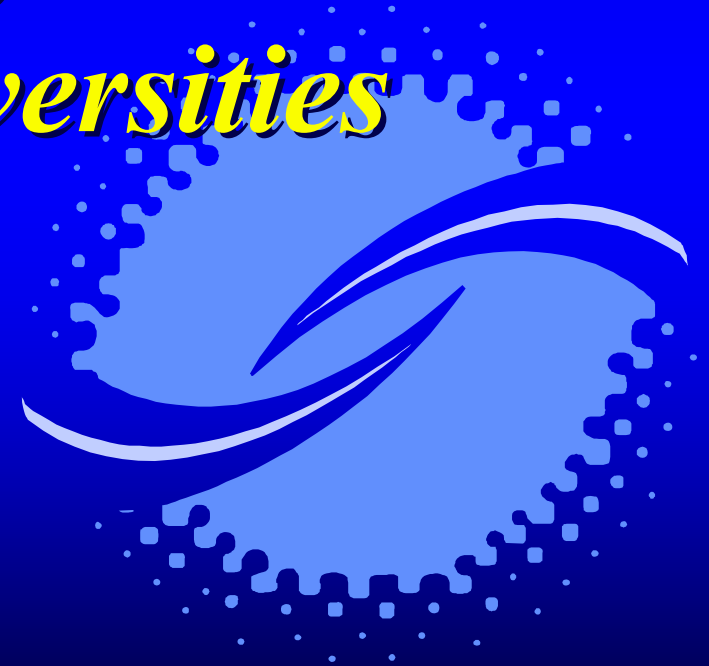


***Development of a radiation
worker registry and personal
dosimetry database for use in
hospitals and universities***

**John Cormack and Jane Shearer
Division of Medical Imaging
Flinders Medical Centre
South Australia**



Maintaining personal monitoring records-1

- **PAPER:** No batteries, power or IT technology required. Cumbersome and time consuming, however, if large numbers of persons are to be monitored. Searching records on specific criteria is cumbersome and time consuming.
- **SPREADSHEETS:** Simplest form of electronic record. OK for small numbers of monitored persons if only a limited number of fields needed for each person. Some mathematical manipulation possible, but searching and report generation can be cumbersome. Electronic importation of data possible

Maintaining personal monitoring records-2

- **DATABASES:** Come into their own where there are many persons to be monitored and many items of data associated with each person. Allow easy searching on complex criteria and easy generation of reports. Can be run off a server for multi-user access. Level of access can be controlled depending on the status of the user. Monitoring data can be electronically imported.
 - **Microsoft Access, Dbase V, Filemaker Pro**
 - **4D**
 - **Oracle**

Database Development Platform

(ACI 4th Dimension 6.05)

- “Mid-range” database development package
- Multi-platform – works on both PCs and Macs and on a network of PCs and Macs.
- Single user or multi-user server-client operation. Web server facility.
- Relatively compact compared to other database development platforms.
- Relatively cheap, given the range of incorporated features.

4D Database Development Package

- Academic edition free (www.4d.com/academic.html)
- full developer academic edition for about \$200 (providing you have academic status). The normal prices are \$339 and \$995 respectively.
- 4D Server edition - \$1500
- 4D Server/developer edition - \$2500
- Additional pricing information available from <http://www.4d.com/anz>

Data Input

- **Personal details, contact information**
- **Employment history**
- **Sources of exposure (radionuclides,x-rays)**
- **External doses**
- **Internal doses**
- **Incident reports**
- **Pregnancies**
- **Licensing and training information**

Monitoring Parameters (Some)

- Radionuclide intakes (CEDE)
- DDE, Hp(10), photon dose
- SDE, Hp(0.07), beta dose
- LDE, Hp(3), lens dose equivalent
- Neutron dose
- Date, time and period of exposure
- Position and type of monitor

Calculated Parameters (Some)

- **Total Effective Dose Equivalent (TEDE) - current, last 12 months, maximum, total accumulated.**
- **Shallow Dose Equivalent (SDE) - current, last 12 months, maximum, total accumulated.**
- **Extremity Dose**
- **Trend over last 2 years (or selected period)**
- **True/False flags to indicate where dose constraint for an occupational group has been exceeded.**

Reports

- **Brief** – TEDE for latest monitoring period only.
- **Summary** – TEDE, DDE, SDE and LDE for latest monitoring period plus cumulative and last 12 month dose.
- **Detailed** – All TEDE, DDE, SDE and LDE records for a selected period of time plus cumulative and last 12 month TEDE. Dose constraint flags and comments also displayed.
- **Termination (of Employment) Report**

(Some) Traps for Young Players

- **Date and time on the computer may be wrong – needs to be confirmed by user!**
- **Last (and sometimes first!) names change.**
- **Monitoring periods can change (so it's better to look at dose rate than dose).**
- **People switch departments and occupations.**
- **Possible to import same data twice unless precautions are taken.**
- **If somebody else is going to be using the database, don't depend on a rational and commonsense approach! Assume that everything that can go wrong, will go wrong!**

FMC Database Features -1

- **Simple, easy to use, user interface with (hopefully) most user indiscretions anticipated so that no major disasters can occur.**
- **Entry and modification of general user details with included scrollable input/output layouts for a near infinite number of employment history, pregnancy, external dosimetry, internal dosimetry and incident reports.**

FMC Database Features -2

- **Automatic calculation and updating of cumulative dose (TEDE, DDE, SDE, LDE and extremity), last 12 months dose and maximum dose rate over last 12 months, plus calculation of total dose and max dose rate over any selected time period.**
- **Direct and automatic input and update of user doses directly from ARL or Landauer dosimetry records supplied in electronic format on disks or over the network.**

FMC Database Features -3

- **Calculation of internal doses from internal database of ALI values.**
- **Flagging of errors and comments made on dosimetry measurements.**
- **Automatic flagging of chosen notification levels (for DDE, SDE, LDE and extremity doses) for each occupation as doses are added.**

FMC Database Features -4

- **Viewing and printing of reports relating to dosimetry and/or user details. Three styles of dosimetry reports are available, depending on the detail required.**
- **Graphing of trends.**
- **Generation of a standard report for employees at termination of employment.**
- **Selection of data by centre and/or user name, or by any combination of criteria desired. Wildcards supported.**

FMC Database Features -5

- **Customization:** Institution logo and contact details can be saved and inserted automatically on all reports.
- **Accounting:** Individual accounts for each centre and employer can be generated.
- **Automatic flagging of dose monitoring time periods which overlap with a declared pregnancy.**
- **E-mail communication (individual and broadcast) from within the application with users, notifying them of latest dosimetry results and overdue monitors.**

Security

Several passworded levels of access are provided:

- **Administrator or Radiation Safety Officer** - View, add and modify all data. Bulk deletion of data. Assign users and passwords. Customization.
- **Clerical** - View ,modify and add data
- **Inspector** - View all data, but addition or modification of data not allowed
- **Centre Administrator** - View, add and modify data for a specified centre only,
- **Individual** - View personal records only



Radiation Worker Registry and Monitoring Database



Version 3.0



© John Cormack, Radiation Safety

Flinders Medical Centre, January 2004

Selection Criteria

SELECTION CRITERIA

Centre ID

Centre

User Surname

- 5190
- Anaesthesia
- ANATOMY AND HISTOLOGY
- ARL Controls
- Biochemistry (Medical)
- Clinical Biochemistry

er Registry Database



Version 3.0

© John Cormack, Radiation Safety
Flinders Medical Centre, January 2004

Selected Personnel Records

| | | | | |
|-------------------|----------------------------|--------------------|----------------------------|------|
| Title | Last Name | First Name | Initials | Sex |
| Mr. | Anony159 | Daryl | | Male |
| Primary User ID | 0000056885 | Date of Birth | Friday, 14 March 1958 | |
| Secondary User ID | R\00004646 | E-Mail Address | | |
| Occ. Code | 23 | Centre ID | 05182 | |
| Occupation | Nuc. Med./Lab Technologist | Centre | Nuclear Medicine | |
| Employer | Flinders Medical Centre | Location/ Lab. No. | | |
| | Flinders Medical Centre | Telephone | | |
| | Flinders Medical Centre | Home Address | 10 Glebe Street Glasgow | |
| | Bedford Park | | | |
| | South Australia 5042 | | | |
| Telephone | (08) 8204 5511 | Telephone | 0899992396 | |

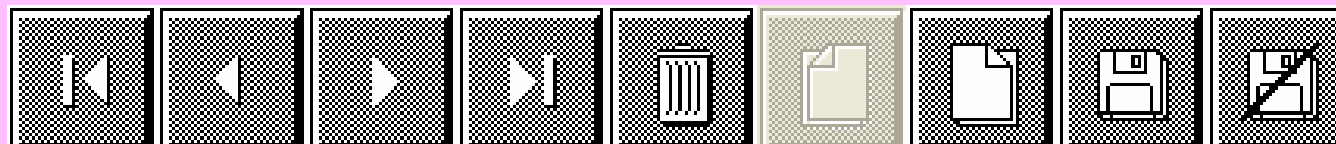
Current Monitoring and Radiation Exposure Details

| | | | |
|-----------------------|------------------------|-----------------------|---------|
| Monitoring method | TLD Badge | Monitoring Period | Monthly |
| Main radiation source | Unsealed radionuclides | Frequency of exposure | Daily |

| | | | | | |
|-----------|---|----------------|---------|-------------|------------------|
| Licensed? | <input checked="" type="radio"/> Yes <input type="radio"/> No | Licence Number | LS13140 | Expiry Date | Tue, 30 Nov 2004 |
|-----------|---|----------------|---------|-------------|------------------|

| | | | |
|--------------------------------|---|---------------------------|---|
| Area Radiation Safety Officer? | <input type="radio"/> Yes <input checked="" type="radio"/> No | Attended Training Course? | <input type="radio"/> Yes <input checked="" type="radio"/> No |
|--------------------------------|---|---------------------------|---|

| | | | |
|------------------------|---|------------------------------|--|
| Laboratory Supervisor? | <input type="radio"/> Yes <input checked="" type="radio"/> No | Date of last course attended | |
|------------------------|---|------------------------------|--|



Send Email

Selected Personnel Records

Last Name: First Name: Sex:
 User ID: Occ. Code: Occupation:
 Employer: Centre ID:
 Centre:

External Doses

| StartDate | EndDate | Exp Type | Quantity | Dose (µSv) | Quantity | Dose (µSv) | E | C |
|-------------|--------------|------------|----------|------------|----------|------------|----|---|
| 1 Apr, 2004 | 00/00/00 | Whole Body | | 0 | | 0 | | |
| 1 Mar, 2004 | 00/00/00 | Whole Body | | 0 | | 0 | | |
| 1 Feb, 2004 | 29 Feb, 2004 | Whole Body | DDE | 200 | SDE | 200 | | * |
| | | | LDE | 200 | Neutron | 0 | | |
| 1 Jan, 2004 | 31 Jan, 2004 | Whole Body | DDE | 40 | SDE | 40 | | |
| | | | LDE | 40 | Neutron | 0 | | |
| 1 Dec, 2003 | 31 Dec, 2003 | Whole Body | DDE | 20 | SDE | 10 | | * |
| | | | LDE | 20 | | 0 | | |
| 1 Nov, 2003 | 30 Nov, 2003 | Whole Body | DDE | 60 | SDE | 60 | | * |
| | | | LDE | 60 | | 0 | | |
| 1 Oct, 2003 | 31 Oct, 2003 | Whole Body | DDE | 120 | SDE | 110 | | * |
| | | | LDE | 120 | | 0 | | |
| 1 Sep, 2003 | 00/00/00 | Whole Body | | 0 | | 0 | LO | * |
| | | | | 0 | | 0 | | |



External Doses

Monitor Number: 2554558E

Billed

Record last updated on: 29 Mar, 2004

StartDate: 1 Jan, 2004

Paid

EndDate: 31 Jan, 2004

Monitor Type: Luxel OSL Standard

Monitor Pos: Waist

Exposure Type: Whole Body

Centre ID: 05182

Centre: Nuclear Medicine

Primary User ID: 0000056885

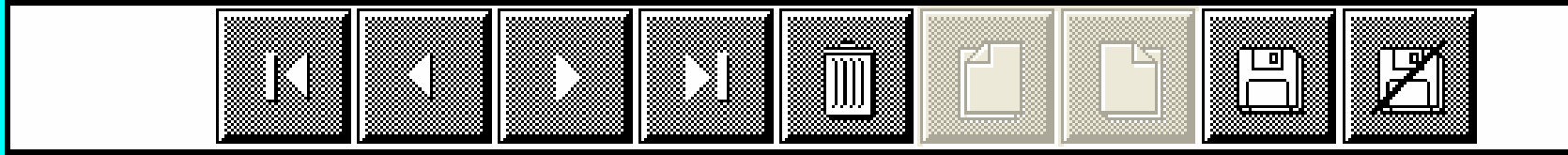
User Surname: Anony159

View More Information

| Monitored Quantity | Dose (µSv) |
|--------------------|------------|
| DDE | 40 |
| SDE | 40 |
| LDE | 40 |
| Neutron | 0 |

Error Code and Description

Comments



Selected Personnel Records



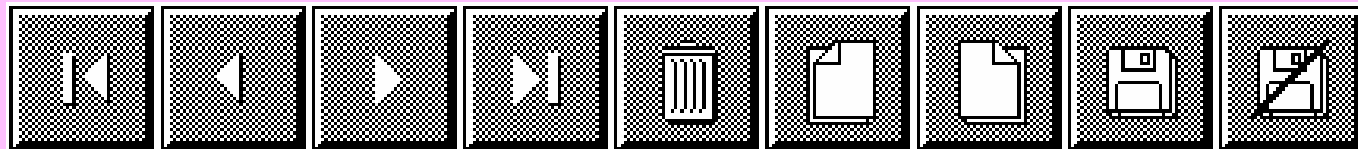
| | | | | |
|---------|------------|---------------|-----------------------|------|
| Title | Last Name | First Name | Initials | Sex |
| Mr. | Anony159 | Daryl | | Male |
| User ID | 0000056885 | Date of Birth | Friday, 14 March 1958 | |

Exposure Details - Unsealed Radioactive Substances

| FROM (Date) | TO (Date) | Radionuclide | Activity(MBq) | Chemical Form |
|-------------|-----------|--------------|---------------|---------------|
| 00/00/00 | 00/00/00 | 99mTc | 1,100.00 | |
| 00/00/00 | 00/00/00 | Ga-67 | 360.00 | Citrate |
| 00/00/00 | 00/00/00 | I-131 | 4,000.00 | Sodium Iodide |
| 00/00/00 | 00/00/00 | Mo-99 | 0.00 | |
| 00/00/00 | 00/00/00 | Tl-201 | 220.00 | Chloride |
| | | | | |
| | | | | |

Exposure Details - Sealed Radionuclides, X-rays and Other Radiation Sources

| FROM (Date) | TO (Date) | Radiation Source | Exposure Frequency |
|-------------|-----------|------------------|--------------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |



Selected Personnel Records



| | | | | |
|---------|------------|---------------|-----------------------|------|
| Title | Last Name | First Name | Initials | Sex |
| Mr. | Anony159 | Daryl | | Male |
| User ID | 0000056885 | Date of Birth | Friday, 14 March 1958 | |

Internal Doses

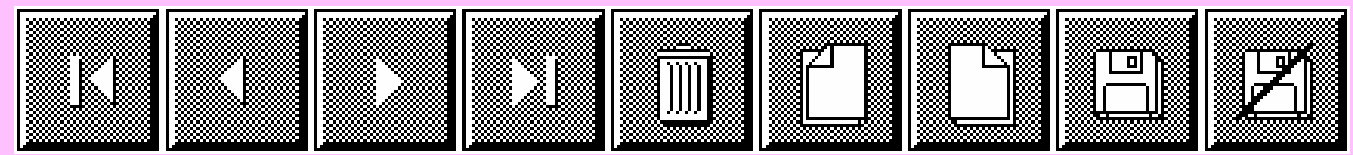
| StartDate | EndDate | Radionuclide | Chemical Form | Activity (MBq) | Dose (μSv) | C |
|-----------|---------|--------------|---------------|----------------|------------|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

Accident/Incident Reports

| Date | Accident/Incident Description | Eff. Dose (μSv) |
|------|-------------------------------|-----------------|
| | | |
| | | |
| | | |

Pregnancies

| Conception Date | Declaration Date | Action Taken: | End Date | Foetal Dose (μSv) |
|-----------------|------------------|---------------|----------|-------------------|
| | | | | |
| | | | | |
| | | | | |



Selected Personnel Records

Last Name First Name Sex
User ID Occ. Code Occupation
Employer Centre ID
(current) Centre

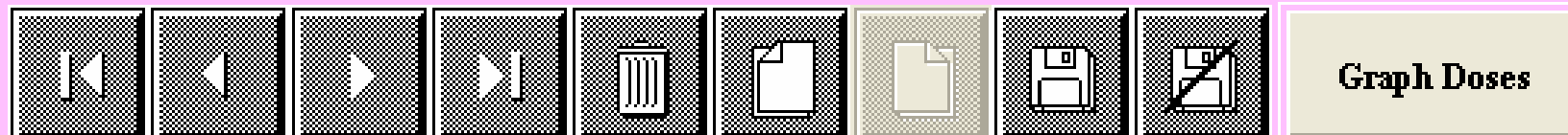
Initial TEDE (μSv): As of (Date):
Initial SDE (μSv):
Initial Lens DE (μSv):

Additional Monitored Doses (μSv) from: to:

| | | | |
|---------------------------------|------------------------------------|---------------------|------------------------------------|
| EXTERNAL (Photon and/or DDE) | <input type="text" value="5,870"/> | EXTERNAL Total DDE | <input type="text" value="5,870"/> |
| EXTERNAL (Beta and/or SDE) | <input type="text" value="1,580"/> | INTERNAL Total CEDE | <input type="text" value="0"/> |
| EXTERNAL (Neutron DDE) | <input type="text" value="0"/> | TOTAL EDE (TEDE) | <input type="text" value="5,870"/> |
| EXTERNAL (Lens Dose Equivalent) | <input type="text" value="1,860"/> | EXTREMITIES | <input type="text" value="0"/> |

Cumulative TEDE (μSv): As of (Date):
Cumulative SDE (μSv):

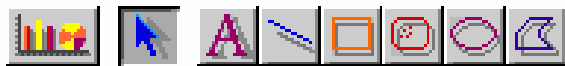
| | |
|---|------------------------------------|
| Cumulative TEDE (μSv) over last 12 months of monitoring | <input type="text" value="1,410"/> |
| Max. DDE rate ($\mu\text{Sv}/\text{annum}$) over last 12 months of monitoring | <input type="text" value="3,165"/> |
| Cumulative SDE (μSv) over last 12 months of monitoring | <input type="text" value="1,340"/> |
| Cumulative Extremity Dose (μSv) over last 12 months of monitoring | <input type="text" value="0"/> |



Dose Graph



File Edit Text Chart Object Database

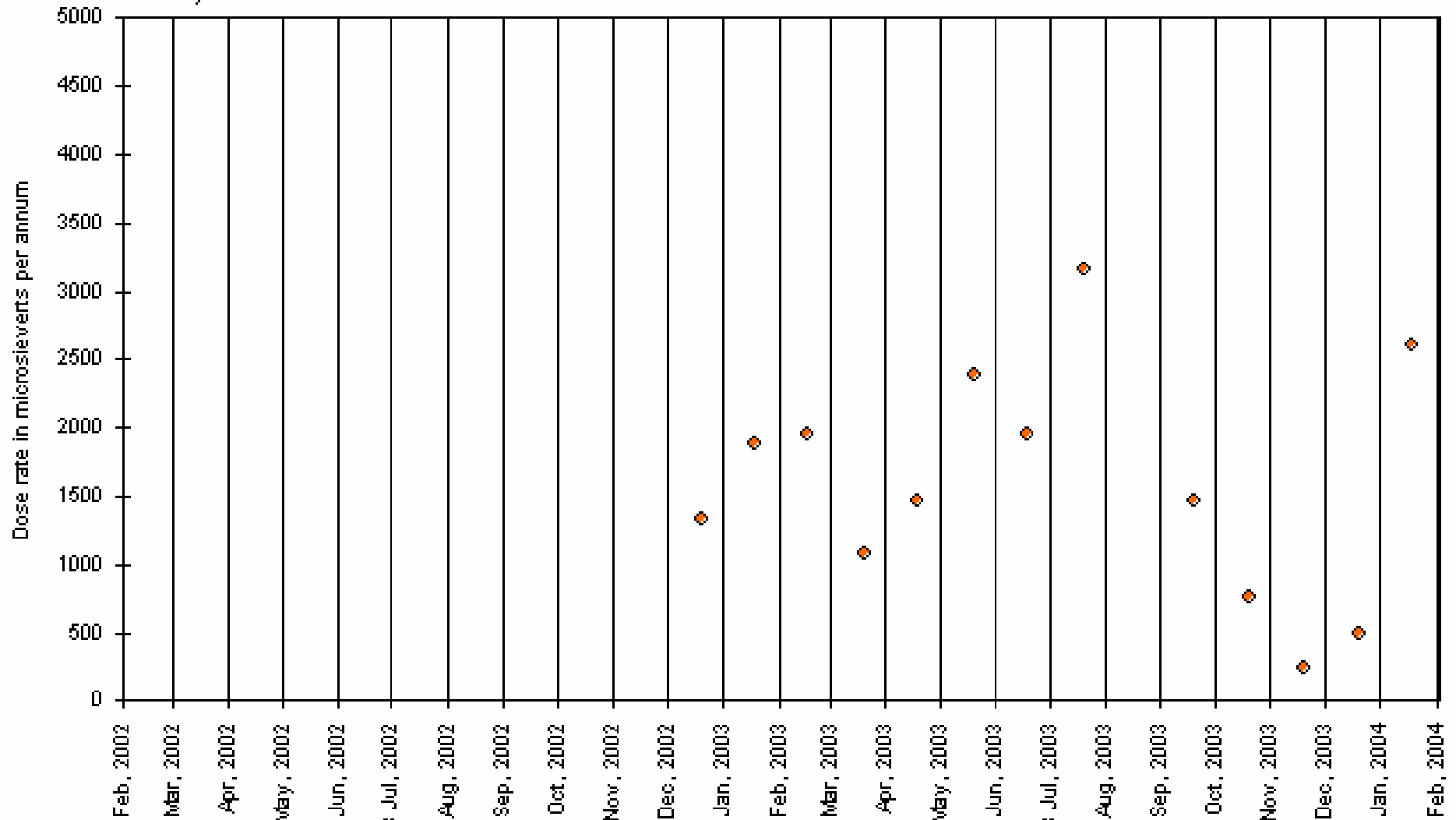


Monitored External DDE Dose Rate - Whole Body

Anony159

0000056885

Nuclear Medicine



Email Broadcast

THIS EMAIL WILL BE SENT TO ALL PERSONS IN THE CURRENT SELECTION

Message Type

- Free Text
- Dose Report
- Monitor Change
- Late Return (Nice)
- Very Late Return (Nasty)

E-Mail Host

From Address

Message

Subject

Dear Ron

Your radiation monitor readings from Sun, 1 Feb 2004 to Sun, 29 Feb 2004 were:

DDE : 40 microsieverts

SDE : 40 microsieverts

LDE : 50 microsieverts

Neutron : 0 microsieverts

and your cumulative dose (TEDE) to Sun, 29 Feb 2004 was 320 microsieverts.

Comments: None

If you have any queries, please contact the Radiation Safety Officer

Cancel

OK

Email Broadcast

THIS EMAIL WILL BE SENT TO ALL PERSONS IN THE CURRENT SELECTION

Message Type

- Free Text
- Dose Report
- Monitor Change
- Late Return (Nice)
- Very Late Return (Nasty)

E-Mail Host

From Address

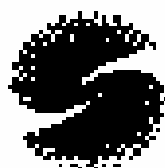
Message Subject

Dear Ron

Your current monitor is due to be changed in the next few days
Please ensure that it is available for the changeover.

Cancel

OK



FLINDERS
MEDICAL
CENTRE

Personal Dosimetry Report

(Brief - External Exposures Only - microsieverts)

Last Dosimetry Record for Selected Users

05182

Nuclear Medicine

Flinders Medical Centre

Anony14, Ron

Primary User ID: 0000069081

| External | | Monitor ID | ET | DDE | SDE | LDE | Neutron | E | C |
|-------------|--------------|------------|----|-----|-----|-----|---------|---|---|
| 1 Feb, 2004 | 29 Feb, 2004 | 3342808E | WB | 40 | 40 | 50 | 0 | | |

Anony140, Allan

Primary User ID: 0000009347

| External | | Monitor ID | ET | DDE | SDE | LDE | Neutron | E | C |
|-------------|--------------|------------|----|-----|-----|-----|---------|---|---|
| 1 Jan, 2004 | 31 Jan, 2004 | 2554562E | WB | 120 | 110 | 120 | 0 | | |

Anony156, Julia

Primary User ID: 0000009401

| External | | Monitor ID | ET | DDE | SDE | LDE | Neutron | E | C |
|-------------|--------------|------------|----|-----|-----|-----|---------|---|---|
| 1 Feb, 2004 | 29 Feb, 2004 | 3342801E | WB | 20 | 40 | 40 | 0 | | |

Anony157, Jane

Primary User ID: 0000023358

| External | | Monitor ID | ET | DDE | SDE | LDE | Neutron | E | C |
|-------------|--------------|------------|----|-----|-----|-----|---------|---|---|
| 1 Feb, 2004 | 29 Feb, 2004 | 3342800E | WB | 40 | 50 | 50 | 0 | | |

Anony159, Daryl

Primary User ID: 0000056885

| External | | Monitor ID | ET | DDE | SDE | LDE | Neutron | E | C |
|-------------|--------------|------------|----|-----|-----|-----|---------|---|---|
| 1 Feb, 2004 | 29 Feb, 2004 | 3342799E | WB | 200 | 200 | 200 | 0 | | * |

Anony162, David

Primary User ID: 0000026550

| External | | Monitor ID | ET | DDE | SDE | LDE | Neutron | E | C |
|-------------|--------------|------------|----|-----|-----|-----|---------|---|---|
| 1 Feb, 2004 | 29 Feb, 2004 | 3342798E | WB | 0 | 0 | 0 | 0 | | |

PM Databases – Issues that need to be resolved

- **Standardisation of electronic data files for import and export.**
- **Standardisation of reporting format.**
- **Standardisation of quantities and units used for monitoring.**
- **Faster turn-around time from PMS providers.**



Further Information

For further information regarding the *FMC Radiation Worker Registry and Personal Dosimetry Database*, and a copy of the program, contact :

John Cormack
Chief Medical Scientist
Flinders Medical Centre
Bedford Park
South Australia 5042

Email:

john.cormack@fmc.sa.gov.au