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## Introduction

### Elimination of Radiation Risk

**Myth** - Radiation is particularly dangerous and the risks from it should be eliminated...

**Fact** - It is not possible to eliminate the risk from radiation (natural background is always present), however the risk can be managed and reduced to 'acceptable' levels.

An opinion is "now worker and population doses are so low is further reduction justified? "If doses CAN be reduced SHOULD they be? If radiation risk decreases is there an increase in other risks? Is there a mechanism to allow the balancing of multiple risks?"

### ALARA (As low as reasonably achievable)

The International Commission on Radiation Protection (ICRP) established that radiation doses should be 'as low as reasonably achievable, social and economic factors being taken into account'<sup>1,2</sup> – the ALARA principle (a philosophical concept with no defined rules on how it is demonstrated).

The ALARA principle has stood the test of time and is the basis of radiation risk regulation in many countries  
ALARA does not imply that the risk has gone.

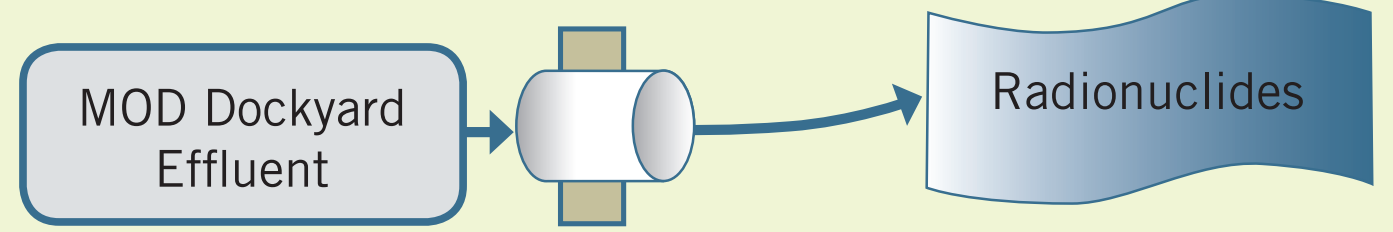
### ALARP (As low as reasonably practicable)

The Health and Safety at Work etc Act 1974 defined reasonably practicable and as such it has a legal definition with fixed rules on how it is demonstrated in court. The key is, is the time, trouble, and expense of any measure fully documented before the realisation of risk? ALARA has no formal process although is commonly taken to be the production of a "cost/benefit" analysis.

## Example 2 - The Environmental Balance

### MOD Have

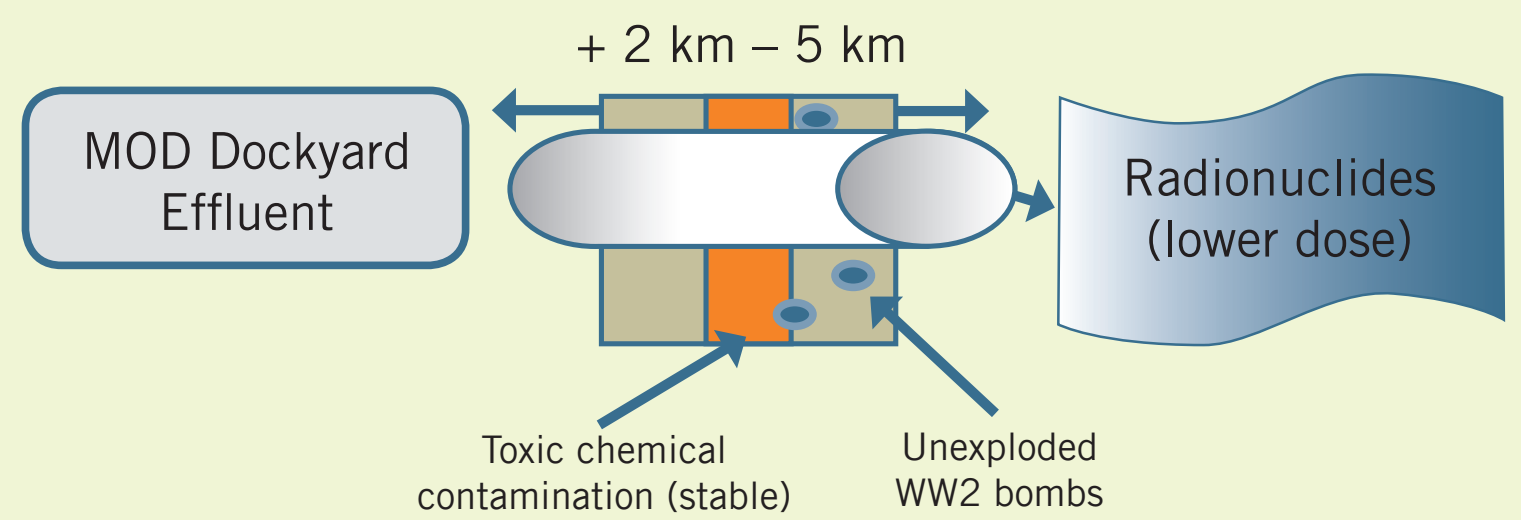
- Liquid effluent pipeline discharges radionuclides to sea (only during certain tides)



### Sea (only certain tides)

### EA Want to

- Extend pipeline to avoid effluent being washed back
- Discharge further out to sea would reduce public dose
- However, large environmental cost as pipeline would go through extensively contaminated seabed



### Outcome

- Competing risks considered – dose reduction not worth it
- EA proposal withdrawn

### Lesson

- Take an holistic approach to the health and environmental risk and persuade the regulator to do the same

### ICRP

- The continuing research effort into the biological effects of low doses of radiation and the active seeking of ways to reduce already low doses sends the message that radiation is particularly deadly and must be controlled.
- Risk is not compared with risks such as that from chemicals or other industrial processes.

### Regulators

- Seek to establish what is reasonably practicable for industry, imposing greater and greater restrictions until industry fights back.
- This process works in other industries as the regulator is challenged when the cost of compliance rises.

## Moderators of Risk? What is the impact of the approach to radiation risk analysis

### UK Practitioners

- ALARP is not ALARA, however it is often viewed as so (ALARP = ALARA – social and economic factors).
- With ALARA, both practitioners and regulators often omit the key balancing factor of social and economic issues.
- This leads to the spurious conclusion that doses must ALWAYS be reduced.

### Nuclear Industry

- Commonly the regulators are seen as 'beyond question' (ex-industry employees seen as at the peak of their career) and every pronouncement must be obeyed.
- The nuclear industry fails to challenge the regulator and the restrictive demand is therefore propagated throughout industry.

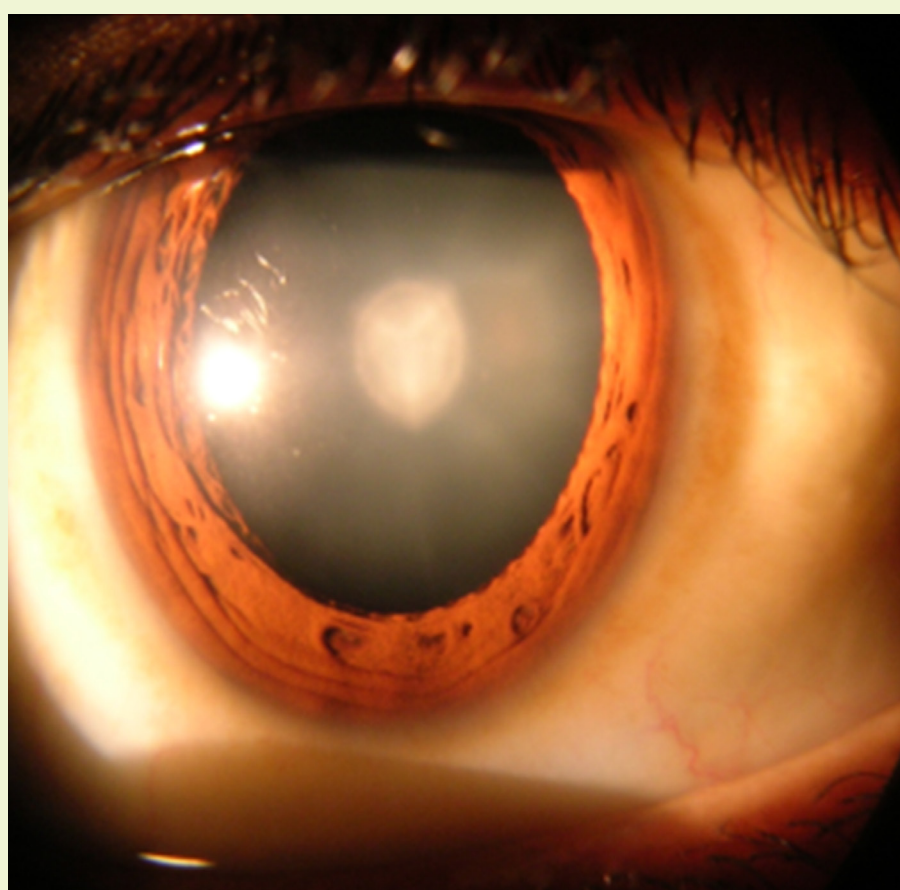
## Example 1 – The ICRP and Eye dose

- Proposal**<sup>3</sup> – cataract formation has been underestimated therefore dose limits need reducing by a factor of 10.

- Issue** – ICRP consider detriment from a cataract (easily treatable and not long term threat to life) = detriment from whole body exposure (usually cancer with threat to life and protracted treatment).

- Outcome** – 'unquestioning acceptance of ICRP position', reduction in eye doses destroys public confidence in radiation.

- Solution** – ICRP should resolve flaws in the use of detriment before recommending reducing dose limits.



## Suggested Way Forward

Radiation protection needs reviewing and rebalancing whilst recognising that there is a public perception that radiation risk should be eliminated.

A suggested way forward would be for the ICRP to develop a framework to assess competing risks. The framework needs to be developed in a transparent and consistent manner. To develop the framework the membership of the ICRP will need to include specialists in general risk management and social scientists.

For the framework to work industry needs to cease having a deferential attitude to the regulators.

The issue of detriment needs to be tackled, again with the input of ionising radiation experts with practical experience.

### References

[1] Annals of the ICRP, Publication 26, Vol 1, No.3 [1977]  
[2] Annals of the ICRP, Publication 103, Vol 37, (2-4) [2007]

[3] ICRP Tissue Draft report 2011: Early and late effects of radiation in normal tissues and organs: threshold doses for tissue reactions and other non-cancer effects of radiation in a radiation protection context