RECOMMENDATIONS TO THE FELLOWS
BACKGROUND KNOWLEDGE

Although the WNU Summer Institute is not a nuclear engineering course or an advanced course for nuclear specialists, it is expected that all Fellows will arrive with certain background knowledge of nuclear technology. This knowledge will be expected by the presenters, so to understand the lectures about nuclear power technology it is important that you review the references below to be sure you have the necessary background information. With the exception of the table below the references will be found on the web. The areas that are considered fundamental are the working of nuclear power reactors, the nuclear fuel cycle and radioactive waste.

Most of the information provided hereunder can be found in two sources: World Nuclear Association (WNA) web site (www.world-nuclear.org), and Bertrand Barre's "All about Nuclear" CD, published by AREVA, which you can order for free (www.areva.com)

NUCLEAR POWER REACTORS

Go to www.world-nuclear.org and click on Site Map, then on Information and Issue Briefs. Under Nuclear Power for Electricity click on Nuclear Power Reactors (revised Oct. 2005)

An alternative path to this document is to go to *www.world-nuclear.org* **and click on the Site Map. Under** Introduction to Nuclear Energy **click on** Nuclear Power Reactors (info paper).

NUCLEAR FUEL CYCLE

Go to www.world-nuclear.org and click on Site Map, then on Information and Issue Briefs. Under Nuclear Power for Electricity click on Nuclear Fuel Cycle.

(When reading this article you can click on "enrichment" to get more information on the enrichment process. An example is given relating to the balance of material during enrichment. For the technical people reading this, the formula that relates uranium mass to the enrichment and to the depleted uranium tails is the following: $M \times 0.7 = E + (M-1) \times d$, where M is the mass of uranium in kg, E is the percent enrichment of U-235, and d is the percentage of U-235 in the tails.

The energy generated by the fissioning of fuel is generally given in Megawatt days (MWd), which is actually 8×10^{10} J. The fission of one gramme of heavy metal (U or Pu) is very close to 1 MWd; thus fuel that is burned to 45 000 MWd/t (Megawatt days/tonne) contains roughly 45 kg of fission products per ton (4.5 %).)

RADIOACTIVE WASTES

Go to www.world-nuclear.org and click on Site Map, then on Information and Issue Briefs. Scroll down to the Section on Radioactive Wastes and click on; Waste Management in the Nuclear Fuel Cycle.

An alternative way to this document is to go to www.world-nuclear.org , then click on Nuclear electricity made simple, then on radioactive waste management.

Finally, for an even more complete discussion go to Nuclear Energy Text and read Chapter 5: The "Back End" of the Nuclear Fuel Cycle.

OTHER TOPICS

There are many other topics of importance on the WNA website and it is recommended that you read others that interest you. It is particularly recommended the one on Safety of Nuclear Power Reactors.

Finally, presented below is some basic data that is of interest when discussing energy generation by different fuels.

SOME BASIC DATA ON ENERGY IN GENERAL

Energy conversion: The heat values and carbon coefficients of various fossil fuels

	heat value	*unit*	*% carbon*	*CO_2*
Hydrogen	121	MJ/kg	0	
Crude Oil	45-46	MJ/kg	89	70-73 g/MJ
	37-39v	MJ/L		
LPG	49	MJ/kg	81	59 g/MJ
Natural Gas	39	MJ/m^3	76	51 g/MJ
	55	MJ/kg		
Black Coal (NSW & Qld)	21.5-30	MJ/kg	67	90 g/MJ
Black Coal (SA & WA)	13.5 - 19.5	MJ/kg		
Black Coal (Canadian bituminous)	27.0 - 30.5	MJ/kg		
Black Coal (Canadian sub-bituminous)	18	MJ/kg		
Brown Coal (Vic. average)	9.7	MJ/kg	25	
Brown Coal (Loy Yang)	8.15	MJ/kg		1.25 kg/kWh
Firewood (dry)	16	MJ/kg	42	94 g/MJ
Natural uranium, in LWR	500	GJ/kg	0	
Natural uranium, in LWR with U & Pu recycle	650	GJ/kg	0	
Natural uranium, in CANDU	650	GJ/kg	0	
Natural uranium, in FBR	28,000	GJ/kg	0	
Uranium enriched to 3.5%, in LWR	3900	GJ/kg	0	