



## URANIUM-NATURAL RADIONUCLIDE SAFETY DATA SHEET

### Physical characteristics:

HALF LIFE:  $4.5 \times 10^9$  years

TYPE DECAY: alpha, beta<sup>-</sup>, betas - principally from daughters:

Th-234 (0.19 MeV) and Pa-234m (2.29 MeV)

### External radiation hazards and shielding<sup>1</sup>:

Surface dose rate on 100 gm glass jar of uranyl nitrate is typically 1.5  $\mu$ Sv/hr.

Maximum range of beta radiation: glass 0.6 cm, plastic 1 cm

There also is some gamma radiation associated with Uranium, but if chemical purification has removed the radium, the dose rate will be low.

### Hazards if internally deposited<sup>1</sup>:

In general, uranyl nitrate or uranyl acetate are considered to be more chemically toxic as a heavy metal (like lead or bismuth) than as a radiotoxic element and care should be taken to prevent ingestion by following good hygiene: wearing disposable gloves (this will also minimize beta exposure) and washing up after use. (eg for uranyl nitrate: 1 MBq = 81 gm, 1 Ci = 3000 kg)

Dusty, or vapor or aerosol-producing operations must be contained in fume hoods or glove boxes since deposition in the lungs is more hazardous.

### Personal monitoring<sup>1</sup>:

Generally dosimeters are not required unless one is handling, i.e. in contact with, uranium samples for more than one hour/week without any absorber between one's skin and the samples. Usually, it is only appropriate to measure finger doses using TLDs.

### Special problems and precautions<sup>1</sup>:

1. Always wear protective gloves to keep contamination from skin. Change gloves often.
2. G.M. survey meters are efficient for measuring uranium contamination. Wipe test surveys required for unrestricted areas, e.g. floors.
3. Please call the Radiation and Safety Officer (6488 7932) for information on waste disposal for solid or insoluble materials.

### Annual Limit of Intake (ALI)<sup>2</sup>:

2.63 MBq oral, 0.0408 MBq inhalation

### Maximum exempt quantity in Radiation Safety Act 1975 WA Regulations Schedule V<sup>3</sup>:

Note: material must be soluble for disposal to sewer

Substance	Formula	Molecular Weight (g)	Mass (g) for Sched V, 4 MBq limit	Dilution limit (g/l)
uranyl acetate	$\text{UO}_2(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	424.2	281.0	77.3 SOL
uranyl chloride	$\text{UO}_2\text{Cl}_2$	341	225.9	62.1 SOL
uranyl hexafluoride	$\text{UF}_6$	352.1	233.3	64.2 INSOL
uranyl nitrate	$\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	502.1	332.6	91.5 SOL
uranyl (IV) oxide	$\text{UO}_2$	270.1	178.9	49.2 INSOL
uranyl (VI) oxide	$\text{UO}_3$	286.1	189.5	52.1 INSOL
uranyl (IV/VI) oxide (pitchblende)	$\text{U}_3\text{O}_8$	842.2	186.0	51.2 INSOL
uranyl sulphate	$\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$	420.2	278.4	76.6 SOL
uranyl formate	$\text{UO}_2(\text{CHO}_2)_2$	316	209.4	57.6 ?
uranyl magnesium acetate	$\text{UO}_2\text{Mg}(\text{CH}_3\text{COO})_4$	530	351.1	96.6 INSOL
uranyl zinc acetate	$\text{UO}_2\text{Zn}(\text{CH}_3\text{COO})_4$	571.1	378.4	104.1 INSOL
sodium diuranate	$\text{Na}_2\text{U}_2\text{O}_7$	634	210.0	57.8 INSOL
ammonium diuranate	$(\text{NH}_4)_2\text{U}_2\text{O}_7$	624.1	206.7	56.8 ?

### References:

1. [http://www.nchps.org/nuclide\\_information\\_library.htm](http://www.nchps.org/nuclide_information_library.htm)
2. Radiation Safety Act WA 1975 and Radiation Safety (General) Regulations 1983
3. Dose Coefficients for Intakes of Radionuclides by Workers, Annals of the ICRP Publication 68, 1994