Yeelirrie Uranium Project

Response to Submissions

Attachment 11

Review of Impacts to Cattle

Impacts to Cattle

Introduction

Concern has been raised regarding the potential radiological impacts of cattle grazing in the general vicinity of the Yeelirrie project area.

In understanding the impacts, it is important to note that there are two potential radiological situations that must be considered. The first is the potential doses to humans from the consumption of beef that has grazed in the Yeelirrie region and the second is the radiological impacts to the animals themselves. The distinction here is important because it is common to mix these two concepts and think of them as one effect, when in fact they are very different.

This note provides a summary of impacts to both cattle and to humans that might consume the meat.

Determining Radiation Impacts

When the word "dose" is used it is important to note that it refers to a standardised measure of detriment. For example, extensive studies have shown that when humans receive a dose of 1 Sievert (with an abbreviation of Sv) of radiation, this will increase the chance of getting a fatal cancer by 5%. However, there are different types of radiation which have differing energies. There are also different ways that the radiation interacts with the human body and with the different organs and this depends upon the chemical nature of the radionuclide. The term dose takes all of these variables into account to give a single measure. This way it is possible to work out a total dose from, for example, inhaling radioactive dust through to drinking water containing radionuclides through to standing next to a drum of uranium oxide.

There is a standard way to calculate the dose to a person from eating beef containing radionuclides. The approach is to determine the amount and type of radionuclides in the edible portions of the animal and then estimate how much of the edible portion is consumed. Then, using well established dose factors for the different radionuclides, which are published by International Institutions, the dose that a human receives can be calculated.

The radionuclide content of the meat can be determined by sampling and measuring or by using well established and standard models which use the radionuclide concentrations of plants and soils. Usually sampling of animals is unnecessary because the models are recommended by International Institutions and have been verified.

When considering the radiological impacts doses to animals, the situation is very different. While there is generally one structure or model of the way the human body functions, this is not the case with animals and plants. The assessment is therefore based on broad species groups. This requires an understanding of how radiation affects different plant and animal species and there has been extensive international research conducted to quantify this, led by the Europeans. Additional and ongoing research occurs and continues to examine the actual effects on plants and animals of various levels of exposure.

The research has led to the development of a software package that collates the research into standard databases and provides a measure of impact for a set of standard reference animals and plants. The software is known as ERICA. Other systems, such as RESRAD, also provide a way to determine impacts to animals and plants.

The ERICA System

The ERICA system has recently been developed and is based on a tiered system, where impacts are initially assessed using broad parameters and if necessary, additional more detailed assessments can occur.

A key parameter in any assessment system is the "concentration ratio". This provides a measure of the uptake of radionuclides into animals and plants and is the ratio of radionuclides in the environment in which a species lives and in the species itself. For example, some sampling for the Yeelirrie PER measured radionuclides in soils and in species of plants. This enabled the development of concentration ratios for those species. ARPANSA has also published some Australian related information in the publication ARPANSA publication TR167 – "A review of existing Australian radionuclide activity concentration data in non-human biota inhabiting uranium mining environments".

In Australia, the ERICA software has been endorsed by the national authority on radiation protection – ARPANSA (http://www.arpansa.gov.au/). It is also utilised by the Australian Government Office of the Supervising Scientist (http://www.environment.gov.au/science/supervising-scientist). Various other institutions around the world employ the ERICA system for determining radiological impacts to animals and plants.

The ERICA software conducts an assessment on a set list of standard animals and plants, however, as more information becomes available on species the software allows the information to be added along with new species. At the moment, assessments are conducted in Australia use a model and real data for a kangaroo.

Understanding the Existing Environment

There is another important factor to consider when assessing impact and that is the fact that there is a naturally occurring level of radioactivity everywhere in the world, including in the Yeelirrie region. The natural levels of radioactivity give doses to humans and to plants and animals and this is known as background doses. The natural background dose varies around the world depending mainly on the geology of the region and the weather conditions. In Australia, the background dose is quoted as 2 to 3 millisieverts (one millisievert is one one-thousandth of a Sievert) per year. This comes from gamma radiation (like xrays and is from naturally occurring radionuclides in soils and outer space), radon in air, radioactive dust in air and in the food we eat. The level of naturally occurring radioactivity is considered to be harmless and therefore not subject to control.

An important point is that the food that we eat contains radionuclides which lead to radiation doses. The cattle in the pastoral region of Western Australia including the Yeelirrie region already also contain radionuclides and the operation of the Yeelirrie mine is predicted to increase the amount of radionuclides in the animals.

In this assessment, the impacts of the naturally occurring radiation levels have been included to provide perspective on the impacts from the proposed Yeelirrie operation.

Human Dose Impact

Using the methods outlined above (and provided in detail in the PER), the dose to human from the consumption of beef from cattle grazing the Yeelirrie region are shown in figures 1 and 2.

Figure 1 shows the existing average natural background doses in the Yeelirrie region by exposure pathway.

Figure 2 shows the estimated age dependant doses to people from the consumption of their own weight in beef from cattle that has been grazing in the Yeelirrie region. The human dose is dominated by the dose from the naturally occurring radionuclides in the beef.

Figure 1: Naturally Occurring Background Annual Doses in the Yeelirrie Region (mSv/y)

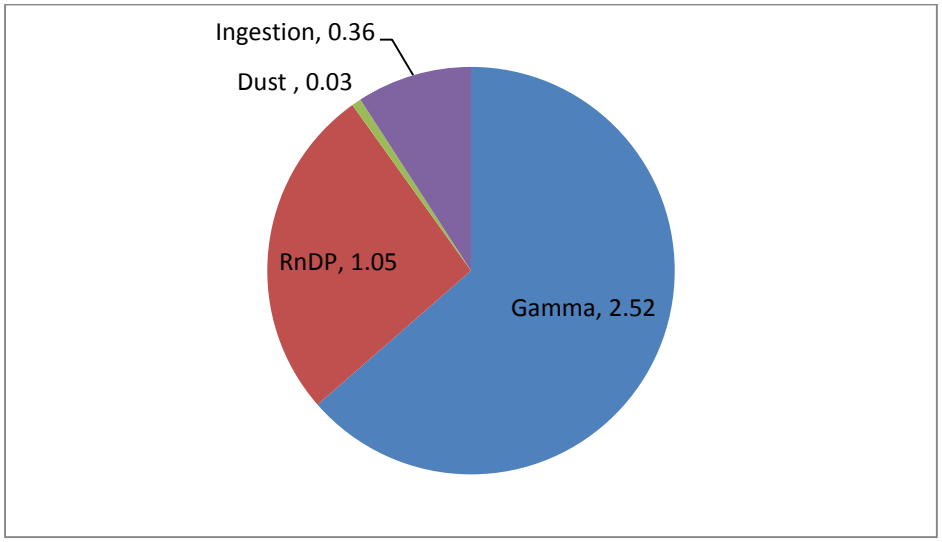
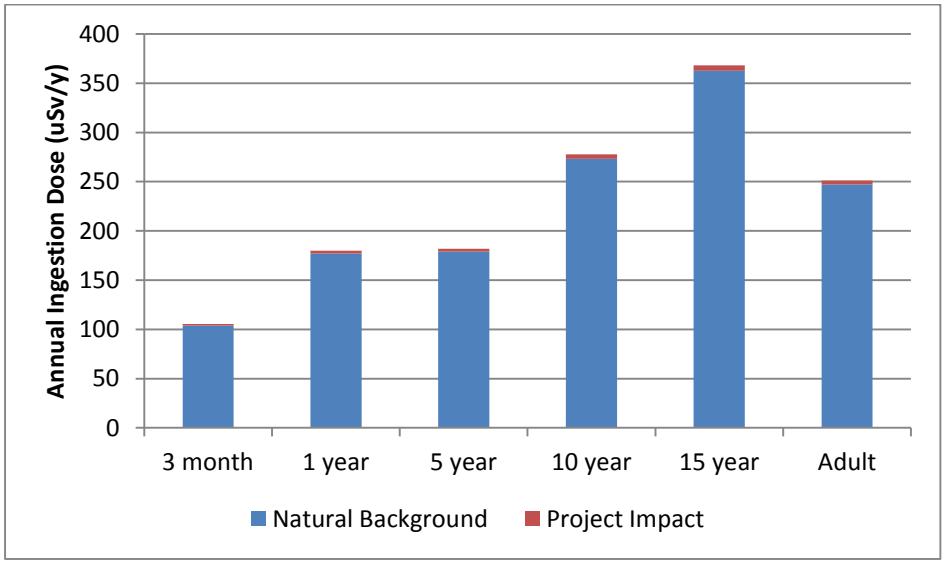


Figure 2: Calculated Ingestion Doses (Natural Background and Project Resultant Impacts)



The impact of the proposed operation on ingestion doses is therefore very low.

Impacts to Cattle

As outlined above, an assessment of the radiological impacts to flora and fauna was conducted using the ERICA assessment software and this is outlined in the PER. For the assessment, the default concentration ratios were used for all terrestrial species, however, area specific concentration ratios were used for kangaroos.

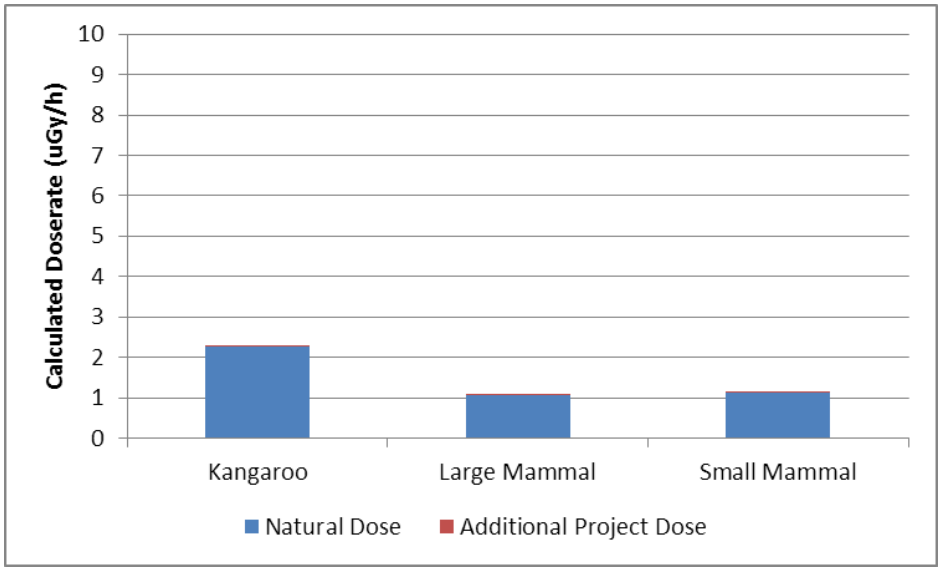
The output of the assessment showed that radiological impacts were negligible to the reference animals and plants and also to kangaroos.

To determine the impacts to cattle in the region, it is important to consider the existing impacts from natural background. The ERICA software can be used to do this by taking the existing background radiation levels and undertaking an ERICA assessment using those figures. The existing impacts can then be compared with the impacts after 15 years of operations.

The existing radiological conditions in the region are presented in the PER in section 9.6.3 and using the naturally occurring soil concentrations the existing radiological risks can be calculated. The ERICA assessment was conducted for kangaroos, large mammals (where the species group is large herbivores) and small mammals for the existing natural environment and after 15 years of operations and the results can be seen in figure 3.

Figure 3 shows the impacts to the three species examined and shows the impact from the natural background and the additional impact from the operation (after 15 years). The results are scaled to the default ERICA screening level of 10uGy/h, which is the level at which a more detailed assessment should be conducted or where controls should be implemented.

Figure 3: ERICA Impact Assessment to Species in Yeelirrie Region



Summary

The impact to cattle in the Yeelirrie region is low.

This is because the emissions from the proposed project are low and the uranium content of emitted dust is also low. This is what leads to the low to negligible impacts as predicted by the dose modelling and ERICA software assessment.

To quantify the statement that "the emissions are low", the following comparisons are provided.

The air quality modelling conducted for the PER and presented as appendix L1 of the PER determined that the average annual naturally occurring dust concentration in air in the Yeelirrie is 25ug/m^3.

The modelled increases in dust concentration were as follows;

	Distance	**Modelled Dust Concentrations (ug/m^3)**	**% Increase over background**
Yeelirrie Pool	10.2km NE	1.1	4
Accommodation Village	16.4 SE	0.1	0.4
Yeelirrie Homestead	16.4 SE	0.1	0.4
Ululla Homestead	28.5N	0.2	0.8
Palm Springs	50.4 ESE	0.01	0.04

These changes are barely noticeable above natural background dust levels.

For dust deposition, the background dust deposition in the area is approximately 1 to 2g/m^2/month. Table 2 shows the percentage increase in dust deposition per month based on a background of 1g/m^2/month.

Table 2: Annual Dust Deposition Rates

Location	**Distance from Orebody**	**Ground Level Concentrations Dust Deposition (g/m^2.month)**	**% Increase over background**
Yeelirrie Pool	10.2km northeast	0.013	1.3
Accommodation Village	16.4km south east	0.002	0.2
Yeelirrie Homestead	16.4km southeast	0.002	0.2
Ululla Homestead	28.5km north	0.006	0.6
Palm Springs	50.4km east-southeast	0.0004	0.04