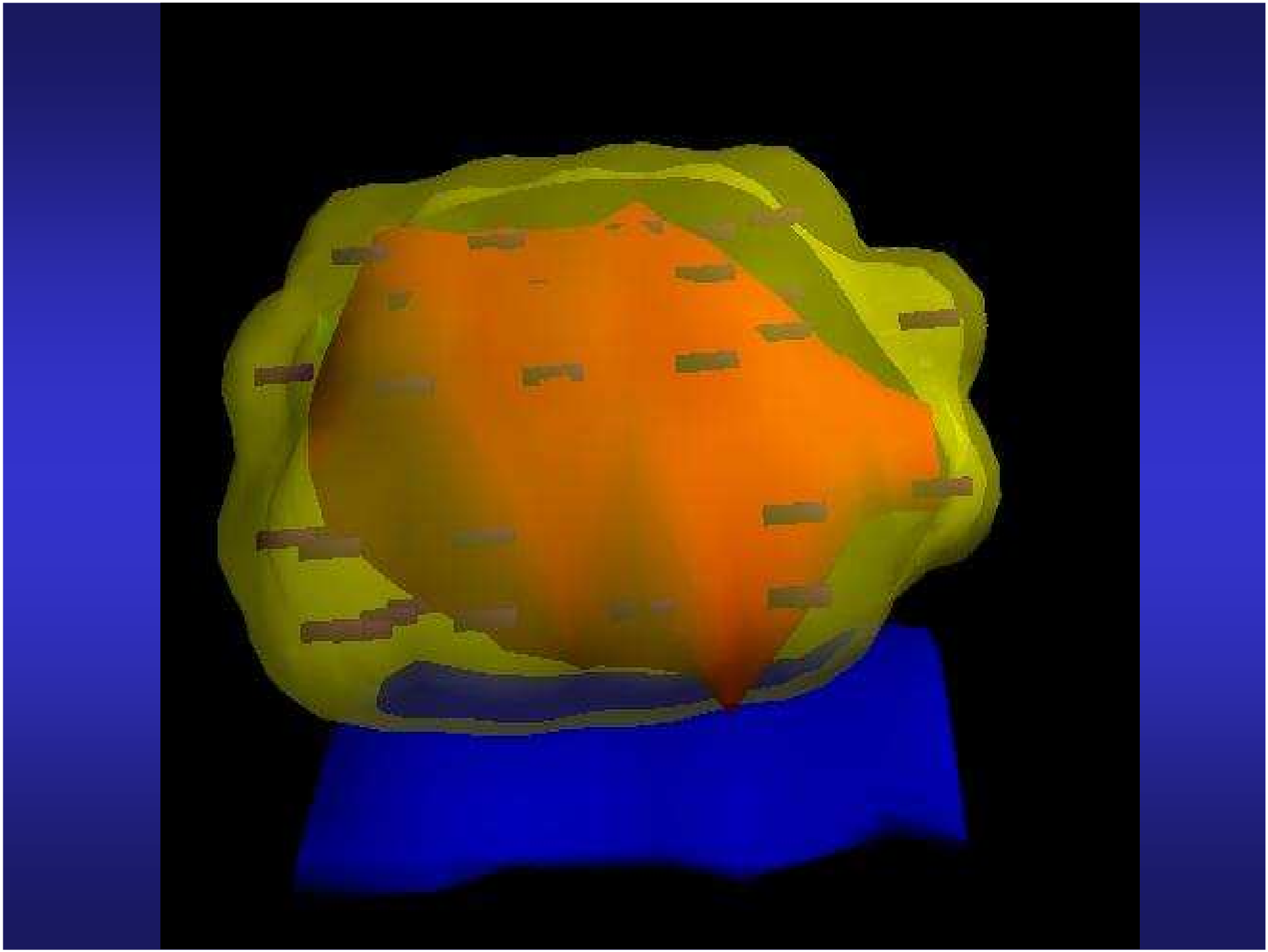




Conclusions (1)

- Permanently implanted sealed radioactive sources do not pose any major Radioprotection problem , however :
- Dose received from the patient must be taken into account in case of a pregnant partner (a rare occurrence)

Conclusions (2)

- Specific rules should be given to allow the patient to deal with the (rare) expelled sources
- Rules for Body cremation must be given to the patient before the implantation (with informed consent for a possible autopsy if necessary)
- Additional recommendations are to be given for subsequent pelvic surgery, fathering of children and possible trigerring of security monitors

ICRP Annual Meeting
Buenos Aires. Argentina. 2 - 6 November 2003

ICRP TG 46

Managing Patient Dose in Digital Radiology

(E. Vano; Ref. ICRP Digital reduced2 Argentina Nov03)

ICRP TG 46
Managing Patient Dose in Digital Radiology

- Agreed during the ICRP meeting in The Hague (September 2001).
- Members:
  - E. Vano (Chairman), R. Loose, B. Geiger, B. Archer, K. Faulkner.
  - Corresponding members: M. Rosenstein, J.M. Fernandez, H.P. Busch, M. Wucherer, B. Bergh, R. Gagne, C. Sharp.

Digital radiology is increasing …

- Image quality and patient dose audit are a challenge for the future in digital radiology.
- Industry reported 15% growth in sales of medical equipment in the first quarter of 2003 and 45% in PACS.

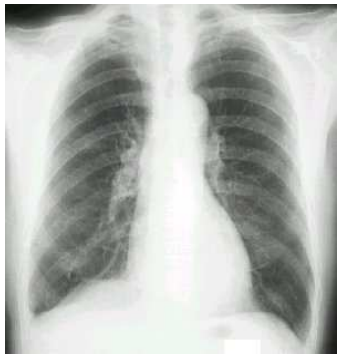
From the Glossary:
PACS = Picture Archiving and Communication System
A system capable of acquiring, transmitting, storing, retrieving, and displaying digital images and relevant patient data

Increase in the number of examinations with digital …

In several U.S. hospitals the number of examinations per in-patient day increased by 82% after a transition to film-less operation.

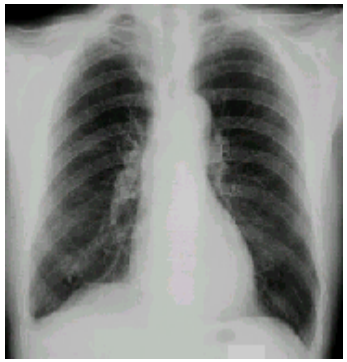
Outpatient utilization (i.e. the number of examinations per visit) increased by 21% compared with a net decrease of 19% nationally at film-based hospitals.

Conventional film - screen

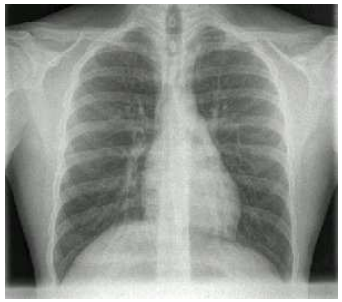


Entrance dose: 0.2 mGy

Overexposure (0.8 mGy) is clearly detected

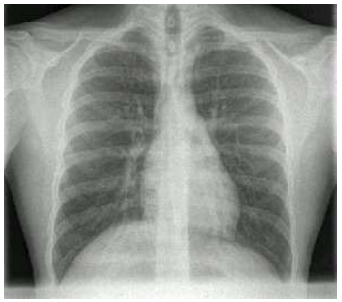


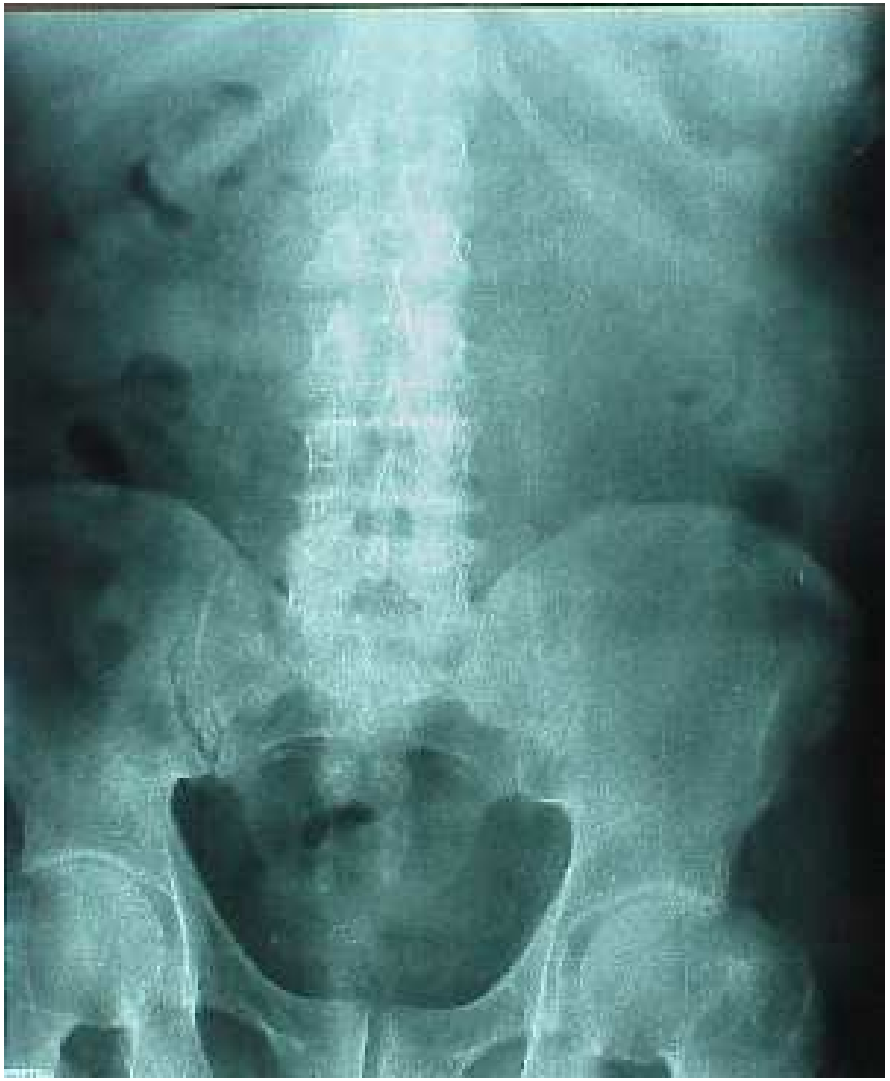
Digital (CR)



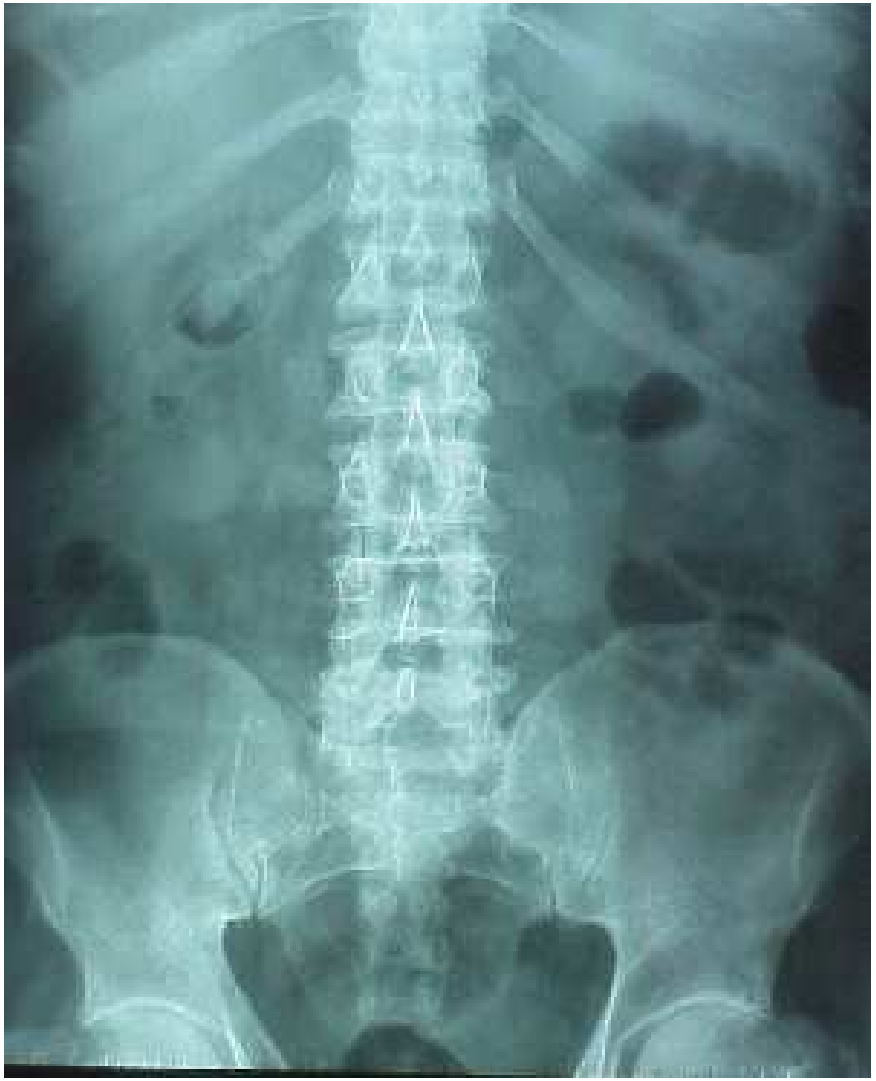
Entrance dose: 0.2 mGy

Overexposure (0.8 mGy) is not easily detected





Relative exposure index 1.15
Image too noisy



Relative exposure index 1.87
Image with enough quality

From the Glossary. Exposure Index = Term usually used in relation to the absorbed dose to the phosphor plate

Fig. 2.2

KEY POINTS OF THE DOCUMENT

- In digital radiology, higher patient dose per image usually means improved image quality. However, there is a tendency with digital systems to use higher patient doses than necessary. This increase in patient doses should be avoided.

KEY POINTS OF THE DOCUMENT

- With digital fluoroscopy systems it is very easy to obtain (and delete) images. There may be a tendency to obtain more images than necessary. This would irradiate the patient more than is clinically necessary. Procedure protocols should be agreed to manage this problem.

Proposed ICRP recommendations (R1)

1. Appropriate training should be undertaken before the clinical use of digital techniques.
2. Local diagnostic reference levels should be reviewed.
3. Frequent patient dose audits should occur when digital techniques are introduced.

Proposed ICRP recommendations (R3)

4. New digital system or new post-processing software require optimisation programmes (for radiation dose) and continuing training.
5. Quality control in digital radiology requires new procedures and protocols (visualization, transmission and archiving of the images).
6. As digital-radiology images are easier to obtain and to transmit the justification criteria should be reinforced.

Proposed ICRP recommendations (R2)

7. Industry should promote tools to inform about the exposure parameters and the resultant patient doses. These data should be standardized, displayed and recorded.
8. The raw image data should be made available to the user.

From Glossary: RAW image (RAW = Read After Write). The term “raw data” is often used to emphasize that images are unprocessed.

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News; Draft ICRP Reports

Draft ICRP Reports - be informed, provide comments!

The work of two ICRP Task Groups is nearing completion. The reports of the Task Groups address
(1) Digital radiology and the radiological protection of patients, and
(2) the Release of nuclear medicine patients treated with unsealed sources from clinics.

If you are at all interested in these two drafts, please look at them here. If you wish to offer your comments, please send them to the Scientific Secretary of ICRP, Dr Jack Valentin, at scient.secretary@icrp.org (postal address ICRP, SE-17116 Stockholm, Sweden; fax +46 8 729 729 8). If you comment on behalf of several persons, or on behalf of an organisation, please say so! Your comments must be in our hands by 30 June 2003 (digital radiology) and 31 July 2003 (release of nuclear medicine patients) in order for us to be able to take them into account.

Draft report 1: Digital radiology text
Draft report 1: Digital radiology figs 1
Draft report 1: Digital radiology figs 2
Draft report 2: Release of nuclear medicine patients

Access on 26 October 2003

1 ICRP digital draft 20 April 2003 **32/221/03**

2 **ICRP TG 46**

3 **"Dose Management in Digital Radiology"**