GE Healthcare

working with sulfur-35 safely

Radioactive half-life $T_{1/2}$	87.5 days
Principal emission	0.168 MeV beta (maximum)
Monitoring for contamination	Thin end-window beta detector
Biological monitoring	Urine samples
20 mSv annual limit on intake by inhalation	1.5×10^7 Bq (~ 0.4 mCi)
Shielding required	1-cm perspex/plexiglas. Although thinner shielding is adequate to reduce dose, it does not have good mechanical properties.

Special considerations

- Vials should be opened and used in ventilated enclosures.
- Avoid the generation of sulfur dioxide or hydrogen sulfide, which could be inhaled.
- Radiolysis of ^{35}S-labelled amino acids may lead to the production of labelled volatiles that could contaminate internal surfaces and reaction vessels.
- Always follow the ten golden rules.

Half-life 87.5 days

	-9	-8	-7	-6	-5	-4	-3	-2	-1	0
	1.074	1.065	1.057	1.049	1.040	1.032	1.024	1.016	1.008	1.000
days	1	2	3	4	5	6	7	8	9	10
	0.992	0.984	0.977	0.969	0.961	0.954	0.946	0.939	0.931	0.924
days	11	12	13	14	15	16	17	18	19	20
	0.917	0.909	0.902	0.895	0.888	0.881	0.874	0.867	0.860	0.854
days	21	22	23	24	25	26	27	28	29	30
	0.847	0.840	0.833	0.827	0.820	0.814	0.807	0.801	0.795	0.789
days	31	32	33	34	35	36	37	38	39	40
	0.782	0.776	0.770	0.764	0.758	0.752	0.746	0.740	0.734	0.728
days	41	42	43	44	45	46	47	48	49	50
	0.723	0.717	0.711	0.706	0.700	0.695	0.689	0.684	0.678	0.673
days	51	52	53	54	55	56	57	58	59	60
	0.668	0.662	0.657	0.652	0.647	0.642	0.637	0.632	0.627	0.622
days	61	62	63	64	65	66	67	68	69	70
	0.617	0.612	0.607	0.602	0.598	0.593	0.588	0.584	0.579	0.574
days	71	72	73	74	75	76	77	78	79	80
	0.570	0.565	0.561	0.557	0.552	0.548	0.543	0.539	0.535	0.531
days	81	82	83	84	85	86	87	88	89	90
	0.526	0.522	0.518	0.514	0.510	0.506	0.502	0.498	0.494	0.490
days	91	92	93	94	95	96	97	98	99	100
	0.486	0.483	0.479	0.475	0.471	0.468	0.464	0.460	0.457	0.453

The data provided is general information that gives a basic understanding of radiation safety. You must however consult your local radiation safety expert to ensure that you comply with all national regulations and local rules. All numbers are taken from The Radionuclide and Radiation Protection Data Handbook 2002, Radiation Protection Dosimetry, Vol 98(1), Nuclear Technology Publishing, (2002).

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10 golden rules

rule	other considerations
1. Understand the nature of the hazard and get practical training.	Never work with unprotected cuts or breaks in the skin, particularly on the hands or forearms. Never use any mouth-operated equipment in any area where unsealed radioactive material is used. Always store compounds under the conditions recommended. Label all containers clearly, indicating nuclide, compound, specific activity, total activity, date, and name of user. Containers should be properly sealed.
2. Plan ahead to minimize time spent handling radioactivity.	Carry out a dummy run without radioactivity to check your procedures (the shorter the time, the smaller the dose).
3. Distance yourself appropriately from sources of radiation.	Doubling the distance from the source quarters the radiation dose (The Inverse Square Law).
4. Use appropriate shielding for the type of radiation.	1-cm perspex/plexiglas will stop all beta particles but it is important to be aware of Bremsstrahlung from high-energy beta-emitters. Use suitable thickness of lead or lead acrylic shielding for X-ray and γ emitters.
5. Contain radioactive materials within defined work areas.	Always keep active and inactive work separated as far as possible, preferably by maintaining rooms used solely for radioactive work. Always work over a spill tray within a ventilated enclosure. These rules may be relaxed for small (a few tens of kBq) quantities of ^{3}H-, ^{35}S-, ^{33}P-, ^{14}C-, and ^{125}I-labelled compounds in a non-volatile form in solution.
6. Wear appropriate protective clothing and dosimeters.	Laboratory overalls, safety glasses, and surgical gloves must be worn at all times. However, beware of static charge on gloves when handling fine powders. Local rules will define which dosimeters should be worn (e.g. body film badge or thermo-luminescent extremity dosimeter for work with high energy beta-emitters).
7. Monitor the work area frequently for contamination control.	In the event of a spill follow the prepared contingency plan: i. Verbally warn all people in the vicinity ii. Restrict unnecessary movement into and through the area iii. Report the spill to the Radiation Protection Supervisor/Adviser iv. Treat contaminated personnel first v. Follow clean-up protocol.
8. Follow the local rules and safe ways of working.	Do not eat, drink, smoke, or apply cosmetics in an area where unsealed radioactive substances are handled. Use paper wipes and dispose of them appropriately. Never pipette radioactive solutions by mouth. Always work carefully and tidily.
9. Minimize accumulation of waste and dispose of it by appropriate routes.	Use the minimum quantity of radioactivity needed for the investigation. Disposal of all radioactive waste is subject to statutory control. Be aware of the requirements and use only authorized routes of disposal.

imagination at work

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