

Abr.: epid. (epidermal), i.amn. (intraamnial), i.br. (intra broncheal), i.d. (intra dermal), ih (inhalative), i.m. (intra muscular), i.p. (intra peritoneal), i.pl. (intra pleural), i.tr. (intra tracheal), i.v. (intra venous), p.o. (peroral), s.c. (subcutaneous), w.b. (whole body exposure), i.c. (intra corneal), i.ca. (intra cardiacal)

APPENDIX 2

Literature evaluated

In vivo Studies with Beryllium metal

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
Be metal	influence of inhalative exposure (initial lung burden) on clearance of radiolabelled Sr-particles from the lung and histopathology of the lung/ cell populations in broncheo-alveolar-lavage cells	rat	ih	n.a.	Finch et al.	1993	4
Be metal	mortality, histopathology of the lung and carcinogenesis after inhalative exposure (initial lung burden)	rat	ih	936	Finch et al.	1994	4
Be metal	lung clearance, histopathology and broncheo-alveolar-lavage cell stimulation after single (initial lung burden) inhalative exposure (1 year observation)	rat	ih	170	Finch et al.	1994b	2
Be metal	whole-body retention and abnormalities in broncheo-alveolar-lavage fluid after single (initial lung burden) inhalative exposure	rat	ih	n.a.	Finch et al.	1994c	4
Be metal	influence of inhalative exposure (initial lung burden) on lung clearance of plutonium and mortality	rat	ih	2856	Finch et al.	1990	2
Be metal	influence of inhalative exposure (initial lung burden) on clearance of radiolabelled Sr-particles from the lung	rat	ih	n.a.	Finch et al.	1991	4
Be metal	chronic inflammation in lung/carcinogenesis (life-time study)	rat/mouse	ih	928	Finch et al. / C 1	1996	2
Be metal	lung toxicity after acute inhalation exposure (up to 350 d)	mouse	ih	234	Finch et al. / C 2	1998	2
Be metal	carcinogenicity after acute inhalation exposure (life-time study, until only 10% survivors)	mouse (p53 KO)	ih	170	Finch et al. / C 10	1998a	2

Be metal	lung toxicity after acute inhalation exposure (up to 171 days)	rat	ih	128	Haley et al. / C 3	1990	2
Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
Be metal	carcinogenesis after single local injection (2 years after exposure)	rat	i.m, i.pl.	40	Hueper et al.	1954	3
Be metal	absorption/excretion, mortality, carcinogenesis and K-ras activity after single inhalative exposure	mouse (2 strains)	ih	416	Nikula et al.	1995	4
Be metal	Inflammatory response in lung after acute inhalation exposure (6 months after exposure)	mouse	ih	86	Nikula et al. / C 15	1997	2
Be metal	carcinogenesis and K-ras, c-raf-1 and p53 protein expression/gene mutation in tumor tissue after single inhalative exposure	rat	ih	120	Nickel-Brady et al.	1994	4
Be metal	p53 protein expression in tumor tissue obtained from carcinogenicity study	rat	ih	n.a.	Belinsky et al.	1994	4
Be metal	K-ras and p53 protein/gene expression in tumor tissue obtained from carcinogenicity study	rat	ih	24 tumors	Belinsky et al.	1997	4
Be metal / BeCu metal	particle clearance from lung and histopathology after single intratracheal administration (up to 28 days observation)	mouse	i.tr.	224	Benson et al. / C 16	2000	2
Be metal, BeO	pulmonary toxicity of metal/500°C BeO after intratracheal application (up to 90 d observation)	monkey	i.br.	14	Haley et al.	1994	2
Be metal, BeO, BeF ₂ , BeCl ₂	(article in Russian, abstract in English) carcinogenesis after single intratracheal or single/multiple inhalative exposure; difference due to calcination temperature of BeO	rat	i.tr., ih		Litvinov et al.	1983	
Be metal, BeF ₂ , Be(OH) ₂ , BeO, Be Carbide, Be Phosphate, Be Silicate, BeSO ₄	carcinogenicity, histopathology, pulmonary retention and clinical biochemistry after exposure	rat, guinea pig, rabbit, dog, monkey	i.tr., ih, s.c., i.p., i.v., i.ca.	n.a.	Schepers et al.	1961	4
Be metal, Be(OH) ₂ , Be alloys	carcinogenicity after single intratracheal application (up to 18 months observation)	rat	i.tr.	460	Groth et al. / C 11	1980	2

Be metal, Be Carbonate, BeSO ₄ , BeF, Be Citrate	(article in Italian) ocular lesions upon intracorneal injection	rabbit	i.c.		Ferraris et al.	1952	
Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
Be metal, BeF ₂ , BeSO ₄ , BeCl ₂ , Be(NO ₃) ₂ , BeO, Be benzenesulfate, Be oxalate	human skin patch test on occupationally exposed individuals and non-exposed volunteers	human	epid.	29	Curtis et al.	1951	3
Be metal, BeSO ₄ , CuBe Alloy	skin sensitization (Magnussen-Kligman): induction with BeSO ₄ , challenge with Be-Alloy	guinea pig	i.d./epid.	30	Zissu et al.	1996	3

In vitro Studies with Beryllium metal

Compound	Endpoint Investigated	cell type	First Author / Summary No.	Year	Klimisch Score
Be metal	cytotoxicity after exposure to particulate beryllium and dependence on the particle size	rat pulmonary alveolar macrophages	Finch et al.	1991	2
Be metal, BeSO ₄	cytotoxicity	hamster ovary (CHO), rat lung (LEC) cells	Brooks et al.	1987	4
Be metal, BeO, BeSO ₄	cytotoxicity	hamster ovary (CHO), rat lung (LEC) cells	Finch et al.	1988	3

In vivo studies with Beryllium compounds

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
Be(OH) ₂	lung retention and immunological reaction after intravenous exposure to Beryllium hydroxide in or without combination with antigens	sheep	i.v.	n.a.	Hall et al.	1984	4
Be(OH) ₂	tissue distribution and lymph node proliferation after subcutaneous injection	sheep	s.c.	n.a.	Hall et al.	1984b	4
BeO	histopathology of the lung after 3 acute exposures (monthly intervals; observation period 2 years)	monkey, dog	ih	5 6	Conradi et al.	1971	4
BeO	(article in Japanese, abstract in English) carcinogenesis after repeated (15 exposures) intratracheal administration (life-time observation)	rat	i.tr.	30	Ishinishi et al.	1980	3
BeO	(article in Polish) osteosarcoma after intravenous exposure	rabbit	i.v.	20	Kommitowski et al.	1967	
BeO	(article in German, abstract in English) bone tumor formation with lung metastases after intraossal implantation	rabbit	intraossal	20	Kommitowski et al.	1974	4
BeO	(article in Japanese, abstract in English) carcinogenesis after intrafemoral implantation of hydroxymethylcellulose-BeO-pellets (56 weeks observation)	rabbit	intraossal	30	Hiruma et al.	1991	3
BeO	histopathology, body weights, hematology and blood biochemistry after single bolus thoracic infusion	guinea pig	thoracic infusion		Shima et al	1983	3
BeO	histopathology after single intratracheal injection	rat	i.tr.	23	Davies et al.	1950	4
BeO	immunoreactions (skin sensitization, immunocompetent cell population determination) after single intratracheal exposure; strain-specific responses	guinea pigs (2 strains)	i.tr.	12 / strain	Barna et al.	1984a and b	4
BeO	histopathology after single intratracheal injection (up to 120 days observation)	guinea pig	i.tr.	30	Chiappino et al.	1969	4

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
BeO	effect of reproduction/ lactation on lung toxicity after single intratracheal administration (up to 15 months observation)	rat	i.tr.	206	Clary et al.	1975	3
BeO	carcinogenesis in rabbits after intravenous acute exposure (up to 1 year)	rabbit	i.v.	9	Dutra et al.	1950	3
BeO	(article in Japanese, Title in English) tumor formation after exposure	rabbit			Araki et al.	1954	
BeO	morphological detailed description of a tumor observed in a rabbit after repeated (11 months) daily inhalative exposure (observation 17.5 months)	rabbit	ih	19	Dutra et al.	1951	3
BeO	absorption, distribution, excretion after acute inhalative exposure	dog	ih	n.a.	Finch et al. / C 14	1990	3
BeO	(abstract only) histopathology after inhalative exposure (initial lung burden) to high- and low temperature calcinated BeO (up to 22 months observation)	dog	ih		Haley et al.	1989	
BeO	lung toxicity after two inhalative exposures (up to 210 d)	dog	ih	20	Haley et al. / C 18	1992	2
BeO	histopathology after inhalative exposure (up to 369 h) to different grades of BeO (different post-exposure observation periods)	cat, dog, guinea pigs, rabbit, rat, monkey	ih	133	Hall et al.	1950	4
BeO	lung toxicity after acute inhalative exposure (up to 21 days)	rat	ih	4/group	Hart et al.	1984	3
BeO	lung toxicity/clearance after acute inhalative exposure (up to lifetime)	rat, hamster	ih	535	Sanders et al./ C 19	1975	2
BeO	skin sensitization with dermal induction/intradermal challenge	guinea pig	epid./i.d.	30	Chiappino et al.	1969	4
BeO	lung clearance of other particles and lung carcinogenesis after single inhalative exposure (observation 625 to 850 days)	rat	ih	303	Sanders et al.	1978	2

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
BeO, BeCl ₂	(article in Polish, title and keywords in English) effect on reproductive performance and offspring development	rat			Selivanova et al.	1986	
BeO, BeCl ₂	(article in Russian, abstract in English) carcinogenesis and histopathology after chronic inhalative exposure	rat	ih	640	Litvinov et al.	1984	
BeO, BeSO ₄	immune cell stimulation in broncho-alveolar-lavage cells upon single intratracheal exposure after preimmunisation	mouse	i.m./i.tr.	80	Huang et al.	1992	3
BeO, BeSO ₄	histopathology of the lung upon chronic inhalative exposure or three intratracheal injections	rat	ih, i.tr.	30	Vorwald et al.	1959	4
BeO, Be SO ₄ , BeF ₂	blood clinical chemistry and uric acid/creatinine excretion after repeated (35 days) inhalative or single intravenous exposure	dog	i.v., ih	10	Spiegl et al.	1953	4
BeO, Be Phosphate, ZnBe Silicate	primary bone tumors with metastases into lung, mortality and histopathology after single intravenous exposure to suspensions of the barely soluble compounds	rabbit	i.v.	19	Hoagland et al.	1950	4
Be ores	lung toxicity/carcinogenesis under daily inhalation exposure (up to 28 months)	monkey, rat, hamster	w.b. ih	n.a.	Wagner et al.	1969	3
⁷ BeCl ₂	whole body retention of radiolabel after single intravenous or peroral administration	dog	i.v. / p.o.	4	Richmond et al.	1964	4
⁷ BeCl ₂	whole body retention of radiolabel after single intravenous or intraperitoneal administration	rat	i.v. / i.p.	24	Richmond et al.	1965	4
⁷ BeCl ₂	body retention and blood cell/serum distribution of retained radiolabel after single intravenous exposure	mouse	i.v.	n.a.	Sakaguchi et al.	1988	4
⁷ BeCl ₂	tissue distribution after single or repeated exposure (different routes)	rat	i.v., s.c., i.m., i.p., i.tr.	75	van Claeve et al.	1953	4
⁷ BeCl ₂	(only title and keywords) effect on carrier on distribution after intratracheal exposure	rat	i.tr.		Kuzntsov	1974	
BeCl ₂	(only title and keywords) distribution / retention and lung toxicity after inhalative exposure	guinea pig	ih		Hart et al.	1980	

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
BeCl ₂	hematopoiesis-related enzyme activity in the blood and spleen of pregnant mice after subcutaneous exposure	rat	s.c.	29	Sakaguchi et al.	1996	4
BeCl ₂	skin sensitization (Magnussen-Kligman): induction with BeSO ₄ , challenge with Be-Alloy	guinea pig	i.d./epid.	40	Bomann et al.	1979	4
BeCl ₂	absorption, distribution and excretion after single intravenous exposure	rat	i.v.	n.a.	Klemperer et al.	1952	4
BeCl ₂	mortality and enzyme activity in blood and tissues after single intraperitoneal administration	rat, guinea pig	i.p.	116 72	Cochran et al.	1951	4
BeCl ₂	absorption, distribution and excretion after single peroral or intravenous exposure	mouse, rat, monkey, dog	p.o. , i.v.	n.a.	Furchner et al.	1993	2
BeCl ₂	distribution and placental penetration after single intravenous injection	mouse	i.v.	28-36	Bencko et al.	1979	3
BeCl ₂	organ distribution and excretion (bile, faeces, urine) after single intravenous application	rat	i.v.	12	Cikrt and Bencko	1975	3
BeCl ₂	(only title) teratogenicity	chicken			Puzanova et al.	1978	
BeCl ₂	histopathology and enzyme activity in liver after single intraperitoneal exposure	rat	i.p.	45	Malendowicz	1966	3
⁷ BeCl ₂ , BeSO ₄ , Be Citrate, Be phosphate	tissue distribution and alpha-fetoprotein production after intravenous exposure to particulate Be salts	mouse/rat	i.v.	10 / 10	Vacher et al.	1974	4
⁷ BeCl ₂ , BeSO ₄ , Be Citrate, Be phosphate	skin sensitization and influence of the route of exposure on this parameter; elimination from skin	guinea pigs	i.v., i.d., i.p.	94	Vacher et al.	1972	2
⁷ BeCl ₂ , ⁷ BeF ₂	(article in Russian) organ distribution of Be after exposure by different routes	rat			Bugryshev et al.	1984	
Be (NO ₃) ₂	influence of two chelating agents on beryllium distribution and liver toxicity after repeated (21 days daily) oral exposure	rat	p.o.	24	Flora et al.	1995	3
Be (NO ₃) ₂	histopathology and enzyme activity in lung after dietary exposure (25 doses)	rat	in-feed	10	Goel et al.	1987	3

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
Be (NO ₃) ₂	histopathology and enzyme activity in lung after dietary exposure (40 doses)	rat	p.o.	12	Goel et al. / C 12	1980	3
Be (NO ₃) ₂	(only abstract) influence of chelation/antioxidant therapy on clinical chemistry, hepatic peroxidation and metal burden in organs after blood parameters after intramuscular bolus exposure	rat			Johri et al.	2002	
Be (NO ₃) ₂	influence of chelation/antioxidant therapy on clinical chemistry, hepatic peroxidation and metal burden in organs after blood parameters after intramuscular bolus exposure	rat	i.m./i.tr.	65	Johri et al. / C 17	2004	2
Be (NO ₃) ₂	influence of an ayurvedic medicine on histopathology and enzyme activity of reproductive female organs after single intravenous exposure	rat	i.v.	24	Mathur et al.	1989	3
Be (NO ₃) ₂	influence of chelation/antioxidant therapy on enzyme activity and organ peroxidation in kidney and liver after repeated (28 days) intraperitoneal exposure	rat	i.p.	35	Mathur et al. / C 13	2004	3
Be (NO ₃) ₂	effects on maternal and fetal toxicity by intravenous exposure of pregnant rats on day 14, 16, 18 and 20 post coitum	rat	i.v.		Mathur et al.	1994	2
Be (NO ₃) ₂	influence of chelation/antioxidant therapy on organ enzyme activity, hepatic peroxidation and metal burden in organs after blood parameters after intraperitoneal bolus exposure	rat	i.p.	24	Mathur et al.	1994a	3
Be(NO ₃) ₂	(only title and keywords) lung effects after single intradermal exposure	guinea pig	i.d.		Levy et al.	1961	
Be (NO ₃) ₂	influence of an ayurvedic medicine on organ histopathology and clinical biochemistry after single intravenous exposure	rat	i.v	60	Mathur et al.	1994b	3
Be (NO ₃) ₂	influence of dietary plant leave administration on blood glucose after single intravenous exposure	rat	i.v	40	Prakash et al.	1986	3

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
Be (NO ₃) ₂	influence of chelation/antioxidant therapy on organ enzyme activity, hepatic peroxidation and metal burden in organs after single intramuscular exposure	rat	i.m	20	Sharma et al.	2000	3
Be (NO ₃) ₂	influence of chelation therapy on fetotoxicity after single intramuscular exposure	rat	i.m	18	Sharma et al.	2002	3
Be (NO ₃) ₂	influence of chelation therapy on clinical chemistry parameters and tissue (organs/reproductive organs) enzyme activity after repeated (daily for 21 days) intraperitoneal exposure	rat	i.p.	35	Shukla et al.	1998	3
Be (NO ₃) ₂	investigation on beryllium contents in blood and urine and lymphocyte stimulation of exposed humans and rats/guinea pigs exposed by inhalation	rat/guinea pig	w.b. ih	10 10	Stiefel et al.	1980	3
Be phosphate	electron microscopic investigation of the liver after intravenous exposure to beryllium phosphate particles	rat	i.v.	36?	Dinsdale et al.	1982	3
Be phosphate	electron microscopic investigation of the liver after intravenous exposure to beryllium phosphate particles with or without administration of colloidal carbon	rat	i.v.	n.a.	Dinsdale et al.	1981	3
Be SO ₄	carcinogenicity after inhalative exposure; EXPOSURE TO OTHER CARCINOGENIC COMPOUNDS IN ADDITION	monkey	ih	12	Vorwald et al.	1968	3
Be SO ₄	blood kinetics after single intravenous administration	rat	i.v.	49	Vacher et al.	1968	4
Be SO ₄	absorption, distribution and excretion after single intravenous exposure	rat	in drinking water	12	Reeves et al.	1965	2
Be SO ₄	in vivo micronucleus assay in mice after single oral exposure and lung carcinogenesis in strain A mice after repeated (3 per week, 2 weeks) intraperitoneal exposure	mouse	p.o. i.p.	65	Ashby et al. / B3, C 4	1990	2
Be SO ₄	skin sensitization (Local Lymph node assay)	mouse	epid.	4	Basketter et al. / C 5	1999	2

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
Be SO ₄	carcinogenicity and chronic toxicity upon life-span dietary administration	rat	in-feed	52	Schroeder et al.	1975	2
Be SO ₄	lymphocyte transformation test for sensitization, broncho-alveolar-lavage cell populations and organ histopathology (lung, spleen, kidney) after single intratracheal exposure	mouse	i.tr.	21	Burdon et al.	1997	3
Be SO ₄	toxicity to fish upon acute exposure	perca fluviatilis, rutilus rutilus	in water	n.a.	Jagoe et al.	1993	3
Be SO ₄	skin sensitization/lymphocyte stimulation upon repeated (twice weekly for 6 weeks) intradermal exposure	rabbit	epid.	94	Kang et al. / C 20	1977	2
BeSO ₄ , BeCl ₂ , BeF	(article in Japanese, abstract in English) excretion of radiolabelled material and sensitization in footpad- and macrophage migration inhibition test after subcutaneous exposure	mouse	i.d		Sakaguchi et al.	1983	
Be SO ₄	acute toxicity to Daphnia magna	Daphnia	in water	n.a	Khangerot et al. / C 6	1989	2
Be SO ₄	21 day earthworm reproduction test, 28 day enchytraeid reproduction test and the 28 day collembola reproduction test	eisenia fetida, enchytraeus crypticus, folsomia candida	in soil	n.a	Kuperman et al. / C 7a, b, c	2006	2
Be SO ₄	acute toxicity to birds after single intravenous exposure	pigeons and chicks	i.v.	26	Pham et al.	1966	3
Be SO ₄	(only title and keywords) embryonic development and RNA-synthesis	lymnaea			Bose et al.	1973	

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
7 Be SO ₄ , 7Be Phosphate	selective uptake into and toxicity to liver cell populations (parenchymal/non-parenchymal)	rat	i.v.	n.a.	Skilleter et al.	1985	4
Be SO ₄	histopathological and ultrastructural abnormalities in the liver of normal and hepatectomized rats after single intravenous administration	rat	i.v.	36	Goldblatt et al.	1973	4
Be SO ₄	histopathology (inflammatory and proliferative response) after daily inhalative exposure (72 weeks)	rat	ih	300	Reeves et al. / C 8	1967	2
Be SO ₄	lactate dehydrogenase activity in different lung fractions after daily inhalative exposure (72 weeks)	rat	ih	n.a.	Reeves et al.	1967	4
Be SO ₄	accumulation/excretion of beryllium in/from lung after daily inhalative exposure (72 weeks)	rat	ih	300	Reeves et Vorwald	1967	2
Be SO ₄	cardiovascular toxicity (telemetry) upon intratracheal exposure	dog	i.tr.	n.a.	Pham et al.	1970	4
Be SO ₄	influence of intraperitoneal iron treatment on mortality after repeated (2h/d, 14 d) inhalative exposure	rat	ih	40	Sendelbach and Witschi	1987	3
Be SO ₄	histopathology and cell proliferation by thymidine uptake (up to 21 days) after single inhalative exposure	rat/mouse	ih	36 40	Sendelbach et al.	1986	3
Be SO ₄	histopathology in lung, cell proliferation by thymidine uptake and enzyme activity in brocheo-alveolar-lavage fluid one year after single inhalative exposure	rat	ih	24-32	Sendelbach et al.	1989	3
Be SO ₄	(only title and keywords) effect of exposure on blood volume and blood cell stimulation	rabbit			Mosser et al.	1970	
Be SO ₄	acute toxicity to fish	guppy	in water	n.a.	Slonim et al. / C 9	1973	2
Be SO ₄	acute toxicity to salamander larvae	A. opacum, A. maculatum	in water	380	Slonim et al.	1975	2
Be SO ₄	weight change, mortality and histopathologic damage in lung after repeated (alternate-daily, 1month) inhalative exposure	rat	ih	80	Stokinger et al.	1950	3

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
Be SO ₄	mouse ear swelling test in different HLA-DPB01 transgenic mice	mouse	epid.	n.a.	Tarantino et al.	2005	3
Be SO ₄	histopathology of lung and immune cell stimulation induced by single intratracheal administration after subcutaneous sensitization	rat	s.c. / i.tr.	n.a.	Votto et al.	1987	3
Be SO ₄	(only abstract) effect of exposure in drinking water on body weight and nervous system	rat	in water		Freundt et al.	1990	
	mortality, histopathology and carcinogenicity upon inhalative (up to 18 months) exposure	rat	ih	275	Schepers et al.	1957	2
Be SO ₄	influence of intravenous exposure on DNA-repair in regenerating liver after partial hepatectomy	rat	i.v.	35	Witschi et al.	1970	3
Be SO ₄ , BeF ₂ , Be Phosphate	symptomatic, mortality and lung histopathology upon inhalative (up to 30 days) exposure (observation up to 300 days)	monkey	ih	20	Schepers et al.	1964	4
BeF ₂	(only title and keywords) acute inhalation toxicity				Stokinger et al.	1953	
BeF ₂	skin sensitization and its strain-specificity after dermal application	guinea pig (2 strains)	epid.	n.a.	Turk et al.	1969	4
7Be Citrate	excretion and blood concentration after single intravenous administration	rabbit	i.v.	6	Underwood et al.	1952	4
7Be Carbon	adsorption, distribution and excretion of radiolabel from weanlings and aged mice after single oral administration of radio-Be	mouse	p.o.	100	LeFevre et al. / C 21	1986	2
Na ₂ BeF ₄	(article in Japanese, Title and figures in English) mortality and histopathological changes in mice after single intraperitoneal exposure	mouse	i.p.		Nomiyama et al.	1978	
Be-sulphosalicylate	effect of intravenous exposure at LD50 dose on enzyme induction in liver triggered by inducer	rat	i.v.	50	Ord et al.	1981	3
ZnBe Silicate	osteosarcoma-formation and metastases after intravenous exposure to suspensions	rabbit	i.v.	10	Janes et al.	1954	3
ZnBe Silicate	(only abstract) osteosarcoma after intraosseal injection	rabbit	intraossal		Mazabraud et al.	1975	

Compound	Endpoint Investigated	Animal Species	Route of Administration	Number of animals used	First Author / Summary No.	Year	Klimisch Score
ZnBe Silicate	(only title and keywords) lung toxicity after intratracheal exposure	guinea pig	i.tr.		Levy et al.	1965	
ZnBe Silicate	osteosarcoma-formation and metastases after intravenous exposure to suspensions (observation 120 weeks)	rabbits	i.v.	57	Barnes et al.	1957	3
ZnBe Silicate	a tumor induced by intravenous exposure was transplantable into the eyes of other rabbits	rabbits	i.v.	20	Higgins et al.	1964	4
ZnBe Silicate	primary bone tumors with metastases into lung after single intraossal administration of suspensions	rabbits	intraossal	12	Tapp et al.	1966	4
ZnBe Silicate, Be Silicate	bone tumors after intravenous exposure	rabbits	i.v.	n.a.	Sissons et al.	1950	4
"soluble Be compounds"	(only title and keywords) absorption through injured skin	rat	epid.		Ivannikow et al.	1982	
n.a.	(article in Russian, abstract in English) organ distribution of Be after exposure by different routes	rat	i.v., i.p., i.tr		Bugryshev et al.	1976	
n.a.	influence of calcium content of diet on dietary beryllium-induced mortality and body mineral concentrations	Achatina	p.o.	40	Ireland	1986	3
n.a.	histopathology of embryos after single intraamniac exposure	chicken	i. amn.	n.a.	Puzanova	1980	3
n.a.	(article in Japanese, abstract in English) influence of subcutaneous exposure on blood coagulation/hematopoiesis parameters; skin sensitization by dermal exposure after subcutaneous immunization	mouse	s.c./epid.		Sakaguchi et al.	1998	
n.a.	(article in Russian) kinetics, distribution and excretion	rat, dog			Zhuravlyev et al.	1974	

In vitro studies with Beryllium compounds

Compound	Endpoint Investigated	cell type	First Author / Summary No.	Year	Klimisch Score
BeO	cytotoxicity and in vitro cell transformation	rabbit embryo fibroblasts	Kommitowski et al.	1973	4
BeO, BeSO ₄	(only abstract) cytotoxicity and biochemical enzyme activity after exposure	rabbit alveolar macrophages	Kang et al.	1979	
7BeO, 7BeSO ₄	cellular localisation of particulate or ionic Be	dog broncho alveolar lavage cells	Eidson et al.	1991	4
BeO, BeCl ₂ , Be(NO ₃) ₂	rec-assay, Ames test with preincubation and sister chromatide exchange assay	bacillus subtilis, E. coli (2 strains) / V79	Kuroda et al. / B 6a, b, c	1991	4
BeO, Be-sulphosalicylate	lymphocyte (normal or Be-sensitized in vivo) proliferation in vitro in response to beryllium compound treatment	guinea pig lymphocytes	Jones et al.	1975	4
BeO, BeSO ₄	cytotoxicity	dog broncho alveolar lavage cells	Finch et al.	1988	3
BeO, BeCl ₂ , Be(NO ₃) ₂	rec-assay, Ames test and sister chromatide exchange assay	Salmonella sp., V79	Endo et al.	1991	4
BeCl ₂	cytotoxicity	human carcinoma (KB), human embryonic lung (HEL-R66), dog kidney (MDCK), monkey kidney (VERO)	Mochida et al.	1986	4
BeCl ₂	influence of exposure on calcium uptake and signalling	primary mouse peritoneal macrophages	Misra et al.	1999	4
BeCl ₂	cytotoxicity	HeLa-S3, Vero, HEL-R66	Sakaguchi et al.	1984	4
BeCl ₂	influence on fidelity of DNA synthesis and DNA-binding	no cells	Sirover et al.	1976	2
BeCl ₂	influence on vascular wall and platelet reactivity	bovine Aorta (isoorgan) /human platelets	Togna et al.	1997	4
BeCl ₂	bacterial gene mutation (plate incorporation)	E. coli	Zakour et al.	1984	4
Be SO ₄	Ames test, chromosome aberration	S. typhimurium, hamster lung cells (CHL)	Ashby et al. / B 1 / B2	1990	2

Compound	Endpoint Investigated	cell type	First Author / Summary No.	Year	Klimisch Score
Be SO ₄	cytotoxicity, cell cycle and chromosome aberration	CHO/LEC	Brooks et al.	1989	4
Be SO ₄	carcinogenicity (cell transformation in vitro)	syrian hamster embryo cells	Fritzenschaf et al.	1993	4
Be SO ₄	carcinogenicity (cell transformation in vitro)	syrian hamster embryo cells, BALB-3T3 cells, Rauscher Murine Leukemia Virus-Infected Fisher 344 Rat Embryo Cells	Dunkel et al.,	1981	2
Be SO ₄	activation of transcription factor and interleukin-stimulation	mouse macrophages (H69.12j)	Hamada et al.	2000	4
Be SO ₄	in vitro cell transformation and transplantation of transformed cells into mice; gene expression profiling of transformed cells	mouse 3T3	Joseph et al.	2001	4
Be SO ₄	cytotoxicity, in vitro cell transformation and transplantation of transformed cells into mice; mRNA- and protein expression of oncogenes in transformed cells	mouse 3T3	Keshava et al.	2001	4
Be SO ₄	cytotoxicity, DNA-synthesis and influence on stimulated proliferation	mouse spleen cells	Price et al.	1985	4
Be SO ₄	cytotoxicity, DNA-synthesis and influence on stimulated proliferation	mouse splenocytes	Price et al.	1986	4
Be SO ₄	Be-lymphocyte proliferation test in broncho-alveolar lavage cells from chronic beryllium disease patients; induction of TNF- α production and apoptosis in macrophage cell lines	mouse macrophages (H69.12j, P388D.1), human CBD BAL macrophages (DEOHS-1)	Sawyer et al. / B 4	2000	2
Be SO ₄	cytotoxicity, mRNA- and protein expression of TNF- α	mouse macrophages (H36.12a,b,d,e,j, P388D.1, RAW264.7, J774A.1), human monocytes/histiocytic lymphoma cells (THP-1, U937)	Sawyer et al. / B 5	2000a	2
Be SO ₄	cell cycle arrest upon exposure	rat liver cell line (BL9L)	Skilleter et al.	1983	4

Compound	Endpoint Investigated	cell type	First Author / Summary No.	Year	Klimisch Score
Be SO ₄	cell cycle analysis after exposure	rat liver cell line (BL9L)	Skilleter et al.	1991	4
Be SO ₄ , Be Phosphate	uptake of radio-Be into selective population of liver cells	rat primary liver cells	Skilleter et al.	1985	4
Be SO ₄ , Be (NO ₃) ₂	Ames -Test (plate incorporation and fluctuation)	S. typhimurium (5 strains), E. coli (1 strain)	Arlauskas et al.	1985	4
⁷ Be SO ₄ , Be-sulphosalicylate	cytotoxicity and uptake	rat liver cells (ARL)	Skilleter et al.	1979	2
Be ⁺⁺ Ion beam	cytotoxicity	V79	Scampoli et al.	2001	4
	(article in Russian, abstract in English) DNA-repair	E. coli	Dylevoi	1990	
"Beryllium and other potentially genotoxic agents"	chromosomal aberration and sister chromatic exchange; WORKERS EXPOSED TO SEVERAL CHEMICALS IN ADDITION TO BERYLLIUM	humane lymphocytes from workers	Garry et al.	1989	3
"forms of beryllium in a beryllium plant"	in vitro lymphocyte proliferation in response to BeSO ₄ (in vitro BeLPT)	humane lymphocytes from workers	Kreiss et al.	1989	3
⁷ Be-sulphosalicylate	Be binding to lymphocytes of guinea pigs with or without prior sensitization; binding of Be to lymphocytes from non-sensitized humans	guinea pig lymphocytes (3 strains), human lymphocytes	Skilleter et al.	1984	4
	(only abstract) DNA-misincorporation (isolated enzyme)	no cells	Luke et al.	1975	
	(only title) uptake into cells	alveolar macrophages	Hart et al.	1980	
	(only title) cytotoxicity	human lung fibroblasts	Hart et al.	1982	