

# Nuclear Density Meter Radiation Study



# Introduction

- Nuclear Density Meters (NDM) are typically safe to use and be around, but can cause serious health problems if misused or in poor condition.
- The easiest way of monitoring the radiation that NDM operators are exposed to, is to sign up to the personal dosimetry service offered by the National Radiation Laboratory (NRL).
- In February 2010 Downer NZ, Dunedin, registered with the NRL to Monitor the Radiation levels their main NDM users are exposed to

# Radiation



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# Radiation

- 2 Radioactive Sources in a NDM
- Americium 241 used with beryllium to measure moisture content – neutron radiation (harmless).
- Caesium 137, used to measure wet density – Gamma radiation same as a x-ray (cause for concern).
- In low doses over a number of years can cause cancer and genetic defects. In extremely large doses can cause burns, nausea and hair loss to name a few effects

# Measuring Radiation Dose

- The effective dose is measured in Sieverts (Sv)
- 1Sv causes nausea, vomiting and diarrhoea
- 3Sv will cause temporary hair loss
- At 4.5Sv half of the people exposed will die
- 8Sv is generally fatal
- The average person is exposed to 3mSv a year of natural radiation (UV radiation)
- A patient is exposed to about 0.1mSv during an x-ray

# Radiation Accumulates in Reproductive organs



- Someone should tell this guy

# Personal Dosimetry Service






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# Personal Dosimetry Service

- Offered by NRL, a department of the Ministry of Health.
- If you are within 1m of the exposed gamma source of an NDM for more than 2 hours a week you must be monitored.
- This equates to about 1,440 shots a week with the NDM if you are near the gauge for about 5secs next to the unshielded source per shot.
- Fill in registration form, pay \$15 for the holder and \$10 a month for replacement films and the monthly report



# Typical Dosimetry Report

 <b>NRL</b> National Radiation Laboratory		<b>NATIONAL RADIATION LABORATORY</b> PO Box 25-099, Christchurch 8030, New Zealand Phone: +64-3-366 5059, Facsimile: +64-3-366 1156 Email: pds@nrl.moh.govt.nz				The tests, calibrations or measurements covered by this document have been performed in accordance with ISO/IEC requirements, which include the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.					
<b>Customer Details</b> Mr A Ziffo Example Centre Nowhere in particular Who Knows		<b>Report Authorisation</b>  Kathryn Kingsbury — Personal Dosimetry Technician				<b>Centre Number</b> 3579		<b>Distribution List</b> Batch Number 009/04 Report Number 105781 Report Date 01 Jan 2005			
<b>Dosimeter</b>		<b>Wearing Details*</b>				<b>Dose™ (mSv)</b>		This space reserved for future use.			
Number	Type	Wearer	Occupation Code	Reference	Position	Used From	Used Until	Method	Hp(0.07)	Hp(10)	Notes
4K13884	Film	Bloggs, Arthur	MRTX		Trunk	01 Jun 2004	01 Sep 2004	Yellow holder	-	3.4	
4K13885	Film	Bloggs, Arthur	MRTX		Collar	01 Jun 2004	01 Sep 2004	Yellow holder	-	6.1	10
4K13886	Film	Bloggs, Joe	MRTX		Trunk	01 Jun 2004	01 Sep 2004	Yellow holder	-	<0.05	9
4K13887	Film	Doa, Jane	MRTX		Trunk	01 Jun 2004	01 Sep 2004	Yellow holder	-	<0.05	
4K13888	Film	Ziffo, Arnold			Trunk	01 Jun 2004	01 Sep 2004	Yellow holder	-	<0.05	1
<b>DOSE HIGHLIGHTING</b> <ul style="list-style-type: none"> <li>For colour dose rate highlighting to work (blue for below a threshold, red for above) the columns <i>Position</i>, <i>Used From</i>, and <i>Used Until</i> must be complete. Where one or more of these columns is unavailable, black will be used.</li> <li>If the dose exceeds the minimum reporting dose, it will be in bold.</li> </ul> Dose rate thresholds for <b>higher-than-normal</b> dose rate highlighting at this centre are as follows: <ul style="list-style-type: none"> <li>For area dosimeters: 1.0 mSv/month for Hp(10), 9.0 mSv/month for Hp(0.07)</li> <li>For collar dosimeters: 1.0 mSv/month for Hp(10), 5.0 mSv/month for Hp(0.07)</li> <li>For extremity dosimeters: 9.0 mSv/month for Hp(10), 9.0 mSv/month for Hp(0.07)</li> <li>For trunk dosimeters: 0.5 mSv/month for Hp(10), 5.0 mSv/month for Hp(0.07)</li> </ul>						<b>ADDITIONAL INFORMATION</b> <ul style="list-style-type: none"> <li>The reported Wearing Details are those supplied by the Customer. The accuracy of this information is the responsibility of the Customer.</li> <li>For information on our measurement precision, please see our Statement of Uncertainties.</li> </ul> <b>TECHNICAL DATA</b> <ul style="list-style-type: none"> <li>Except where stated, dosimeters were received in a physical condition suitable for dosimetric purposes.</li> <li>All doses are assessed in accordance with NRL Standard Operating Procedure SOP/PDS/024, Dose assessment.</li> </ul>					
<b>NOTES</b> 1 Film packet was damaged on receipt.						10					
***** End of Report *****											
PDS Customer Dose Report v1.1						105781			Page 1 of 1		

# Results of Downer Personal Dosimetry Monitoring






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# Results

- The monitoring was carried out for 3 months for two employees.
- The level of radiation that each employee was exposed to was below the level of 0.15mSv, which is the lowest that can be detected.
- Shows that the NDM users were following correct procedure and that the gauge is in good working order

# Copy of Feb Dosimetry Report

 <b>NRL</b> National Radiation Laboratory		<b>NATIONAL RADIATION LABORATORY</b> PO Box 25-099, Christchurch 8144, New Zealand Phone: +64-3-366 5059, Facsimile: +64-3-353 5669 Email: pds@nrl.moh.govt.nz <b>RADIATION DOSE REPORT</b>				The tests, calibrations or measurements covered by this document have been performed in accordance with IANZ requirements, which include the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.							
<b>Customer Details</b> Michael Harley Downer EdI Works PO Box 13-031 Green Island Dunedin 9018			<b>Report Authorisation</b>  Jo Carlton — Personal Dosimetry Technical Officer				<b>Centre Number</b> 3965  <b>Distribution List</b> blue one monthly  <b>Batch Number</b> 035/10  <b>Report Number</b> 199551/1  <b>Report Date</b> 05 Mar 2010						
<b>Dosemeter</b>		<b>Wearing Details*</b>					<b>Dose** (mSv)</b>			This space reserved for future use.			<b>Notes</b>
<b>Number</b>	<b>Type</b>	<b>Wearer</b>	<b>Occupation Code</b>	<b>Reference</b>	<b>Position</b>	<b>Used From</b>	<b>Used Until</b>		<b>Hp(0.07)</b>	<b>Hp(10)</b>			
9B36311	Film	Harley, Michael				01 Feb 2010	01 Mar 2010	Blue holder	—	<0.15			
9B36312	Film	Stevenson, Dean				01 Feb 2010	01 Mar 2010	Blue holder	—	<0.15			
<b>DOSE HIGHLIGHTING</b> <ul style="list-style-type: none"> <li>For colour dose rate highlighting to work (blue for below a threshold, red for above) the columns <b>Position</b>, <b>Used From</b>, and <b>Used Until</b> must be complete. Where one or more of these columns is unavailable, black will be used.</li> <li>If the dose exceeds the minimum reporting dose, it will be in <b>bold</b>.</li> </ul> Dose rate thresholds for higher-than-normal dose rate highlighting at this centre are as follows: <ul style="list-style-type: none"> <li>For area dosimeters: 1.0 mSv/month for Hp(10), 9.0 mSv/month for Hp(0.07)</li> <li>For collar dosimeters: 3.0 mSv/month for Hp(10), 9.0 mSv/month for Hp(0.07)</li> <li>For extremity dosimeters: 9.0 mSv/month for Hp(10), 9.0 mSv/month for Hp(0.07)</li> <li>For trunk dosimeters: 1.0 mSv/month for Hp(10), 9.0 mSv/month for Hp(0.07)</li> </ul>													
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## Why Do It?



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# Acknowledgements

Thanks to Managers at Downer NZ Dunedin for allowing me to be here today.

Thanks to Stuart Moulding of Civiltrain and Geotechnics for the training manuals where the background info came from for this presentation.

Questions?

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