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WORLD MINE TAILINGS FAILURES

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NOTICE & DISCLAIMER

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The magnitude index (Col c) indicates the overall scale of an event based on its release, runout and deaths. The index base is the decade 1991 to 2000. The score for each component is the unweighted ratio of the event measure to the average measure for the reference decade

The severity codes are based on but not excusively determned by criterion values for release,runout & deaths

										ICOLD INCIDENT CLASSIFICATIONS												ECONOMIC HISTORY AS OF FAILURE/EVENT											Magnitude Index Scores (act/ ref decade average)					INDEX BY SEVERITY CODE		
SEVERITY COLOR CODE	SEVERITY CODE	MAGNITUDE INDEX	LOCUS OF FAILURE	FACILITY & MINE DESCRIPTION	ORE TYPE	DAM TYPE	DAM FILL MATERIAL	DAM HEIGHT (meters)	STORAGE VOLUME (cu. meters)	Type Number	Type Key	Type Cause	Incident Number (see note)	INCIDENT YEAR	INCIDENT DATE	RELEASE (cu. meters)	RUNOUT (km)	DEATHS	SOURCES	NOTES		DEPOSIT TYPE	ORE TYPE	Est. Size (resource) Mtonnes	Cu, %	Au, ppm	CuEq, %	1st Prod	Est. Mill through-put to event, Mtonnes	Adverse Minerals			Release	Runout	Deaths	Overall		vser	ser	minor
				MINE/PROJECT & LOCATION																		ORE DEPOSIT DATA											P/PRAVG	Q/QRAVG	R/RRAVG	SUM AH:AJ		raw		
	1	27.96	1	Mina Córrego do Feijão,Ma#1 and Dam #6,Vale, Minas Gerais Brazil	FE			110		1	B			2019	25-Jan-19	12,000,000	8	300	see www.worldminetailingsfailures.org	a failure by static liquefaction after lingering in vukneerable condition for nealy a decade													6.33	0.21	21.43	27.96				
			2	Cerro Crona Mine, GoldFields, Cajamarca,Peru	Cu,Au	CL	R			2	A			2018	16-Dec-18			0	institucionales/oefa-supervisa-derrame-de-relaves-	seal of spring within the impoundment failed allowing taiings to flow into spring water		POR	Cu/Au					2008					0.00	0.00	0.00					
	3	0	3	Rosebery Mine 2 5 TSF,MMG,Tasmania,Australia	Zn/Cu/Au					1	A			2018	10-Oct-18			0	L. Bennett,The Advocate 10/25/2018 (42)	at drainage pond for newly commissined tsf overtopping due to heavy rains													0.00	0.00	0.00					
			1	Duke Energy,LV Sutton Power Station, Cape Fear North Carolina,unident1 of 3	Coal							OT		2018	20-Sep-18			0		at tsf identified as high risk and scheduled for statutorily required relocation of contents and closure hurricane floods overtopped& caused breach													0.00	0.00	0.00					
			1	Duke Energy,HF Lee Power Plant , Goldsboro, North Carolina, 3 ashponds submerged	Coal				304,750			OT		2018	xx-Sep-18			0	Waterkeeper Alliance Sept.19,2018(40); Knoblauch (41)	3 coal ash ponds holding 1 mllion tonnes collectively all inundated and leaking coal ash into Neuse Riveralso happened in 2016													0.00	0.00	0.00					
			1	Duke Energy,LV Sutton Power Station, Cape Fear North Carolina,unident2 of 3	Coal							OT		2018	13-Sep-18			0		at 1 of 3 unamed coal ashh ponds at LV Sutton													0.00	0.00	0.00					
	3			Antamok Mine , TSF#3 Itogon Benguet Mining Corp,Phillipines	AU					1	B			2018	18/Aug/18			0	Sun Star August 28,2018 (41)	Heavy rains caused a breach in the stopper boards of a penstock;2nd incident see 28 /Oct/16													0.23	0.67	0.36	1.26		0	1.255269891	
	2		1	Cineguita, Mexico	AU/AG					1	A			2018	5/Jun/18	439,000	26	5				POR	cu	1,400	0.34			2014					0.00	0.00	0.00	0.00				
	3	0	2	Caserones Copper Mine, Lumina Copper, Chile	CU					1	A			2018	20/Mar/18	15			Mining Weekly 04/04/2018	tailings spill shuts down processing $16n impairment;http://www.soychile.cl/Copiapo/Norte-Minero/2018/03/30/525147/Filtracion-de-relave-fino-en-Caserones-fue-de-15-metros-cubicos.aspx																				
				Huancapatí Áncash , Peru Compañía Minera Lincuna SA (Grupo Picasso),Tailings Dam # 3										2018	3/Mar/18	80,000			wise	the incident has contaminated crops, the Sipchoc creek and the Santa river													0.00	0.00	0.00	0.00		0	0	0
	3		1	Cadia, NSW Australia, (Newcrest Mining Ltd)	AU,CU					1	A	SI	-	2018	9/Mar/18				WISE, Bowker,LN [28]	broke through south dam of north compundment but in images materal is a slump fully contaned in so. dam. Interrupted operations briefly , appears to have no public consequence; owned ad operated by Vale until 2011 sale of its interest for $1.8bn to present owner Norsk Hydro. Long													0.00	0.00	0.00	0.00		0	0	0
			1	Barcarena, Pará, Brazil , Alunorte(Hydro Alu Norte/Norsk Hydro ASA)	Bauxite					1	A	OT		2018	17/Feb/18				WISE	see very strong language at WISE on company denials that OT ocurred and murder of an environmental activst; appears to be very signifcant event with high pulic consequences (environmental)													0.00	0.00	0.00	0.00		0	0	0
			1	Compartment 2 Hernic Platinum Project (ferrochrome) South Africa	PL					1	A	SI		2017	29/Dec/17				businesslive.co.za/story/?resource_id=SENSIN_20180105084900_18	compartment 2 was usd for final processing wastes from the feoorchrome facility; Breach sealed further repairs being undertaken. Links to tw reports in Portuguese			coal										0.00	0.00	0.07	0.07		0	0.071428571	0
	2	0.07	1	Kentucky Power & Light	coal					1				2017	5/Oct/17	-	0	1	mycarrollnews.com/content/tetra-tech-employee-dies-ash-pond-accident-ku	Tetra Tech employee workng as a contractor was killed in a slide of coal ash that was being removed from the ashpond t allow its re use			AU					2016												
	2	-	2	Kokoya Gold Mine,MNG Gold Mining Ltd,Monrovia,Liberia Avesoro Holding	AU	CL	WR		300,000	1	A	ST	-	2017	9/Sep/17	11,356			frontpageafricaonline.com/news/liberia-investigation-into-cyanide-spillage-finds-mng-gold-liable-of- http://thenewslib.com/mng-gold-contaminates-creek/polluting-bong-county/	failed to uphold international best practice in order to avert environmental pollution.failure of liner for CIL cyanide tainted tailings													1.38	0.00	0.00	1.38		1.384017003	0	0
	1	1.38		Vedanta Aluminium Limited Smelter Ash Pond, Jharsuguda, India	Al	U				1	A	U	-	2017	28/Aug/17	2,625,000			telegraphindia.com/1170908/jsp/odisha/story_171460.jsp	115 acres of agricultural land had been covered by ash layered around 0.5 metres to 3 metres. The officials have also found evidence of severe water pollution in the Bheden river.																				
	3		2	Husab, Namibia (Swakop Uranium (Taurus Minerals))	U					1	A			2017	7/Jul/17			0	namibian.com.na/166987/archive-read/Husab-tailings-facility-leaked-due-to-pump-failure	pump failure in commissioning caused overtopping initially denied by miner. Fully contained near perimter. No release onto unlined area													0.00	0.00	0.00	0.00		0	0	0.00045
	3	0.00	2	Highland Valley Copper, British Columbia, Canada (Teck Resources)	Cu		Sand	140		1	A			2017	8/Apr/17	850	0	0	at-mine; https://infotel.ca/newsitem/highland-valley-copper-tailings-water-leak-under-investigation/it41667	A 4.5-metre deep and six-metre wide trench down the face of the 140-metre high dam. Contaminated water collected ;water leak in pipe servicing TSF due to freezing. No production interruption or interruption in use of facilty													0.05	0.51	0.00	0.57		0	0.56554497	0
	2	0.57	1	Mishor Rotem, Israel (ICL Rotem)	P			60		1	A	SI		2017	30/Jun/17	100,000	20		Reuters 2Jul17,Bowker LN[25]	ICL reported that on June 30 a dike partially collapsed at Pool 3, used for " accumulation" of highly acidic waste water which "surged through a dry Ashalim riverbed .. left a wake of ecological destruction more than 20 km (12 miles) long."			Cu/ag/au	16.41	1.19			1971			annual report 2016		0.11	0.00	0.14	0.25		0	0.248306057	0
			3	Husab, Namibia (Swakop Uranium (Taurus Minerals))	U									2017	xx/May/17				https://www.namibian.com.na/166987/archive-read/Husab-tailings-facility-leaked-due-to-pump-failure	pump failure in commissioning caused overtopping initially denied by miner. Fully contained near perimter. release onto unlined area.																				
	2	0.25	1	Tonglvshan Mine, Hubei Province, China (China Daye Ltd.)	Cu Au Ag Fe					1	A			2017	12/Mar/17	200,000		2	WISE	A partial dam failure occurred " which flooded a fish pond downstream of approx. 27 hectares. Two persons were reported dead and one was reported missing"													0.03	0.00	0.00	0.03		0	0	0.02636
	3	0.03	1	Antamok, Baguio, Philippines (Benguet Corp.)	Au?					2	B	ST	-	2016	28/Oct/16	50,000			Antamok leak under control, Baguio Midland Courier Website, 6Nov16	tailings material leaked into Liang River during a typhoon													0.00	0.00	0.00	0.00		0	0	0
			1	Duke Energy Coal Ash Overt	coal				414,938	1	B	OT		2016	1/Oct/16				ecowatch.com/coal-ash-duke-energy-2053607683.html	Duke Energy on Norway Sovereign Wealth Fund blacklist for its history of severe environmental damage http://etikkradet.no/files/2017/05/Rec-Duke-Eng-17486.pdf													0.42	0.00	0.00	0.42		0	0.421795658	0
	2	0.42	1	New Wales plant, Mulberry, Polk County, Florida (Mosaic Co)	P					1	U	U	-	2016	27/Aug/16	800,000			WISE, WFLA.com	sinkhole appeared in a phosphogypsum stack, opening a pathway for contamined liquid into the underground.reached the Floridan Aquifer, a major drinking water resource.			Al										1.05	0.00	0.00	1.05		1.054489145	0	0
	1	1.05	4	Louyang Xiangjiang Wanji Aluminum, China	Al					1	A	SI	-	2016	10/Aug/16	2,000,000			AGU Landslide Blog 15Aug16, az-china.com 11Aug16	The southwest corner of its red-mud dam body was unsound had a landslide accident. dam was about 1.5km in length. (http://blogs.agu.org/landslideblog/2016/08/15/luoyang-1/) Xiangjiang Wanji Aluminium is a private alumina refinery ... established in 2005 ... annual capacity is 1.2 million tonnes of alumina. (http://az-china.com/archives/7980#)													0.00	0.00	8.21	8.21		8.214285714	0	0
	1	8.21	1	Hpakant, Kachin state, Myanmar	Jade			60						2015	21/Nov/15			115	WISE; https://www.rfa.org/english/news/myanmar/landslide-0504201818040.html; https://www.reuters.com/article/...	Failure of waste rock pile for Jade mining.		chalcocite	CU/Au	5.9	2.1			2003	15.6											
			3	Sepon Mine Western TSF Pipeline MMG as Lane Zane Minerals,Savannakhet Province Laos	Cu/AU		E			2	A			2015					MMG 2017 Sustainability Report	by January 2017 10.7 km of the total 11.5 km corroded with age tailings pieline had been replaced. Corroision greater than expected to du chnaged chemistry of the tailings			Fe										23.73	16.33	1.36	41.42		41.41648195	0	0
	1	41.42	1	Fundao (Germano), Minas Gerais, Brazil ,Samarco(Vale & BHP)	Fe	US	MW	90	55,000,000	1	A	ST	-	2015	5/Nov/15	45,000,000	637	19	Report on the Immediate Causes of the Failure of the Fundão Dam, August 25, 2016; The Australian, 16Nov15, 9Jan16; Sydney Morning Herald, 14Nov15; Do the right	19 deaths. caused a partial erosion of Santarém dam aouldeand damage to a side wall of the Selinha dike, one of the side walls of the Germano dam Destoted village of Bento Rodriguez. Waste discharge reached the Atlantic Ocean.			Au										0.01	0.00	0.00	0.01		0	0	0
			1	Gold King Mine, near Silverton, Colorado	Au	N/A	N/A			3	B	ST	-	2015	5/Aug/15	11,356			USEPA Summary Report, EPA Internal Review	During work by EPA a large accidental release wastewater from the Gold King Mine near Silverton, CO.			Au										0.00	0.03	0.00	0.03		0	0	0
			2	Yellow Giant Mine, Banks Island, British Columbia, Canada	Au					2	A	ST	-	2015	25/Jun/15	240	1		Vancouver Sun;Bowker Wordpress unauthorized tailings deposition in old shaft	Effluent and mine waste leaked from a pair of underground mine sites, including from a "non-engineered" containment berm and a concrete plug at an old underground site. Discharge reached the ocean through a creek, several beaver-dam-created wetlands and Banks Lake before entering the ocean at Surrey Bay. (Vancouver Sun, 27Jul15) ("Pollution spill at Yellow Giant gold mine sparks investigation by Environment Canada," Hoekstra, Vancouver 29Jul15)													0.00							
	3		3	Rosario Mine, San Luis Potosi Mexico, Santa Cruz Silver Mining LTD.	Ag					1	A			2015	xx/Jan/15	2,000			santacruzsilver.com/s/news_releases.asp?ReportID=692457	Restart of past producing mne by newly formed co.; pipe faiure; runout contained by berm;company fine $180k			NI										0.00	0.00	0.00	0.00		0	0	0
	1		1	Queensland Nickel,Yabulu Refnery,(Clive Pamer), Townsville Australia	NI					1	A	OT		2014	04/xx/2014				Millington,Ben 12/14/16 ABC.Net; Administrator Report April 2016 [19]; https://www.townsvillebulletin.com.au/news/qni-fined-for-	several days of unautghorized uncntrlled releases warned of inadequate capacity n 2012 & ignored, complex fnancial background maintenance deferedl under BHP before transfer to Palmer in liquidation Gov't footing cleanup bill			Fe										0.00	0.00	0.21	0.21		0	0.214285714	0
	2	0.21	1	Herculano Iron Mine, Itabirite, Minas Gerais, Brazil	Fe					1	A	U	-	2014	10/Sep/14			3	WISE	A large amount of waste was released on top of vehicles and workers. A truck driver, a bulldozer with operator and a Fiat Uno with the driver were all buried. "Tailings dam failure kills three workers," Mining.com, September 12, 2014.		PCD	Cu	10000	0.5		0.5		1000	Py			0.02	0.00	0.00	0.02		0	0	0.02109
	3	0.02	1	Buenavista del Cobre mine, Cananea, Sonora, Mexico (Grupo Mexico)	Cu					1	A	U	-	2014	7/Aug/14	40,000			WISE	Southern Copper Corp. (Grupo México) Flow into the 420km-long Bacanuchi river waterway, a tributary of the Sonora River, directly affecting 800,000 people		PCD	Cu Au	507	0.28	0.29	0.512607128	2005	56.3628125	Py			12.44	0.18	0.00	12.62		12.62245909	0	0
	1	12.62	1	Imperial Metals, Mt Polley, British Columbia, Canada	Cu Au	MCL	MW	40	74,000,000	1	A	FN	-	2014	4/Aug/14	23,600,000	7		Expert Panel Report, BowkerLN[27]	Report on Mount Polley Tailings Storage Facility Breach, Independent Expert Engineering Investigation and Review Panel, Province of British Columbia, January 30, 2015; Imperial Metals 2015 Annual Report			Coal										0.18	0.00	0.00	0.18		0	0.176099687	0
	2	0.18	1	Dan River Steam Station, North Carolina (Duke Energy)	Coal				155,000,000	1	A	ST	-	2014	2/Feb/14	334,000			WISE, Caldwell 2014	Collapse of an old drainage pipe under a 27-acre ash waste pond. Ash flowing through drainage pipe into Dan River. Tailings Facility Failures in 2013/2014, Caldwell, 4Nov14		Coal											0.00	0.77		0.77		0	0	
	3	0.77		Coalmont Energy Corporation, Basin Coal Mine	Coal	U	U			1	A	OT	-	2014	24/Aug/13	30	30		globalnews.ca/news/805234/coalmont-villagers-fuming-over-black-river/	The coal processing plant malfunctioned Saturday, forcing plant water to be drained into a detention pond. The tailings then overflowed into an emergency pond with the material entering the Tulameen river .													0.00	3.33		3.33		3.333333333	0	
			1	Arcelor Mittal, Minorca Mine ,Minnesota						1	A			2014					http://content.govdelivery.com/accounts/MNPCA/bulletins/108f692?fbclid=IwAR106VETs7vwoie3PqLH6k8hplCVST2zsV6Swfaf7Gzqe0ROsinbM_d6egU	"Between May 2013 and April 2014 leaks from the company's tailings pipeline and a dike failure at the tailings storage basin impacted more than fifteen acres of wetland.																				
			3	Arcelor Mittal, Minorca Mine ,Minnesota						2	A			2013					http://content.govdelivery.com/accounts/MNPCA/bulletins/108f692?fbclid=IwAR106VETs7vwoie3PqLH6k8hplCVST2zsV6Swfaf7Gzqe0ROsinbM_d6egU	"Between May 2013 and April 2014 leaks from the company's tailings pipeline and a dike failure at the tailings storage basin impacted more than fifteen acres of wetland.																				
			3	Arcelor Mittal, Minorca Mine ,Minnesota						2	A			2013					http://content.govdelivery.com/accounts/MNPCA/bulletins/108f692?fbclid=IwAR106VETs7vwoie3PqLH6k8hplCVST2zsV6Swfaf7Gzqe0ROsinbM_d6egU	"Between May 2013 and April 2014 leaks from the company's tailings pipeline and a dike failure at the tailings storage basin impacted more than fifteen acres of wetland.																				
	1	3.33	1	Minas De Bacis Mine Co, Mexico										2013			130		Unesco (32)	unesdoc.unesco.org/images/0024/002475/247519e.pdf;300 fisherman families lost livelihood													0.00	0.00		0.00				
	2		1	Durango, Mexicou										2013	21/Jan/13			1	Unesco (32)	unesdoc.unesco.org/images/0024/002475/247519e.pdf			Cu Mo										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Zangezur Copper Molybdenum Combine, Armenia	Cu Mo			53.6	31,000,000	2	A	U	-	2013	15/Nov/13				WISE, Green Program	Cronimet Mining AG. Tailings pipeline damage, tailings flowing into Norashenik River for several days (http://www.thegreenprogram.org/slopedoc2.html)			Coal										0.35	0.00	0.00	0.35		0	0.353253864	0
	2	0.35	2	Obed Mountain Coal Mine Alberta, Canada (Sherritt International)	Coal					1	B	U	-	2013	31/Oct/13	670,000			WISE; Caldwell, 2014	"Sherritt International. Breach of wall in containment pond. Plume of slurry containing fine coal particles, clay and heavy metals into the Apetowun und Plate creeks and eventually the Athabasca River. $52.2 million Set aside by Sherritt for cleanup (2013 Annual Report)". Tailings Facility Failures in 2013/2014, Caldwell, 4Nov14 undocumented description of plume 113 miles away			Au										0.03	0.00	0.00	0.03		0	0	0
			1	Casa Berardi Mine, La Sarre, Abitibi region, Quebec (Hecla Mining Company)	Au					1	B	OT	-	2013	May/13	57,000			Caldwell 2014	Breach of an internal tailings dyke which resulted in a surge of liquids and suspended solids over the external tailings dyke. Tailings Facility Failures in 2013/2014, Caldwell, 4Nov14			Cu										0.05	0.00	0.00	0.05		0	0.052724457	0
	2	0.05	1	Gullbridge Mine Newfoundland	Cu	DS	E	7		1	B	SI	-	2012	17/Dec/12	100,000			WISE, Caldwell 2013	At 7:45 am on Monday December 17, the tailings dam at the former Gullbridge copper mine, central Newfoundland failed while work was under way to stabilize it. The failure resulted in a breach of the 7 m high dam approximately 25 m wide. The dam was impounding mine tailings that were partially covered by water forming a tailings pond.			Ni U										0.13	0.00	0.00	0.13		0	0.126538697	0
	2	0.13	1	Sotkamo, Kainuu Province, Finland (Talvivaara)	Ni U					1	A	SE	-	2012	4-Nov-12	240,000			WISE	Talvivaara Mining Company Plc Leak from gypsum pond through a "funnel-shaped hole." Nickel and zinc concentrations in nearby Snow River exceeded the values that are harmful to organisms tenfold or even a hundredfold, uranium concentrations more than tenfold. Heap-leach operation; leakage form gypsum pond also occured in 8 April 2013 (4th leak since 2008); after restarting operations, the gypsum leaked again on 21 May 2013		PCD	Au Cu	590	0.3	0.35	0.58073274	1958	325	Py			6.85	0.00	0.00	6.85		6.854179441	0	0
	1	6.85	1	Padcal No 3, Benquet Philippines (Philex)	Au Cu	US			102,000,000	1	A	OT	-	2012	2/Aug/12	13,000,000			NASSA & CCCP	20.6 million tonnes released due to heavy rains. The Balog and Agno River are heavily polluted. "CSOs release results of independent investigation on Philex's tailings spill," NASSA & CCCP press release, 2 October 2012			Pb Zn										0.00	0.00	0.00	0.00		0	0	0
			1	Hudson Bay (HB) Mine, Salmo, British Columbia (Regional District of Central Kootenay & Teck)	Pb Zn				1,800,000	1	B	SE	-	2012	11/Jul/12				Nelson Star, 9Jul12	A sinkhole in the dam at the the HB mine site south of Salmo has been determined as the primary cause of the slough that threatened the stability of the tailings pond last week. Heavy rainfall throughout the month of June was a contributing factor to some seepage and the initial slough. The Regional District of Central Kootenay purchased the six-hectare tailings area in 1998 as part of their central landfill area. "Sinkhole to blame for slough at mine site near Salmo," Nelson Star, 9Jul12			Au										0.00	0.00	0.00	0.00		0	0	0
			1	Johson Gold Mining Corporation at Baranggay Bangong-Bayan	Au					1	A	ER	-	2012	13/Apr/12				Mambulaoans Worldwide Buzz, 2012	Cyanide-laden mine tailings destroyed 10 houses. (http://mambulaoansworldwidebuzz.blogspot.com/2012/04/friday-13th-disaster-gold-miners_21.html)			AU										0.00	0.00	0.00	0.00		0	0	0
			1	Mineracao Serra Grande Tailings Dam ,State of Goias Brazil, (Anglo Ashanti)	AU	CL						OT		2012		900			/C:/Users/Lindsay/Downloads/AGA-OP12-bra-serra-grande.pdf				Mn										0.01	0.00	0.00	0.01		0	0	0.00527
	3	0.01	1	Mianyang City, Songpan County, Sichuan Province, China	Mn					1	A	OT	-	2011	21/Jul/11	10,000			Future Directions Intl., WISE	Heavy rain on July 20 led the managers of the electrolytic manganese metal plant to release water from its tailing dams into the Fujiang River, which provides drinking water to Sichuan's second largest city - (http://www.futuredirections.org.au/publications/food-and-water-crises/28-global-food-and-water-crises-swa/176-chinese-city-of-4-million-left-dry-as-pollution-contaminates-water.html)			Fe	264				2008					0.11	0.00	0.00	0.11		0	0.105448914	0
	2	0.11	1	Bloom Lake, Triangle Tailings Pond, Quebec, Canada (Cleveland Cliffs)	Fe					1	A	U	-	2011	May/11	200,000			Gov't of Canada Press Release 12/22/14	Triangle Tailings dam breached and released 200,000ms over 7 days until repaired																				
	3			Ray Mine, Eder Gulch TSF, Asarco, Hayden, AZ, USA	Cu					1	A	ST		2011	5-May-11	3,600			National Response Center, Incident No. 975013(39),Earthworks Action 2012 (38)	6000-8000 tons of copper ore tailing released from one of the tailing ponds due to a breach in the dike.			coal										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Vales Point Ash Dam, Wyong (Delta), New South Wales	coal					1	A			2011					Coast County News 12/21/2017 (18)	old unlined facilty covering 362 h had uanuthrized release; EPA ordered reairs			Al										0.53	0.00	0.71	1.24		1.241530287	0	0
	1	1.24	1	Ajka Alumina Plant, Kolontár, Hungary (MAL Magyar Aluminum) #2	Al	DS	Compacted Fly Ash	22	30,000,000	1	A	SE	-	2010	4/Oct/10	1,000,000		10	Kolontár Report, WISE, Zanbak 2010	The Kolontar Report (https://www.google.com/?gws_rd=ssl#q=kolontar+hungary+disaster), 10 people dead and almost 150 injured, about 1,000 acres of polluted land. 8 square kilometres flooded, including several towns. Failure Mechanism and Kinematics of the Ajka Tailings Pond, Hungary, C. Zanbak, 10 December 2010			Sn										0.00	0.00	1.57	1.57		1.571428571	0	0
	1	1.57	1	Zijin Mining, Xinyi Yinyan Tin Mine, Guangdong Province, China	Sn					1	A	OT	-	2010	21/Sep/10			22	Zijin Mining Group; Fry et al, 2012	Illegal practices and unauthorized dam rase per government charges.Gaoqiling tailing pool dam at Qianpai Town, Xinyi City, Guangdong. Yinyan Tin Mine Dam Failure, Zijin Mining Group, 27Dec10, (https://www.regjeringen.no/contentassets/e7016c9a7430498e8c583a533dd1ca15/rec_zijin_2012_eng.pdf, http://www.facing-finance.org/en/database/cases/zijin-mining-collapse-of-tailing-dam-kills-22-destroys-houses/)			Ag, Cu, Pb, Zn										0.01	0.00	0.00	0.01		0	0	0
			1	Huancavelica, Peru, Unidad Minera Caudalosa Chica Mine	Ag, Cu, Pb, Zn			10		1	A	SE	-	2010	25/Jun/10	21,420			Mines & Communities 2010 (36),WISE, McLemore et al, 2014 Guerra,Isabel 2010 (40)Wood 2012 (21)	Contamination of río Escalera and río Opamayo 110 km downstream. See Sampling and Monitoring for the Mine Life Cycle edited by McLemore, Virginia T., Smith, Kathleen S., Russell, Carol C. Russell, SME, 2014			0										0.00	0.01	0.29	0.30		0	0.298534799	0
	2	0.30	1	Las Palmas, Pencahue, VII Region, Maule, Chile (COMINOR)				15		1	B	EQ	-	2010	27/Feb/10		1	4		Intraplate earthquake Mw = 8.8, 80% of total volume estimated lost, overtopping with flow failure			Cu										0.04	0.00	0.00	0.04		0	0	0.04474
	3	0.04	1	Veta del Agua Tranque No. 5, Nogales, V Region, Valparaíso, Chile	Cu	US				1	B	EQ	-	2010	27/Feb/10	80,000	0		Villavicencio	Intraplate earthquake Mw = 8.8, slope 1.4:1, slope instability with seismically induced deformations			0										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Tranque Adosado Planta Alhué, Alhué, Region Metropolitana, Chile		DS		15		1	A	EQ	-	2010	27/Feb/10				Villavicencio	Intraplate earthquake Mw = 8.8, R = 252 km, slope 4.5:1, slope instability with seismically induced deformations			0										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Tranque Planta Chacón, Cachapoal, VI Region, Rancagua, Chile						1	B	EQ	-	2010	27/Feb/10				Villavicencio	Intraplate earthquake Mw = 8.8, slope 1.8:1, slope instability with seismically induced deformations			0										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Tranque Adosado Planta Alhué, Alhué, Region Metropolitana, Chile (Florida Mining)		US				1	B	EQ	-	2010	27/Feb/10				Villavicencio	Intraplate earthquake Mw = 8.8, 80% of total volume estimated lost, slope 1.2:1, slope instability with seismically induced deformations		Vein	Au					1978					0.63	0.00	0.07	0.70		0.704122058	0	0
	1	0.70	1	Karamken, Magadan Region, Russia (cyanide-leach processing facility of gold mines in the region)	Au			20		1	A	U	-	2009	29/Aug/09	1,200,000		1	WISE, MACE	11 houses lost, 1 death (Karamken Update - MACE 2012-02-10); shutdown in 1990s; bad design, bad construction, no maintenance led to groundwater contamination prior to failure;			Mn										0.03	0.00	0.21	0.24		0	0.240647943	0
	2	0.24	1	Huayuan County, Xiangxi Autonomous Prefecture, Hunan Province, China	Mn				50,000	1	A	U	-	2009	14/May/09	50,000		3	WISE	3 killed, 4 injured													0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Coircancha, Gold Hawk, Peru Tailings	AgAUPBZN					1	A	OT	-	2008	8/May/17				canadianminingjournal.com/news/tailings-emergency-peru-wants-pond-at-coricancha-relocated/;http://www.marketwired.com/press-	landslide above TSF washed tailings into rmac River.; Gov't ordered relocationof facilty and stopped all operatons		Strat	Coal					1955					2.16	0.11	0.00	2.27		2.266830952	0	0
	1	2.27	1	Kingston fossil plant, Harriman, Tennessee, USA (TVA)	Coal					1	A	U	-	2008	22/Dec/08	4,100,000	4		WISE,SOURCEWATCH.ORG	5.4 million cubic yards (1.09 billion gallons) of fly ash was released (http://www.sourcewatch.org/index.php?title=TVA_Kingston_Fossil_Plant_coal_ash_spill#TVA_Reaction)			Fe										0.14	0.06	18.14	18.35		18.34826125	0	0
	1	18.35	1	Lixi Tailings Dam(?)Taoshi, Linfen City, Xiangfen county, Shanxi province, China (Tahsan Mining Co.)	Fe	US		50.7	290,000	1	B	U	-	2008	8/Sep/08	268,000	3	254	WISE	At least 254 dead and 35 injured; facility and mine unlicensed. mine not operating - claimed that state-owned company "sealed" TSF;clogging cause loss of permeability????													0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Long Lake Cotainment Ektaki Mine, Northwest Territories, CA (BHP Billiton)	diam					2	A	SI		2008	1/May/08				cbc.ca/news/canada/north/chiefs-to-view-massive-waste-spill-at-ekati-mine-1.703130	4,5 million litres; sewage ipefailed overtook da..silled tailings contents			F										0.01	0.00	0.00	0.01		0	0	0.01054
	3	0.01	3	Glebe Mines, UK	F		E			1	B	OT	-	2007	22/Jan/07	20,000			HSE Report	Flourspar mine. Initial Report of the HSE investigation into the Glebe Mines Stony Middleton dam failure 2007, HSE Central Division - Nottingham, UK, 23Feb07		Laterite (Bauxit	Al										1.05	0.00	0.00	1.05		1.054489145	0	0
	1	1.05	1	Mineracao Rio Pomba Cataguases, Mirai, Minas Gerais, Brazil, Mineração (Industrias Quimicas Cataguases)	Al			30		1	A	OT	-	2007	10/Jan/07	2,000,000			WISE, Miranda Jose Brazil Magazine 1/11/2007	bauxite;The mud flow left about 4000 residents of the cities of Miraí and Muriaé in the Zona da Mata homeless. Crops and pastures were destroyed and the water supply was compromised in cities in the states of Minas Gerais and Rio de Janeiro. ;see Mines & Communities account for two prior event 2003, 2006; dam closed and not allowed to rebuilt after this event;fine $35million (U.S.)			coal										0.00	0.00	0.07	0.07		0	0.071428571	0
	2	0.07	1	Dayton Power & Light	coal					1		SI		2006	25/Jul/06	-	0	1	osha.gov/pls/imis/accidentsearch.accident_detail?id=201954740	Tetra Tech employee working as a contractor was killed in a slide of coal ash that was being removed from the ash pond to allow its re use			?										0.00	0.06	0.00	0.06		0	0.064946155	0
	2	0.06	3	Fonte Santa ,Freixia De Espado a Cinta, Portugal	?	No Design	E	25		2	B	OT	-	2006	27/Nov/06	1,600	3		Duque, 2011[16]; Franca et. al [24]	clogging of spillway (loss of permeability due to clogging);closed for 30 years..deposition of 12.9cubic hm per Franca, total loss of contents; duque & Franca Release&runout Estimates Do Not Agree. Franca cited here.		SSC	Cu	1100	2.16		3.6	1939	135	Co			0.00	0.00	0.00	0.00		0	0	0
	3	0.00	3	Nchanga, Chingola, Zambia (Konkola Copper Mines - Vedanta)	Cu					1	unk	SI	-	2006	6/Nov/06				WISE	Konkola Copper Mines Plc (51% Vedanta Resources plc) Failure of tailings slurry pipeline from Nchanga tailings leaching plant to Muntimpa tailings dumps. Release of highly acidic tailings into Kafue river; high concentrations of copper, manganese, cobalt in river water; drinking water supply of downstream communities shut down.			Au										0.00	0.13	1.21	1.34		1.342490842	0	0
	1	1.34	3	Miliang, Zhen'an County, Shangluo, Shaanxi Province, China	Au					1	A	U	-	2006	30/Apr/06		5	17	WISE	The landslide buried about 40 rooms of nine households, leaving 17 residents missing. Five injured people were taken to hospital. More than 130 local residents have been evacuated. Toxic potassium cyanide was released into the Huashui river, contaminating it approx. 5 km downstream.		Laterite (Bauxit	Al										0.21	0.00	0.00	0.21		0	0.210897829	0
	2	0.21		Mineracao Rio Pomba Cataguases, Mirai, Minas Gerais, Brazil, Mineração (Industrias Quimicas Cataguases)	Al							U	-	2006	Mar/06	400,000			Miranda, Jose Brazil Magazine, January 11, 2007; Mines & Communities (2007)	cited for a TSF infraction in 2006 per this Brazi Magazine account of 2007 major incident..no details given;mine shur after 2006 event per Planet Ark @ Mines & Communities			AU																	
				Prestea Gold Mine Bogosa Gold Ltd. Ghana inc#2 ,Golden Star Resourcs	AU									2005	18-Jun-05				rainforestinfo.org.au/gold/spills.htm	A joint on the main tailings returning pipe was disengaged and cyanide-laden tailings poured into the external environment. It has been reported that 30 community members who drank the water or ate th		Strat	P										0.03	0.00	0.00	0.03		0	0	0.03393
	3	0.03	1	Bangs Lake, Jackson County, Mississippi, USA (Mississippi Phosphates Corp)	P					1	U	U	-	2005	14/Apr/05	64,350			WISE	Mississippi Phosphates Corp. Phosphogypsum stack failure, because the company was trying to increase the capacity of the pond at a faster rate than normal, according to Officials with the Mississippi Department of Environmental Quality (the company has blamed the spill on unusually heavy rainfall, though). Liquid poured into adjacent marsh lands, causing vegetation to die.	Vein-Strat	Hg	1.1				1940				0.00	0.00	0.00	0.00		0	0	0.003690712		
				Pinchi Lake, BC, Canada (Teck Cominco Ltd.)	Hg	WR	E	12			B		-	2004	30/Nov/04	7,000			B.C. Ministry of Energy & Mines Incident Report # 18040-02-O7/PI NC/01 (12/6/2004); http://ammsa.com/publications/ravens-eye/nation	Under Investigation as to whether tailings related; defnitely NOT TSF itself			Au																	
				Prestea Gold Mine Bogoso Gold Ltd. Ghana inc#1	Au							SI		2004	23-Oct-04				rainforestinfo.org.au/gold/spills.htm	communities, as well as other rivers including Egya Nsiah, Benyah and Manse. Villagers downstream found hundreds of dead fish, crabs, shrimps and other life forms floating on the river. Some members of the community harvested and ate the fish before they received information about the spillage		Strat	P										0.12	0.00	0.00	0.12		0	0.119684518	0
	2	0.12	1	Riverview, Florida, USA	P					1	U	U	-	2004	5/Sep/04	227,000			WISE	A dike at the top of a 100-foot-high gypsum stack holding 150-million gallons of polluted water broke after waves driven by Hurricane Frances bashed the dike's southwest corner. Liquid spilled into Archie Creek that leads to Hillsborough Bay.		Strat	Coal										0.08	0.00	0.00	0.08		0	0.084359132	0
	2	0.08	1	Partizansk, United Energy Systems(Dalenergo),Primorski Krai, Russia	Coal	Ring			20,000,000	1	A	U	-	2004	22/May/04	160,000			WISE, Robinson(2004) (32)	A ring dike, enclosing an area of roughly 1 km2 and holding roughly 20 million cubic meters of coal ash, broke. The break left a hole roughly 50 meter wide in the dam. The ash flowed through a drainage canal into a tributary to the Partizanskaya River which empties in to Nahodka Bay in Primorski Krai (east of Vladivostok). For details download Sept. 2004 report by Paul Robinson, SRIC.			U										0.02	0.00	0.00	0.02		0	0	0.01582
	3	0.02	1	Malvési, Aude, France (Comurhex, Cogéma/Areva)	U					1	A	U	-	2004	20/Mar/04	30,000			WISE	Uranium slurries elevated nitrate in river. Decantation and evaporation pond of uranium conversion plant dam failure after heavy rain in preceding year. the release led to elevated nitrate concentrations of up to 170 mg/L in the canal of Tauran for several weeks.			Cu										0.04	0.51	0.00	0.56		0	0.555000079	0
	2	0.56	1	Cerro Negro, near Santiago, Chile, (5 of 5)	Cu	US	T			1	A	ER	-	2003	3/Oct/03	80,000	20		WISE, Villavicencio	Tailings flowed 20 kilometers downstream the río La Ligua., active dam w water cover (dry #1 did not fail)http://www.pnwis.org/inlandnorthwest/files/2014/11/IV-1-Tailings-Dams-They-Need-to-Stay-Here-Forever-Urlich.pdf; p12			Pb-Zn										0.04	0.31	0.00	0.35		0	0.352508096	0
	2	0.35	1	Sasa Mine, Macedonia	Pb-Zn				2,000,000	1	A	ST	-	2003	30/Aug/03	85,000	12		Vrhovnik et al, 2011; Vrhovnik et al, 2013; Peck, 2007	Culvert failure under Sasa Mine Tailings Dam. (Avoiding tailings dam failures, Good practice in prevention, Philip Peck, UNEP GRID Arendal and IIIEE at Lund University, Workshop on the safety of Tailings Management Facilities, November 12, 2007, Yerevan, Armenia); Tailings dam break with waste flowing into Lake Kalimanci 12 km from mine. (http://www.geologija-revija.si/dokument.aspx?id=1229); The Occurrence of Heavy Metals and Metalloids in Surficial Lake Sediments before and after a Tailings Dam Failure, Petra Vrhovnik, Tadej Dolenec, Todor Serafimovski, Matej Dolenec, Nastja Rogan Šmuc		Laterite (Bauxit	Al										0.63	0.00	0.00	0.63		0.632693487	0	0
	1	0.63	1	Mineracao Rio Pomba Cataguases, Mirai, Minas Gerais, Brazil, Mineração (Industrias Quimicas Cataguases)	Al					1	A	U	-	2003	2003	1,200,000			Mines & Communities http://www.minesandcommunities.org/article.php?a=1481	Not Included in WISE Nor is Miranda Reorted 2006 event 1.2 billion liters (1.2 million m3) of toxic water was poured out into the Pomba and Paraíba do Sul rivers. "Brazilian Rains Kill Dozens and Broken Dam Leaves, Thousands Without Shelter ," José Wilson Miranda , Brazzil Magazine, 11 January 2007		HT Manto	Cu	580	1.1		1.1	19th c	200	Py			0.00	0.00	0.00	0.00		0	0	0.00237
	3	0.00	1	El Cobre, Chile - El Soldado (Exxon)	Cu	US	T			1	B	OT	-	2002	8/Nov/02	4,500			Villavicencio	Strong rains and overflow		HT Manto	Cu	580	1.1		1.1	19th c	200	Py			0.00	0.00	0.00	0.00		0	0	0.00422
	3	0.00	1	El Cobre, Chile, 2, 3, 4, 5 (Exxon)	Cu	US	T			1	B	OT	-	2002	22/Sep/02	8,000			Villavicencio	Strong rains and overflow		PCD	Cu Au	187	0.36	0.93	1.105946996	1980	97	Py			0.53	0.00	0.00	0.53		0.527244572	0	0
	1	0.53	1	San Marcelino Zambales, Philippines, Bayarong dam (Benguet Corp-Dizon Copper-Silver Mines Inc)	Cu Au				47,000,000	1	B	OT	-	2002	11/Sep/02	1,000,000			WISE, Piplinks	Dizon Copper Silver Mines Inc. Spillway of Bayarong tailings dam collapsed and Camalca tailings dam damaged during heavy rain. Low lying villages flooded with mine waste; 250 families evacuated; mined ceased operations in 1997		VMS	Cu Pb Zn					1988												
	3		4	Thalanga Mine, Queensland Australia	Cu Pb Zn	UTSD	-	--	290,000	2	B			2002	xxAug2002			0	imwa.info/docs/imwa_2004/IMWA2004_12_Thienenkamp.pdf	bulkheads reaining tailings inunerground workings failed under pressures from grundwater recharfe from- 450at closure in 1998 to -35 in 2002		PCD	Cu Au	187	0.36	0.93	1.105946996	1980	97	Py			0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	San Marcelino Zambales, Philippines, Camalca dam (Benguet Corp-Dizon Copper-Silver Mines)	Cu Au					1	B	OT	-	2002	27/Aug/02				WISE, Piplinks	Heavy rains impounded water on the Bayarong tailings dam and Camalca silt dam, and spillways, eroding these and eventually causing leak. Some tailings spilled into Mapanuepe Lake and eventually into the Sto. Tomas River.																				
			1	Cuajone,Peri						1	A	EQ		2001	23/6/2001				Pacheco				Au										0.00	0.00	0.00	0.00		0	0	0

	3	0.00	2	Tarkwa, Ghana (Goldfields)	Au					2	A	SI		2001	16/Oct/01				Anan Mike Environmental News Service[17]	corpwatch.org/article.php?id=744 (accessed 1Jul16) joint failure in pipe carrying cyanide wasetwater to tsf This is possibly a larger failure, but no additional details are available.		Strat	Fe										0.00	0.21	0.14	0.35		0	0.347985348	0
	2	0.35	3	Sebastião das Águas Claras, Nova Lima district, Minas Gerais, Brazil	Fe					1	A	U	-	2001	22/Jun/01		8	2	WISE	2 killed, 3 missing. Tailings 8 km downstream the Córrego Taquaras stream, mud affected an area of 30 hectares (http://ie.org.br/site/ieadm/arquivos/arqnot10056.pdf)			Sn							Py, Asp, Ga			0.00	0.00	2.00	2.00		2	0	0
	1	2.00	1	Nandan Tin mine, Dachang, Guangxi	Sn					1	A	U		2000	18/Oct/00			28	Wei, WISE	WISE:15 killed, 100 missing, 100 houses destroyed			Coal										0.56	3.08	0.00	3.64		3.640283903	0	0
	1	3.64	1	Inez, Martin County, Kentucky, USA (Massey Energy subsidiary Martin Co. Coal Corp)	Coal					1	A	U	Table 1	2000	11/Oct/00	1,068,500	120		ICOLD, WISE	Estimated 250 million gallons (950,000 m3) of water and 155,000 cubic yards (118,500 m3) of coal waste into local streams 80' deep over a 15-18' crown pillar; $46M for cleanup, $3.5M in state fines; since this event, 22 impoundment spills attributed to Massey-operated sites through2010 (Wheeling Jesuit Univ.)		PCD	Cu	1340	0.4	0.2	0.560418709	1968	317	Py			0.95	0.13	0.00	1.08		1.082373564	0	0
	1	1.08	1	Aitik mine, near Gällivare, Sweden (Boliden Ltd)	Cu	DS	MW & E	15	15,000,000	1	A	ER	Table 1	2000	8/Sep/00	1,800,000	5		ICOLD, WISE	Failure at containment wall separating tailings pond from decant pond, which caused a 1.3m rise I nwater level. Discharge was controlled and only increase in suspended solids in the Leipojoki and Sakajoki Rivers was reported. https://pure.ltu.se/portal/files/96533586/Numerical_analysis_of_staged_construction_of_an_upstream_tailings_dam.pdf			Pb Zn							Py			0.00	0.00	0.00	0.00		0	0	0.00482
	3	0.00	1	Borsa, Romania (Remin S.A - govt)	Pb Zn					1	A	U	Table 1	2000	10-Mar-00	9,140			WISE,[23]	22,000 t of heavy-metal contaminated tailings, contamination of the Vaser stream, tributary of the Tisza River. Company: Remin SA		Tailings	Au					1999		St, Bi, Py, Ga			0.05	2.56	0.00	2.62		2.616827021	0	0
	1	2.62	1	Baia Mare, Romania	Au	DS then US	T		800,000	1	A	ST	221	2000	30/Jan/00	100,000	100		ICOLD, WISE, Rico	(Aurul SA-Esmeralda Exploration, Australia (50%), Remin S.A. (44.8%)) Killed tonnes of fish and poisoned drinking water of more than 2 million people in Hungary; retreating old tailings (mining there for over 2,000 years) with cyanide; high snowfall led to water rise and overtopping causing a breach 25m wide and 2.5m deep (livebettermagazine.com)		PCD	Cu	2000	0.34	0.24	0.532502451	1955	575	Py			3.01	0.00	0.00	3.01		3.005294063	0	0
	1	3.01	2	Toledo City, Philippines (Atlas Con Mining Corp)	Cu					1	B	ST		1999	9/Aug/99	5,700,000			Piplinks	Drainage tunnel blowout			Au Ag										0.01	0.00	0.00	0.01		0	0	0.00527
	3	0.01	2	Red Mountain, BC	Au Ag	Jumbo				1	A	SE		1999	5/Jun/99	10,000			Mt Polley Expert Panel 2015, App. I	Failure of the surface water diversion culvert beneath the facility. Discharge of tailings into the water reclaim pond downstream of the impoundment and into Little Sheep Creek.		Placer	Au										0.02	0.31	0.29	0.61		0	0.608696686	0
	2	0.61	2	Surigao Del Norte Placer, Philippines (#3 of 3) (Manila Mining Corp)	Au					3	U	U	Table 1	1999	26/Apr/99	29,000	12	4	ICOLD, Piplinks	Manila Mining Corp. Tailings spill from damaged concrete pipe. 17 homes buried, 51 hectares of riceland swamped.		Strat	P										0.03	0.00	0.00	0.03		0	0	0.02636
	3	0.03	1	Huelva, Spain (Fertiberia, Foret)	P					1	A	OT	Table 1	1998	31/Dec/98	50,000			ICOLD, WISE	Fertiberia phosphate mine, 50,000 m3 of acidic and toxic water			Au										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Zamboanga Del Norte, Sibutad Gold Project (Philex Mining Corp)	Au					1	A	OT	-	1998	27/Jun/98				Piplinks	Philex Gold Philippines Inc. Heavy rain resulted in overflowing of silt dam at the Sibutad gold project		VMS	Pb Zn	161	0.44		2.53927127	1979		PY			3.59	1.05	0.00	4.64		4.636545144	0	0
	1	4.64	1	Los Frailes, near Seville, Spain (Boliden Ltd.)	Pb Zn	WR	R	27	15,000,000	1	A	FN	209	1998	25/Apr/98	6,800,000	41		ICOLD, WISE, Rico	Modern mining started in 1876 at nearby Aznalcollar; Andaluza de Piritas started open pit in 1979 after delineating recently-discovered mineralization; Boliden purchased company in 1987. Reused Existing TSF w/o study of condition or capacity		Strat	P										0.11	0.00	0.00	0.11		0	0.105448914	0
	2	0.11	1	Mulberry Phosphate, Polk County, Florida, USA (Mulberry Phosphate)	P					1	A	SE	-	1997	7/Dec/97	200,000			WISE; Beavers 2013.	Phosphogypsum stack failure. Biota in the Alafia River eliminated (WISE). Mulberry Phosphate had a gypsum stack dam break that resulted in the release of approximately 50 million gallons of waters into adjacent marshes and ponds. Acidic water eventually traveled down the Alafia toward Tampa Bay. Estimates of fish killed ranged from 50,000 to 3,000,000 (An Overview of Phosphate Mining and Reclamation in Florida, Casey Beavers, University of Florida thesis, April 2013) (stack = impoundment in gypsum lingo?)			Au										0.00	0.00	0.00	0.00		0	0	0
	3		1	Zamboanga Del Norte, Sibutad Gold Project (Philex Mining Corp)	Au					1	A	OT	-	1997	6/Nov/97				Piplinks	Philex Gold Philippines Inc. Heavy rain caused mudflow and rockslide into silt dam at Lalab. Flashfloods damaged nearby houses and rice fields.		PCD	Cu										0.12	0.00	0.00	0.12		0	0.121266252	0
	2	0.12	1	Pinto Valley, Arizona, USA (BHP Copper)	Cu					1	B	SI	Table 1	1997	22/Oct/97	230,000			ICOLD, WISE	Tailings dam slope failure. Tailings flow covers 16 hectares.			?										0.03	0.00	0.00	0.04		0	0	0.03548
	3	0.04	1	Tranque Antiguo Planta La Cocinera, IV Region, Vallenar, Chile	?	US/CL		30		1	A	EQ	-	1997	14/Oct/97	60,000	0		Villavicencio	Intraplate earthquake Ms = 7.0, R = 80 km, dam slope 1.7:1; deaths in 1943 failure after 7.9 magnitude eartquake		Magmatic	Fe										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Algarrobo, IV Region, Vallenar, Chile	Fe	US		18		1	A	EQ	-	1997	14/Oct/97				Villavicencio	Intraplate earthquake Ms = 7.0, R = 100 km, dam slope 1.5:1		Magmatic	Fe										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Algarrobo, IV Region, Vallenar, Chile	Fe	US		20		1	A	EQ	-	1997	14/Oct/97				Villavicencio	Intraplate earthquake Ms = 7.0, R = 80 km, dam slope 1.5:1													0.00					0	0	0
	4	0.00	2	Garpenberg															ec.europa.eu/environment/waste/mining/pdf/mining_dams_seminar.pdf p 34	" Leakage through the underground. Waste rock was placed on the downstream slope to stabilise the dam wall and the investigation showed that an over 100 years old pile of slag was imbedded in the foundation and crossing the dam body"			?										0.00	0.00	0.00	0.00		0	0	0
			1	Maitén, IV Region, Vallenar, Chile	?	US		15		1	A	EQ	-	1997	14/Oct/97				Villavicencio	Intraplate earthquake Ms = 7.0, R = 120 km, dam slope 1.5:1			Pb/Zn/Ag										0.00					0	0	0
	3			Laisfall(Boliden)	Pb/Zn/Ag	US	tailings moraine	40		1				1996					ec.europa.eu/environment/waste/mining/pdf/mining_dams_seminar.pdf p 34	In a list of known swedish incidents as of 2001 " Uncontrolled erosion at an internal dam due to earth works resulted in high flows into the pond downstream."																				
			1	Caraveli,Nazca, Peru						1	B	EQ		1996					pacheco	mercury & cyanide contamination per Pacheco			?										0.16	0.00	0.00	0.16		0	0.158173372	0
	2	0.16	1	Amatista, Nazca, Peru	?	US				1	B	EQ	-	1996	12/Nov/96	300,000			WISE	Liquefaction failure of upstream-type tailings dam during M6.4 earthquake. Flow runout of about 600 meters, spill into river, croplands contaminated.		Vein	Pb Zn										0.09	0.00	0.00	0.09		0	0.087522599	0
	2	0.09	1	El Porco, Bolivia (Comsur-62%, Rio Tinto-33%)	Pb Zn					1	A	U	Table 1	1996	29/Aug/96	166,000			ICOLD, WISE	400,000 tonnes released, "300 km of Pilcomayo river contaminated"didn't include as data pending further decsription of the runout		PCD	Cu	372	0.55	0.11	0.63823029	1969	55	Py			0.84	0.67	0.00	1.51		1.510257983	0	0
	1	1.51	4	Marcopper Mine,Tapian Pit Marinduque Island, Philippines (#2 of 2) (Placer Dome and President Marcos)	Cu					1	A	ST	208	1996	24/Mar/96	1,600,000	26		ICOLD, WISE, Piplinks	Inpit storage Drainage tunnel plug failed. 26 km of the Makulaquit and Boac river systems filled with tailings rendering them unusable; US$ 80 million in damage; no production after this event			Pb Zn										0.12	0.15	0.00	0.27		0	0.26983996	0
	2	0.27	1	Sgurigrad, Bulgaria	Pb Zn	US	T	45	1,520,000	1	A	SI	220	1996	1996	220,000	6		ICOLD, Rico				Au					1957					0.00	0.00	0.00	0.00		0	0	0
	3		2	Negros Occidental, Bulawan Mine Sipalay River, Philippines (Philex Mining Corp)	Au					1	A	U	-	1995	8/Dec/95	-			Piplinks	Pressure exerted by impounded tailings caused leak in decant tower of tailings pond 1 at the Bulawan gold mine. This was the 4th discharge in this area (1st was in 1982); mine reactivated by Philex in 1996 and decommissioned in 2002 after which tailings dried up causing a dust problem as far as 5km from site			Au										0.00	0.00	0.00	0.00		0	0	5.3E-05
	3	0.00	2	Golden Cross, Waitekauri Valley, New Zealand (Coeur d'Alène Mines)	Au		R	25	3,000,000	1	A	FN	207	1995	Dec/95	100			ICOLD	Movement of dam			AU										0.00					0	0	0
		0.00		Surigao del Norte Placer, Philippines (Manila Mining Corp)	AU	WR	E	17						1995	xx/apr/95				pebblescience.org/pdfs/Tailings_dam.pdf			Placer	Au										0.03	0.00	0.86	0.88		0	0.883505086	0
	2	0.88	1	Surigao del Norte Placer, Philippines (#2 of 3) (Manila Mining Corp) 2nd event	Au	WR	E	17		1	B	FN	206	1995	2/Sep/95	50,000		12	ICOLD, WISE	12 people killed, coastal pollution		Vein	Au	43		1.51	1.211161252	1993	8	Py			2.21	2.05	0.00	4.27		4.265709255	0	0
	1	4.27	1	Omai Mine, Tailings dam No 1, 2, Guyana (Cambior)	Au	WR	R	44	5,250,000	1	A	ER	205	1995	19/Aug/95	4,200,000	80		ICOLD, WISE, Rico	Cambior Inc., Canada (65%), Golden Star Resources Inc., Colorado, USA (30%) 80 km of Essequibo River declared environmental disaster zone.			Au										0.00	0.00	0.00	0.00		0	0	0.00264
	3	0.00	1	Middle Arm, Launceston, Tasmania	Au	CL	E	4	25,000	1	A	OT	204	1995	25/Jun/95	5,000			ICOLD				Au										0.02	0.00	0.00	0.02		0	0	0.02109
	3	0.02	1	Riltec, Mathinna, Tasmania	Au	CL	E	7	120,000	2	A	SE	203	1995	Jun/95	40,000			ICOLD														0.07	0.00	0.00	0.07		0	0.071178017	0
	2		1	Tapo Canyon Northbridge California				24		B	N	EQ		1994	17/Jan/94	135,000			Harder&Stewart 1996	liquefaction following earthquake.		Strat	P										1.00	0.00	0.00	1.00		1.001764688	0	0
	1	1.00	1	Hopewell Mine, Hillsborough County, Florida, USA	P					1	A	U	-	1994	19/Nov/94	1,900,000			WISE	IMC-Agrico. Water from a clay settling pond spilled into nearby wetlands and the Alafia River, Keysville flooded.		Strat	P										3.59	0.00	0.00	3.59		3.585263092	0	0
	1	3.59	1	Payne Creek Mine, Polk County, Florida, USA	P					1	A	U	-	1994	2/Oct/94	6,800,000			WISE	IMC-Agrico. Majority of spill contained on adjacent mining area; 500,000 m3 released into Hickey Branch, a tributary of Payne Creek.		Strat	P										0.04	0.00	0.00	0.04		0	0	0.04007
	3	0.04	1	Fort Meade Phosphate, Florida, USA	P					2	A	SE	-	1994	Oct/94	76,000			WISE	Cargill. Phosphogypsum process (?) water. Spill into Peace River near Fort Meade.		Strat	P										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	IMC-Agrico Phosphate, Florida, USA	P					2	A	MS	-	1994	Jun/94				WISE	IMC-Agrico. Sinkhole opens in phosphogypsum stack.			AU										0.00	0.00	0.00	0.00		0	0	0.00053
	3	0.00	2	Mineracao Serra Grande Tailings Dam Anglo Ashanti,State of Goias Brazil	AU	CL		27		1			214	1994	Feb/94	1,000	0	0	ICOLD P42	Slip from rise in phreatic surface.caused by poorly constructed ineffectual drains.no release operations halted for 3 weeks lost revenue		WITS	Au					1950		Py			0.32	0.10	1.21	1.63		1.63319656	0	0
	1	1.63	1	Merriespruit, near Virginia, South Africa (Harmony) - No 4A Tailings Complex	Au	US paddock	T	31	7,040,000	1	B	OT	202	1994	22/Feb/94	600,000	4	17	Fourie 2001(29),ICOLD, WISE, Rico	On Re review by Fourie & others now considered to be a posible liquefaction. Dam wall breach following heavy rain, tailings traveled 4 km downstream, 17 people killed, extensive damage to residential township; No 4 TSF started in 1978 and was only 320m from nearest houses			Cu U	4800	1.4	0.6	3.321256127	1988	10	Py			2.64	0.00	0.00	2.64		2.636222862	0	0
	1	2.64	2	Olympic Dam, Roxby Downs, South Australia,(BHP)	Cu U					3	U	U	-	1994	14/Feb/94	5,000,000			WISE	leakage from unlined tailings impoundment into groundwater. Up to 5 million m3 of contaminated water into the subsoil.			Au										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	3	Minera Sera Grande: Crixas, Goias, Brazil	Au	DS then US	CST	41	2.25Mt	2	A	SI	214	1994	Feb/94	-			ICOLD				P										0.04	0.00	0.00	0.04		0	0	0.04007
	3	0.04	1	Fort Meade, Florida, Cargill phosphate (#3 of 3)	P					1	A	U	-	1994	Jan/94	76,000			WISE				Fe										0.00	0.00	2.21	2.21		2.214285714	0	0
	1	2.21	1	Longjiaoshan, Daye Iron Ore mine, Hubei	Fe					1	A	U	-	1994	Jan/94			31	Wei	failure of upstream-type tailings dam during M6.4 earthquake. Flow runout of about 600 meters, spill into river, croplands contaminated.			U										0.00	0.00	0.00	0.00		0	0	0
	4	0.00	1	Helmsdrf Uranium,Zwckau, Saxny , Germany,Wismut Urnaium	U	US		59	m ponded water	2	B	SI		1994		-	0	0	wiseinternational.org/nuclear-monitor/452/failure-helmsdorf-uranium-mill-tailings-dam[20]	dam at closed U mill feared unstable at risk of failure with high risk to of toxicity to nearby residents in event of failure. Dam re enforced but no not clear 2 years ater whether adequate.			Cu										0.00	0.00	0.14	0.14		0	0.142857143	0
	2	0.14	1	Marcopper, Marinduque Island, Mogpog Philippines(12/6) (#1 of 2) (Placer Dome-President Marcos)	Cu					1	A	U	-	1993	6/Dec/93			2	Piplinks	Siltation (tailings) dam failure. Mogpog River and Mogpog town flooded. The dam was completed in 1992.		Strat	P										0.00	0.00	0.00	0.00		0	0	0
	3		1	Gibsonton, Florida, USA (Cargill)	P					2	A	U	-	1993	Oct/93				WISE	Fish killed when acidic water spilled into Archie Creek (WISE).			Cu										0.00	0.00	0.00	0.00		0	0	2.2E-05
	3	0.00	1	TD 7, Chingola, Zambia	Cu	US	T&E	5		1	A	OT	200	1993	Aug/93	42			ICOLD			Vein	Au Ag	>50	2.5	6	7.312561265	1931	37	Py			0.00	0.00	0.00	0.00		0	0	0
	2		2	Itogon-Suyoc, Baguio gold district, Luzon, Philippines (Benguet Corp)	Au Ag					1	A	OT	199	1993	26/Jun/93				ICOLD, Piplinks	Itogon-Suyoc Mines. Overtopping at the dam of the Itogon-Suyoc gold and silver mines occurred during a typhoon when the dam's penstock and diversion tunnel were blocked. Siltation of the adjoining river. No production after this event.		Wits	Au										0.00	0.00	0.00	0.00		0	0	5.3E-05
	3	0.00	1	Saaiplaas, South Africa, failure on south ring dyke (22Mar93)	Au	US	CST	28		1	A	SI	Table 1	1993	22/Mar/93	100			Blight, ICOLD	Slope Stability in Surface Mining, W. A. Hustrulid, M. Kim McCarter, Dirk J. A. Van Zyl, 2001, Chapter 42, Management and Operational Background to the Three Tailings Dam Failures in South Africa, G Blight, p. 386. Three separate events within 4 days.		Wits	Au										0.00	0.00	0.00	0.00		0	0	5.3E-05
	3	0.00	1	Saaiplaas, South Africa, 2 failures on west ring dyke (18-19Mar93)	Au	US	CST	28		1	A	SI	Table 1	1993	18/Mar/93	100			Blight, ICOLD	Slope Stability in Surface Mining, W. A. Hustrulid, M. Kim McCarter, Dirk J. A. Van Zyl, 2001, Chapter 42, Management and Operational Background to the Three Tailings Dam Failures in South Africa, G Blight, p. 386. Three separate events within 4 days.			Cu										0.11	0.00	0.00	0.11		0	0.113884828	0
	2	0.11	1	Ray Complex, Pinal County, Arizona, AB-BA Impoundment	Cu	US		46		1	A	OT	-	1993	9/Jan/93	216,000			EPA 1997	Swollen out of its banks by the heavy rains, the Gila River breached the AB-BC tailings impoundment containment dike on the night of January 9, 1993. Continued flooding over the next several days resulted in a total of 13 separate breaches of the dike, three of which eroded through the dike and into the toe of the tailings pile.		Vein	Au										0.00	0.00	0.43	0.43		0	0.428571429	0
	2	0.43	1	Marsa, Peru (Marsa Mining Corp)	Au					1	A	OT	-	1993	1993			6	WISE	Dam failure from overtopping.			Pb Zn										0.00	0.00	0.00	0.00		0	0	0
	4	0.00	1	Kojkovac, Montenegro	Pb Zn	WR	E		3,500,000	2	B	ER	198	1992	Nov/92	-			ICOLD			Strat	Coal										0.26	0.00	0.00	0.26		0	0.263622286	0
	2	0.26	1	Maritsa Istok 1, Bulgaria	Coal		Ash	15	52,000,000	1	A	ER	218	1992	1/Mar/92	500,000			ICOLD, WISE	Dam failure from inundation of the beach.		PCD	Cu	590	0.3	0.35	0.58073274	1958	200	Py			17.00	0.00	0.00	17.00		16.99994675	0	0
	1	17.00	1	Tubu, Benguet, No.2 Tailings Pond, Luzon, Philippines - Padcal (Philex)	Cu					1	A	FN	197	1992	2/Jan/92	32,243,000			Piplinks	Philex Mining Corp. Collapse of dam wall (foundation failure). 80,000,000 tonnes released, siltation affected government irrigation system; the 2nd of 3 dams that Philex controls failed in 1994 and a 3rd breached in 2001; Benguet Corp and Lepanto mines have built 5 TSFs each and no longer operate their mines; Itogon-Suyac;s TSF collapsed in 1994 (from UN report (2007))			Al										0.02	0.00	0.00	0.02		0	0	0.02278
	3	0.02	1	Ajka Alumina Plant, Kolontár, Hungary #1	Al	DS	Compacted Fly Ash			1	A	ST	-	1991	3/Nov/91	43,200			Kolontár Report[15]	The Kolontar Report (https://www.google.com/?gws_rd=ssl#q=kolontar+hungary+disaster) Dam break occurred during the construction of Reservoir 10 resulting in alkaline (pH = 10-11) slag water escaping, polluting the rivers Marcal and Rába through the Torna stream to a traceable extent.		VMS	Pb Zn	170			5.693021381	1909	130	PY			0.04	0.00	0.00	0.04		0	0	0.03954
	3	0.04	1	Iron Dyke, Sullivan Mine, Kimberley, BC, Canada (Cominco, Inc)	Pb Zn	US		21		1	A	SI	196	1991	23/Aug/91	75,000			ICOLD, WISE, Mt Polley Expert Panel 2015, App I	Dam failure (liquefaction in old tailings foundation during construction of incremental raise), material was contained in an adjacent pond.			Cu										0.00	0.00	0.00	0.00		0	0	0.00422
	3	0.00	1	Magma Mine Tailings Dam #3	Cu	US				1	A	SI	-	1991	4/Jan/91	8,000			EPA 1997	On January 4, 1991, the face of Tailings Dam No. 3 failed, allowing 150 to 250 tons of tailings to enter Pinto Creek. The tailings discharge was accompanied by approximately two million gallons of water which were released over a period of 16 hours.			Au										0.02	0.00	0.00	0.02		0	0	0.02195
	3	0.02	1	Brewer Gold Mine Jefferson South Carolina	Au					1	A	U	-	1990	1/Nov/90	41,640			NWF, 2012	The spill killed 11,000 fish and decimated 50 miles of the Lynches River. (Protecting America's Waters from Irresponsible Mining, National Wildlife Federation, February, 2012)			U										0.10	0.00	0.00	0.10		0	0.100176469	0
	2	0.10	1	Matachewan Mines, Kirtland Lake, Ontario	U					1	A	U	-	1990	17/Oct/90	190,000			Proceedings of Canadian dam safety conference, Niagara Falls (Canada), Oct 1996; Ontario Environment, 1990	Proceedings: Failure of the dam in 1990, when it discharged 190,000 cu m of tailings into Davidson Creek and the Montreal River. The contaminant plume was observed as far away as Lake Temiskaming, some 168 km downstream. (https://www.etde.org/etdeweb/details.jsp?query_id=1&page=0&osti_id=415194); Ontario Environment (https://archive.org/details/matachewanmineta00ontauoft)													0.26	0.00	0.00	0.26		0	0.263622286	0
	2	0.26		Little Bay Newfoundland						1	B			1989		500,000				researchgate.net/publication/10589756_State_of_the_marine_environment_at_Little_Bay_Arm_Newfoundland_and_Labrador_Canada_10_years_after_a_do_nothing_response_to_a_mine_tailings_spill		Strat	Na										0.00	0.00	0.00	0.00		0	0	0
	4	0.00	1	Soda Lake, California, USA	Na	US	E	3		2	A	EQ	111	1989	17/Oct/89				ICOLD				Ag Pb										0.00	0.00	0.00	0.00		0	0	5.3E-05
	3	0.00	1	Silver King, Idaho, USA (#2 see incident #109 1974)	Ag Pb	DS	E	9	37,000	2	A	OT	108	1989	5/Aug/89	100			ICOLD			Strat	Sand										0.02	0.00	0.00	0.02		0	0	0.0226
	3	0.02	1	Stancil, Maryland, USA	Sand	US	E	9	74,000	1	A	SI	116	1989	1989	38,000	0		ICOLD, Rico, WISE			Strat	Clay										0.00	0.00	0.00	0.00		0	0	0.00016
	3	0.00	1	Southern Clay, Tennessee, USA	Clay	WR	E	5		1	A	SE	112	1989	1989	300			ICOLD			Strat	P										0.00	0.00	0.00	0.00		0	0	0
	4	0.00	1	Big Four, Florida, USA	P	CL	E			2	A	FN	14	1989	1989				ICOLD				Mo										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Thompson Creek, Idaho, USA (Cyprus)	Mo	CL	CST	146	27,000,000	2	A	SE	34	1989	1989				ICOLD			Strat	Limestone										0.00	0.00	0.00	0.00		0	0	0.00243
	3	0.00	1	Unidentified, Hernando, County, Florida, USA #2	Limestone	US	E	12	3,300,000	1	A	OT	163	1988	Sep/88	4,600			ICOLD				Mo										0.37	0.00	1.43	1.80		1.797642629	0	0
	1	1.80	1	Jinduicheng, Shaanxi Province., China	Mo	US		40		1	A	OT	195	1988	30/Apr/88	700,000		20	ICOLD, WISE			Strat	Coal										0.13	0.00	0.00	0.13		0	0.131811143	0
	2	0.13	1	Consolidated Coal No.1, Tennessee, USA,	Coal	DS	MW	85	1,000,000	2	A	ST	121	1988	19/Jan/88	250,000			ICOLD, WISE			Strat	P										0.00	0.00	0.00	0.00		0	0	0.00013
	3	0.00	1	Riverview, Hillsborough County, Florida	P					1	A	ER		1988	1988	246			WISE; Beavers 2013.	Gardiner/Cargill. A breach at a Riverview phosphogypsum stack caused the release of 65,000 gallons of process water into Hillsborough Bay, impacting coastal ecosystems, including sea grasses and mangroves. Acidic spill. Thousands of fish killed at mouth of Alafia River. (An Overview of Phosphate Mining and Reclamation in Florida, Casey Beavers, University of Florida thesis, April 2013)		Strat	Limestone										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Unidentified, Hernando, County, Florida, USA	Limestone	DS	E	12		2	A	FN	164	1988	1988				ICOLD				Au										0.00	0.00	0.00	0.00		0	0	0
			2	Rain Starter Dam, Elko, Nevada, USA	Au	WR	ER	27	1,500,000	3	U	U	98	1988	1988				ICOLD Bulletin 121 p 135	leak in floor of impoundment discovered from major seep dwnstream;dam built; captured water returned to dam		Placer	Au										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	u	Surigao Del Norte Placer, Philippines (#1 of 3) (Manila Mining Corp)	Au					1	A	U		1987	9/Jul/87				Piplinks			Strat	Coal										0.05	0.00	0.00	0.05		0	0	0.04587
	3	0.05	1	Montcoal No.7, Raleigh County, West Virginia, USA	Coal					1	A	U		1987	8/Apr/87	87,000			WISE	tailings flow 80 km downstream		Strat	Coal										0.00	0.00	0.00	0.00		0	0	0
			1	Bekovsky, Western Siberia	Coal	US	Argillite, aleurolite	53	52,000,000	1	A	U	212	1987	25/Mar/87	-			ICOLD				Fe										0.00	0.00	0.00	0.00		0	0	0.00118
	3	0.00	1	Xishimen, China	Fe	US	T	31		1	A	SI	194	1987	21/Mar/87	2,230			ICOLD				Au	150		0.51	0.41603863	1986	3.5				0.00	0.00	0.00	0.00		0	0	0
		0.00	2	Montana Tunnels, MT, USA (Pegasus Gold)	Au	DS	MW	33	250,000	3	U	U	87	1987	1987				ICOLD(bulletin 121 P126)	Failure of earlier liner failure repair		Strat	Coal										0.00	0.00	0.00	0.00		0	0	0
			2	Marianna Mine #58, PA	Coal	US	E	37	300,000	2	A	SI	77	1986	19/Nov/86				ICOLD				Cu Au										0.05	0.00	0.00	0.05		0	0.052724457	0
	2	0.05	1	Mankayan District, Luzon, Phillippines, No.3 Tailings Pond (Benguet Corp subsidiary Lepanto Con Mining Co)	Cu Au		E			1	A	ST	193	1986	17/Oct/86	100,000			ICOLD, Piplinks	Lepanto Consolidated Mining Corporation. Collapse of tailings pond 3 due to weakened dam embankment caused by additional loading. Siltation of the Abra River which affected 9 municipalities		Strat	Fe										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Pico de Sao Luis, Minas Gerais, Brazil Fernandinho, Rio Acima	Fe		T	20		1	A	ER	192	1986	2/Oct/86				ICOLD				Sn										0.00	0.00	0.00	0.00		0	0	5.3E-05
	3	0.00	1	Story's Creek, Tasmania	Sn	Valley side		17	30,000	1	B	OT	191	1986	16/May/86	100			ICOLD				Sn										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Rossarden, Tasmania	Sn	WR	E	7.5	200,000	1	B	OT	190	1986	16/May/86				ICOLD			Strat	Fe										0.02	0.31	0.50	0.83		0	0.829309335	0
	2	0.83	1	Itabirito, Minas Gerais, Brazil	Fe	Gravity	Masonry	30		1	A	ST	189	1986	May/86	41,000	12	7	ICOLD, WISE, Rico	Itaminos Comercio de Minerios. Dam wall burst.			Pb Zn										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Mineral King, BC, Canada	Pb Zn	CL	CST	6	Small	1	B	OT	188	1986	20/Mar/86				ICOLD, MT Polley Expert Panel 2015, App I	Tailings spilt out through dam but were almost completely contained by the emergency pond downstream of the dam.			Fe										0.00	0.00	1.36	1.36		0	1.357142857	0
	2	1.36	1	Huangmeishan, China	Fe					1	A	U		1986	1986			19	WISE			Strat	Sand										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Spring Creek Plant, Borger, Texas, USA	Sand			5	30,000	1	A	OT	114	1986	1986				ICOLD			Strat	Sand										0.01	0.02	0.00	0.03		0	0	0.02631
	3	0.03	1	Bonsal, North Carolina, USA	Sand	WR	E	6	38,000	1	A	OT	17	1985	17/Aug/86	11,000	1		ICOLD				F						1.5				0.11	0.21	19.21	19.52		19.52486283	0	0
	1	19.52	1	Prestavel Mine - Stava, North Italy, 2, 3 (Prealpi Mineraria)	F	US	CST	29.5	300,000	1	A	SI	117	1985	19/Jul/85	200,000	8	269	ICOLD, WISE, Rico	Damage valued at Euro133M; razed 20 buildings in Stava and flowed in to Avisio River; mining of argentiferous galena since 16th c.; fluorite mining commenced in 1934 and throughput increased from 30tpd to 200tpd in 1961; 1st TSF in use by 1962, 2nd by 1970		Strat	Coal										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	La Belle, Pennsylvania, USA	Coal	DS	MW	79	1,230,000	2	A	FN	68	1985	17/Jul/85				ICOLD				Cu										0.26	0.21	0.00	0.47		0	0.468750491	0
	2	0.47	1	Cerro Negro No. (4 of 5)	Cu	US	CST	40	2,000,000	1	A	EQ	30	1985	3/Mar/85	500,000	8		ICOLD WISE, Rico				Cu										0.15	0.13	0.00	0.28		0	0.275833608	0
	2	0.28	1	Veta de Agua	Cu	US	T	24	700,000	1	A	EQ	178	1985	3/Mar/85	280,000	5		WISE, Rico				P										0.39	0.11	3.50	3.99		3.99310809	0	0
	1	3.99	1	Niujiaolong, Shizhuyuan Non-ferrous Metals Co., Hunan	P					1	A	U		1985	1985	731,000	4	49	Wei			Strat	Coal										1.32	0.06	0.00	1.38		1.382213995	0	0
	1	1.38	1	Quintette, MaĔmot, BC, Canada	Coal					2	U	U		1985	1985	2,500,000	3		Blight & Fourie, 2004	Waste dump failure - pore pressure resulting from collapse settlement. River valley filled with waste for 2.5km. (Blight & Fourie, 2004)			Au										0.01	0.04	0.00	0.05		0	0	0.05164
	3	0.05	9	Olinghouse, Nevada, USA	Au	WR	E	5	120,000	1	A	SE	91	1985	1985	25,000	2		ICOLD, Rico, WISE			HT Manto	Cu	580	1.1		1.1	19th c	65	Py			0.00	0.00	0.00	0.00		0	0	0
			1	El Cobre No. 4 - El Soldado (Exxon)	Cu	DS	CST	50		2	A	EQ	44	1985	1985				ICOLD			PCD	Cu	12000	1			1905	680	Py			0.00	0.00	0.00	0.00		0	0	0
			1	Marga, Chile - El Teniente (Codelco)	Cu					1	B	OT	76	1985	1985				ICOLD			Strat	P										0.00	0.00	0.00	0.00		0	0	0

			1	Texasgulf 4B Pond, Beaufort, Co., North Carolina, USA	P	WR	T	8	12,300,000	2	A	SI	122	1984	Apr/84				ICOLD				Fe										0.00	0.00	0.00	0.00		0	0	0
	4	0.00	1	Mirolubovka, Southern Ukraine	Fe	US	E&T	32	80,000,000	2	A	SI	210	1984	15/Jan/84	-			ICOLD bulletin 121 p 111	slip " said to be caused by incompatibility between real and design values for shear characteristics of foundation soil" cured.Stabilized by toe weighting with rockfill.			Au										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Battle Mt. Gold, Nevada,	Au	DS	E	8	1,540,000	2	A	SI	11	1984	1984				ICOLD				Vermiculite										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Virginia Vermiculite, Louisa County, Virginia, USA	Vermiculite	WR	E	9		1	A	ST	179	1984	1984				ICOLD			Vein	Ag Pb					1881					0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Clayton Mine, Idaho, USA	Ag Pb	CL	T	24	215,000	2	A	ST	32	1983	2/Jun/83				ICOLD	Mine shut down in 1986		Vein	Au	65		1.9	1.523977734	1982	1.5				0.00	0.00	0.00	0.00		0	0	0
	4		1	Golden Sunlight, MT, USA	Au	CL	CST			3	U	U	51	1983	5/Jan/83	664			ICOLD Bulletn 121 p 120	a pre existing undetected interruption in the impermeable layer discovered through monitoring & repaired.Discovered in 1890, production ceased in 1945; mine started as open pit in 1983; earlier dumps/tails cleaned up		Vein	Au										0.00	0.00	0.00	0.00		0	0	5.3E-05
	3	0.00	u	Grey Eagle, California, USA	Au	DS	E			3	U	U	53	1983	1983	100			ICOLD Bulletin121 p126	higher cynaide effluent concentrations than expected overwhelmed system 3 mos after start up had reached 400gpm			Cu										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	2	Vallenar 1 and 2	Cu						1	B	OT	175	1983	1983				ICOLD			PCD	Cu	800	0.473	0.05	0.513104677	1957	~100	Py			6.13	0.00	0.00	6.13		6.125662944	0	0
	1	6.13	1	Sipalay, Phillippines, No.3 Tailings Pond (Maricalum Mining Corp)	Cu	WR	MW		37,000,000	1	A	FN	187	1982	8/Nov/82	11,618,257			ICOLD, WISE, Piplinks	dam failure, due to slippage of foundations on clayey soils. Widespread inundation of agricultural land up to 1.5 m high; 1st of 4 discharges reported in this area (4th in 1995); mine reactivated by Philex in 1996 and decommissioned in 2002 after which tailings dried up causing a dust problem as far as 5km from site		Strat	Gypsum										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Royster, Florida, USA	Gypsum	US	T	21		1	A	FN	102	1982	1982				ICOLD				Coal										0.05	0.00	0.07	0.12		0	0.12204405	0
	2	0.12	1	Ages, Harlan County, Kentucky, USA	Coal					1	A	U		1981	18/Dec/81	96,000		1	WISE	163 given as visibly affected runout		Vein	Au	0.087				1936		Py Ga			0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Dixie Mine, Colorado, USA	Au					1	B	U	39	1981	Apr/81				ICOLD	Ceased operations in 1954			Fe										1.85	0.03	0.00	1.88		1.878689337	0	0
	1	1.88	1	Balka Chuficheva, Russia	Fe	US	CST	25	27,000,000	1	A	SI	211	1981	20/Jan/81	3,500,000	1		ICOLD, WISE			Strat	P										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Texasgulf No. 1 Pond, Beaufort Co., North Carolina, USA	P	WR	E		24,700,000	2	A	SI	123	1981	1981				ICOLD				Cu										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Veta de Aqua A	Cu					1	A	EQ	176	1981	1981				ICOLD				Cu										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Veta de Agua B	Cu					1	A	EQ	177	1981	1981				ICOLD																				
			1	San Nicolas Cajmarca Peru										1980					Gil(33)	CONTAMINACIÓN DEL RIO TINGO Y DAÑOS EN LA AGRICULTURA		PCD	Cu	1300	0.53		0.53	1967	100	Py			1.05	0.21	0.00	1.26		1.25961735	0	0
	1	1.26	1	Tyrone, New Mexico (Phelps Dodge)	Cu	US	CST	66	2,500,000	1	A	SI	94	1980	13/Oct/80	2,000,000	8		ICOLD, WISE, Rico			Strat	Sand										0.00	0.00	0.00	0.00		0	0	0
	3		1	Sweeney Tailings Dam, Longmont, Colorado, USA	Sand			7		1	A	SE	119	1980	May/80				ICOLD			PCD	Cu	12000	1		1		580	Py			0.00	0.00	0.00	0.00		0	0	0
	3		1	Marga, Sewell, VI Region, Rancagua, Chile - El Teniente (Codelco)	Cu					1	B	OT		1980	Jun/05				Villavicencio	Strong rains and overflow		PCD	Cu	12000	1		1		580	Py			0.00	0.00	0.00	0.00		0	0	0
	3		1	Arena, Sewell, VI Region, Rancagua, Chile - El Teniente (Codelco)	Cu					1	B	OT		1980	Jun/05				Villavicencio	Strong rains and overflow			Kyanite										0.00	0.00	0.00	0.00		0	0	0
	3		1	Kyanite Mining, Virginia, USA	Kyanite			11	430,000	2	A	OT	67	1980	1980				ICOLD				Cu										0.02	0.00	0.00	0.02		0	0	0.01996
	3	0.02	1	Churchill Copper, BC	Cu					1	A	SE		1979	1/Dec/79	37,854			Mt Polley Expert Panel 2015, App. I	Seepage and piping with release of 10,000,000 gallons of supernatant.			U					1967	3	U			0.20	0.00	0.00	0.20		0	0.195080492	0
	2	0.20	1	Churchrock, New Mexico, United Nuclear	U	WR	E	11	370,000	1	A	FN	173	1979	16/Jul/79	370,000			ICOLD, Wikipedia, Rico	Mined closed in 1982; basic surface remediation and tailings pumped into undergorund mine; high radium levels proximal to and on site; EPA program in progress 110 km runout ascrined by rico not cnsistent with release			U										0.00	0.00	0.00	0.00		0	0	0
			1	Union Carbide, Uravan, Colorado, USA	U	US	T	43		2	A	SI	172	1979	Mar/79				ICOLD				0										0.02	0.00	0.00	0.02		0	0	0.02109
	3	0.02	1	Unidentified, British Columbia, Canada						1	A	FN		1979	1979	40,000			WISE	Piping in the sand beach of the tailings dam		Strat	Oil Sands										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Suncor E-W Dike, Alberta, Canada	Oil Sands	WR	MW	30		2	A	SI	118	1979	1979				ICOLD				U										0.00	0.00	0.00	0.00		0	0	0
	4	0.00	1	Incident No. 1, Elliot, Ontario, Canada	U	WR	E	9		3	U	U	35	1979	1979				ICOLD Bulletin 121 p134	lined butress installed at closure/abadonment to prevent seepage..not clear whether there was a seepage problem before			Au							Asp, Py			0.02	0.01	0.07	0.10		0	0.099683417	0
	2	0.10		Arcturus, Zimbabwe	Au	US	T	25	1.7-2.0 Mt	1	A	OT	185	1978	31/Jan/78	39,000	0	1	ICOLD, WISE, Rico				Au										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Norosawa, Japan	Au	DS		24	225,000	2	B	EQ	90	1978	14/Jan/78				ICOLD				Au					1960					0.04	0.21	0.07	0.32		0	0.318736342	0
	2		1	Mochikoshi Dike No 1 (of 3), Sagami Bay Nr Izu Japan (2 of 2)	Au	US	14	28	476,000	1	A	EQ	84	1978	14-Jan-78	80,000	8	1	ICOLD, okusa-anma 1979(28),Rico	magnitude 7 eq . Tsf three dams reatining totalof 476,000 of tailings;A flow of about 80,000 m 3 of the dike material and tailings,The valley looked as though it had been painted white, with splashes as high as 30 m on the leaves of forest trees. Where the valley opens to the Mochikoshi			Au										0.00	0.00	0.00	0.01		0	0	
	3		1	Mochikoshi Dike No 2 (of 3),Sagami Bay Nr Izu Japan (2 of 2)	Au			19		1	A	EQ	85	1978	14-Jan-78	3,000	0		ICOLD, okusa-anma 1979(28)	erupted after #1			Au										0.00	0.00	0.00	0.00		0	0.003846154	0
				Mochikoshi Dike no 3(of 3), Sagami Bay Nr IzuJapan (2 of 2)	Au	US	T			1	A	EQ	85	1978	14-Jan-78		0		ICOLD, okusa-anma 1979(28)	3 was a new consticted starter dam			Au										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Hirayama, Japan	Au	DS		9	87,000	2	B	EQ	56	1978	15-Jan-78	-	0	0	ICOLD;Okusa et. al Liquefaction of Mine Tailings in the 1978 Izu-Oshima-Kinkai Earthquake,			Strat	Oil Sands										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Syncrude, Alberta, Canada	Oil Sands	CL	T			2	A	FN	120	1978	1978				ICOLD				Pb										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Madison, Missouri, USA	Pb	WR	E	11		1	A	OT	74	1977	28/Feb/77				ICOLD			n.a.	U					1958		U			0.02	0.00	0.00	0.02		0	0	0.01582
	3	0.02	1	Grants, Milan, New Mexico, USA mill site (Homestake Mining)	U	US	T	21		1	A	ST	59	1977	Feb/77	30,000			ICOLD, WISE	Dam failure, due to rupture of plugged slurry pipeline; mill decommissioned in 1993		Strat	U										0.00	0.00	0.00	0.00		0	0	2.1E-05
	3	0.00	1	Western Nuclear, Jeffrey City, Wyoming, USA #2	U					1	A	SI	180	1977	1977	40			ICOLD				REE										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Pit No. 2, Western	REE	US	T	9		1	A	SI	96	1977	1977				ICOLD			Strat	Limestone										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Unidentified, Hernando, County, Florida, USA	Limestone	CL	E	6		2	A	FN	162	1977	1977				ICOLD				U										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Kerr-McGee, Churchrock, New Mexico, USA	U	WR	E	9		1	A	FN	64	1976	Apr/76				ICOLD				Pb Zn										0.16	0.00	0.00	0.16		0	0.158173372	0
	2	0.16	1	Zletovo No. 4, Yugoslavia	Pb Zn	US	T	25	1,000,000	1	A	SI	184	1976	Mar/76	300,000			ICOLD, WISE p42	dam failure, due to high phreatic surface and seepage breakout on the embankment face. Tailings flow reached and polluted nearby river			Fe										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Dashihe, China	Fe	US		37		2	A	EQ	36	1976	1976				ICOLD			Strat	P										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Unidentified, Idaho, USA	P	DS	E	34		2	A	SI	149	1976	1976				ICOLD				Barite										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Cadet No. 2, Montana,	Barite	CL	E	21		2	A	SI	18	1975	Sep/75				ICOLD				Au Ag										0.03	0.00	0.00	0.03		0	0	0.02538
	3	0.03	1	Silverton, Colorado, USA	Au Ag					1	A	U		1975	Jun/75	48,133		0	WISE	"Tailings flow slide polluted nearly 100 miles (160 km) of the Animas river and its tributaries; severe property damage; no injuries "			Pb Zn										0.13	0.51	0.00	0.64		0	0.644631656	0
	2	0.64	1	Madjarevo, Bulgaria	Pb Zn	US	T	40	3,000,000	1	A	ST	219	1975	Apr/75	250,000	20		ICOLD			Skarn	Cu Au	127	2.42	1.12	3.318344769	1979		Py			0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Carr Fork, Utah, USA (Anaconda)	Cu Au			10		1	A	ST	22	1975	Feb/75				ICOLD	Adjacent to Bingham Canyon open pit; underground mine operated form 1979-1982 and re-opened in 1984		Vein	Pb Zn							Py, En, Ga			0.08	0.00	0.00	0.08		0	0.079086686	0
	2	0.08	1	Mike Horse, Montana, USA (Asarco)	Pb Zn	US	T	18	750,000	1	B	OT	79	1975	1975	150,000			ICOLD				Barite										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Dresser No. 4, Montana,	Barite	CL	E	15		1	A	FN	40	1975	1975				ICOLD				Mo										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Keystone Mine, Crested Butte, Colorado, USA	Mo					1	B	U	65	1975	1975				ICOLD			VMS	Pb Zn	40	1.11	0.93	5.022480413	1956		PY Ga			0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Heath Steele main dam, Brunswick, Canada (American Metals)	Pb Zn	WR	R,E	30		2	A	FN	186	1975	1975				ICOLD			Strat	K										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	PCS Rocanville, Saskatchewan, Canada	K	US	T	12		3	U	U	92	1975	1975				ICOLD			Strat	Trona										0.00	0.00	0.00	0.00		0	0	0
		0.00		Unidentified, Green River, Wyoming, USA	Trona	WR	E	18		3	U	U	161	1975	1975				ICOLD			Magmatic	Pt										6.85	1.15	0.93	8.94		8.936597024	0	0
	1	8.94	1	Bafokeng, South Africa, MorenskyTailings dam (2nd occurrence)	Pt	US	T	20	17,000,000	1	A	SE	7	1974	11/Nov/74	13,000,000	45	13	ICOLD, WISE, Rico,Blight Fourie 2004	books.google.com/books?id=mDgarPrQ1_YC&pg=PA383&lpg=PA383&dq=Bafokeng+tailings&source=bl&ots=rgKF0PG8jS&sig=ZHuhBXlzouXT6uMa4exSS0DC96U&hl=en&sa=X&ved=0ahUKEwjKj4OnguLMAhUMcj4KHaBwAc0Q6AEIMDAD#v=onepage&q=Bafokeng%20tailings&f=false (copied 9Jun16).http://www.mdpi.com/2072-4292/6/8/6790/htm			Au										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Golden Gilpin Mine, Colorado, USA	Au			12		1	B	U	50	1974	Nov/74				ICOLD				Mica										0.02	0.00	0.00	0.02		0	0	0.0208
	3	0.02	1	Deneen Mica Yancey County, North Carolina, USA	Mica	US	CST	18	300,000	1	A	SI	37	1974	Jun/74	38,000	0		ICOLD				Ag										0.00	0.00	0.00	0.00		0	0	0.00316
	3	0.00	1	Silver King, Idaho, USA	Ag	DS	E	9	37,000	1	A	OT	109	1974	16/Jan/74	6,000			ICOLD				Ag Pb										0.00	0.02	0.00	0.02		0	0	0.01764
	3	0.02	1	Galena Mine, Idaho, USA #2 of 2 (ASARCO)	Ag Pb	US	MW	9		1	A	OT	49	1974	15/Jan/74	3,800	1		ICOLD, Rico			Strat	Ag Pb										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Berrien, France	Ag Pb	US	R	9		1	A	SE	10	1974	1974				ICOLD				Oil Sands										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	GCOS, Alberta, Canada	Oil Sands	US	T	61		2	A	SI	47	1974	1974				ICOLD				Gypsum										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Unidentified, Mississippi, USA #2	Gypsum	US	T	20		2	A	FN	153	1974	1974				ICOLD				Cu										0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Unidentified, Canaca, Mexico	Cu	US	T	46		1	A	OT	159	1974	1974				ICOLD			PCD	Cu	3200	0.49		0.67	1911	32	Py			0.00	0.00	0.00	0.00		0	0	0
		0.00	1	Ray Mine, Arizona, USA inc #2 (Kennecott)	Cu	US	T	52		2	A	SI	101	1973	5/Feb/73				ICOLD Bulletin121 p112	2nd occurrence(12/2/72)instablity observed in same section of earlier failure due to "perched seepage conditions along a slimes layer'			Pt										0.02	#VALUE!	0.00	#VALUE!				#VALUE!
	3		1	Bafokeng, South Africa, MorenskyTailings dam, #1 of 2	Pt	US	T			1	A			1973		40,000	..04		Oldcop-Rodriguez 2006	reached an rqulibrium 40 m from toe of dam at 4 degrees.cayse unknown			Cu										0.09	0.64	0.00	0.73		0	0.730657218	0
	2	0.73	1	(unidentified), Southwestern USA	Cu	US	E	43	500,000	1	A	SI	169	1973	1973	170,000	25		ICOLD, WISE, Rico	noted as "Southwestern US" in WISE			Cu										0.00	0.00	0.00	0.00		0	0	0
			1	Earth Resources, N M,	Cu	US	T	21		1	A	OT	41	1973	1973				ICOLD			PCD	Cu	3200	0.49		0.67	1911	30	Py			0.00	0.00	0.00	0.00		0	0	0
			1	Ray Mine, Arizona, USA	Cu	US	T	52		1	A	SI	100	1972	2/Dec/72				ICOLD																				
	2		1	Brunita,Spain,Caragena, Spain (SMM Penaroya)	Zn, Pb, Cu	US	MW	25	1,008,000	1	A			1972	20/Oct/72	70,000		1	Pacheco (2004) (30),Matin-Crespo et. Al.2017 (35),WISE	satic liquefaction failure follwing severl days of rain;The flow failure due to static liquefaction occurred at 18:15 on October 20, 1972. 70000 m3 of tailings were released, affected the national highway (Portmasn-Cartagena-La Union), the electricity supply, telephone communications, the train tracks between Cartagena -La Union) and destroyed the cemetery of La Union.		Strat	Coal										0.26	1.65	8.93	10.84		10.84347577	0	0
	1	10.84	1	Buffalo Creek, West Virginia, USA (Pittson Coal Co.)	Coal					1	A	U	Table 1	1972	26/Feb/72	500,000	64	125	ICOLD, WISE, Rico,Blight Fourie 2004	Tailings traveled 27 km downstream, 125 people lost their lives, 500 homes were destroyed. Property and highway damage exceeded $65 million		Vein	Ag Pb										0.00	0.00	0.00	0.00		0	0	0
P			1	Galena Mine, Idaho, USA #1 of 2 (ASARCO)	Ag Pb	US	E	14		2	A	ER	48	1972	1972				ICOLD																				
			1	Atacocha, Peru						1	B			1971					Gil(33)	CONTAMINACIÓN DEL RIO HUALLAGA Y DAÑOS A INFRAESTRUCTURA VIAL (100,000 TON DE RELAVES)		Strat	P										4.75	3.08	0.00	7.82		7.822124229	0	0
	1	7.82	1	Cities Service, Fort Meade, Florida, phosphate	P					1	A	U	31	1971	3/Dec/71	9,000,000	120		WISE, Rico				Au										0.16	0.00	6.36	6.52		6.515316229	0	0
	1	6.52	1	Certej gold mine, Romania	Au			25		1	A	SI	-	1971	30/Oct/71	300,000		89	Mining Watch Romania, 30Oct14; Adevărul, 14Oct10	43 years since the Certej gold mine dam failure, Mining Watch Romania, October 30, 2014; Certej 1971 forgotten tragedy of 89 lives buried under 300 thousand cubic meters of mud, Adevărul, October 14, 2010		Vein-Strat	Hg	1.1				1940					0.00	0.00	0.00	0.00		0	0	0
			1	Pinchi Lake, BC, Canada	Hg	WR	E	13		2	A	ER	95	1971	1971				ICOLD																				
	2		1	Ticapampa, Alianza,Peru				20		1	**B**	EQ		1971					Pacheco	3 deaths													0.00					0	0	0
	2			Chungar Peru										1971	xx/Mar/71				pebblescience.org/pdfs/Tailings_dam.pdf	miners deaths cited without a number used average for deaths(AN319) for magnitude score		Strat	U										0.00	0.00	0.00	0.00		0	0	0
			1	Western Nuclear, Jeffrey City, Wyoming, USA	U					1	A	ST	181	1971	1971				ICOLD			SSC	Cu	612	3		3	1967	50				0.04	0.00	6.36	6.39		6.392995488	0	0
	1	6.39	1	Mufulira, Zambia (Roan Consolidated Mines)	Cu			50	1,000,000	1	A	MS	88	1970	Sep/70	68,000		89	ICOLD, WISE, Blight Fourie 2004	Saturated slime tailings deposited in a TSF #3 over subsidence feature flowed into an underground mine killing 89 miners.		Strat	Clay										0.01	0.00	0.00	0.01		0	0	0.00791
	3	0.01	1	Maggie Pye, United Kingdom, clay	Clay	US	T	18		1	A	SI	75	1970	Jan/70	15,000			ICOLD, WISE			Strat	Clay										0.00	0.00	0.00	0.00		0	0	0
			1	Park, United Kingdom	Clay	WR	T	3		1	A	OT	93	1970	1970				ICOLD			Strat	Clay										0.00	0.00	0.00	0.00		0	0	0
			1	Portworthy, United Kingdom	Clay	DS	R	15		1	A	ST	97	1970	1970				ICOLD			Strat	Gypsum										0.00	0.00	0.00	0.00		0	0	0
			1	Unidentified, Mississippi, USA	Gypsum	US	T	15		1	A	OT	152	1970	1970				ICOLD																				
	3		1	Almivirca,Quiruvilca, Peru,#2inc				40		1	B	EQ							Pacheco			Strat	P										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Williamsport Washer, Maury County, Tennessee, USA	P			21		1	A	U	182	1970	1970				ICOLD														0.00					0	0	0
		0.00	1	Buenaventura,Peru						1	B	EQ		1969					acingenieros.com/descargas/pdfs/Articulo_03_Parte_03.pdf				Cu										0.01	0.00	0.00	0.01		0	0	0.00599
	3	0.01	1	Phoenix Copper, BC	Cu	US				2	A	SE		1969	12-Sep-69	11,356			Mt Polley Expert Panel 2015, App. I	Piping failure occurred 25 years after closure with a release of 9 million gallons of tailings and supernatant.			Fe										0.06	0.00	0.00	0.06		0	0.061530562	0
	2	0.06	1	Bilbao, Spain	Fe					1	A	SI	15	1969	1969	115,000	0		ICOLD, WISE	mudslide		Strat	P										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Monsanto Dike 15, TN,	P	DS	E	43	1,230,000	2	A	SE	86	1969	1969				ICOLD														0.00					0	0	0
			1	Yauli-Yacu,Peru		US		80		1	B	EQ		1968					ICOLD,http://www.acingenieros.com/descargas/pdfs/Articulo_03_Parte_03.pdf,	Table 1 Page 2 brief desription of dam& cause ofFailures In Peru			?										0.00	0.00	0.00	0.00		0	0	0
			1	Stoney Middleton, UK	?					1	A	SI	217	1968	8/Feb/68				ICOLD				Pb Zn										0.05	0.00	0.00	0.05		0	0	0.0513
	3	0.05	1	Hokkaido, Japan	Pb Zn	US	T	12	300,000	1	A	EQ	57	1968	1968	90,000	0		ICOLD, WISE, Rico			Strat	P										0.00	0.00	0.00	0.00		0	0	0
	3	0.00	1	Agrico Chemical, Florida, USA	P					1	A	U	1	1968	1968				ICOLD			Strat	K										0.00	0.00	0.00	0.00		0	0	0
			1	IMC K-2, Saskatchewan, Canada	K	US	T	30		3	U	U	60	1968	1968				ICOLD														2.43	0.00	1.29	3.71		3.711039319	0	0
	1	3.71	u	Iwiny Tailings Dam, Poland						2	A	MS	73	1967	13-Dec-67	4,600,000		18	ICOLD bulletin 121	sink hole caused by blasting/dewatering of underground mine too close to dam; dam sited over an unidentfed deep fracture			Mo										0.01	0.00	0.00	0.01		0	0	0.00633
	3	0.01	2	Climax, Colorado, USA - Mill (Climax Molybdenum Co)	Mo					1	A	U	33	1967	2/Jul/67	12,000			ICOLD	Mill decommissioned in 1970		Strat	P										1.05	0.00	0.00	1.05		1.054489145	0	0
	1	1.05	1	Mobil Chemical, Fort Meade, Florida, phosphate	P					1	A	U	83	1967	Mar/67	2,000,000			ICOLD, WISE	250,000 m3 of phosphatic clay slimes, 1.8 million m3 of water. Spill reaches Peace River, fish kill reported		Strat	Coal										0.00	0.00	0.00	0.00		0	0	0
			1	Unidentified, United Kingdom	Coal	DS		20		1	A	SI	144	1967	1967				ICOLD			Strat	Coal										0.00	0.00	0.00	0.00		0	0	0
			1	Unidentified, United Kingdom #3	Coal	DS	MW	14		2	A	SI	145	1967	1967				ICOLD			Strat	Sand										0.00	0.00	0.00	0.00		0	0	0

		1	Unidentified, United Kingdom #2	Sand	DS	E	30		2	A	SE	146	1967	1967				ICOLD			Strat	Coal					1869					0.09	0.00	10.29	10.37		10.37112791	0	0
1	10.37	1	Aberfan, South Wales Colliery	Coal				230,000	1	U			1966	21/Oct/66	162,000		144	Blight & Fourie, 2004; WISE; Wikipediahttp://www.nuff.ox.ac.uk/politics/aberfan/home.htm	Coal tip (waste rock pile) failure. Waste dumped over spring on hillside above village in Tips; a Tip failed in 1939 burying a road, Tip 4 failed in 1944, Tip 7 failed in 1966 and slid into village WISE has it erroneously as liquefaction failure of dam			tin										0.04	0.00	0.00	0.04		0	0	0.03691
3	0.04	3	Geising/Erzgebirge, German Democratic Republic VEB Zinnerz	tin									1966	10/9/1966	70,000			WISE	collapse of stream deviation tunnel located under the Tiefenbachtal tailings dam			Pb Zn										0.24	0.21	34.86	35.30		35.29953112	0	0
1	35.30	2	Mir Mine,(Placalnica) Sgorigrad, Bulgaria	Pb Zn	US	T			1	A	U	81	1966	May/66	450,000	8	488	ICOLD, WISE/Wood[21]/Stava Foundation (22)	Tailings wave traveled 8 km to the city of Vratza and destroyed half of Sgorigrad village 1 km downstream, killing 488 (people.Harvey Wood 2012.This was in the original Icold Bulletn 121 compilation but with no details. Stava Fundation & Wood provided details for classifications on severity		Strat	Coal										0.00	0.00	0.00	0.00		0	0	0
		1	Williamthorpe, UK	Coal		MW			1	A	OT	183	1966	24/Mar/66				ICOLD			Strat	Gypsum										0.07	0.00	0.00	0.07		0	0.068541794	0
2	0.07	1	Unidentified, Texas, USA	Gypsum	US	T	16		1	A	SE	154	1966	1966	130,000			ICOLD, WISE			Strat	Gypsum										0.04	0.01	0.00	0.05		0	0	0.05251
3	0.05	1	Gypsum Tailings Dam (Texas, USA)	Gypsum	UP		11	7,000,000	1	A	SE		1966	1966	85,000	0		Rico, WISE	Summary of Research on Analyses of Flow Failures of Mine Tailings Impoundments, J. K. Jeyapalan, J. M. Duncan, and H. B. Seed		Strat	Coal										0.02	0.00	0.00	0.02		0	0	0.01838
3	0.02	1	Derbyshire, United Kingdom	Coal	DS		8		1	B	FN	38	1966	1966	30,000	0		ICOLD			Strat	Coal										0.00	0.00	0.00	0.00		0	0	0
	0.00	1	Williamthorpe, UK #2	Coal					1	A	FN	216	1966	1966				ICOLD			Strat	Coal										0.00	0.02	0.00	0.02		0	0	0.01877
3	0.02	1	Tymawr, United Kindom Inc#2 (see 1961)	Coal			25		1	A	OT	125	1965	29/Mar/65		1		ICOLD Bulletin 121 P137, WISE	colliery waste on a valley side at an elevation of		HT Manto	Cu	580	1.1		1.1	19th c	20	Py			1.00	0.31	14.29	15.60		15.59517128	0	0
1	15.60	1	El Cobre Old Dam	Cu	US	T	35	4,250,000	1	A	EQ	45	1965	28/Mar/65	1,900,000	12	200	ICOLD Bulletin 121 P109, WISE, Rico	old dam had water cover (new dam, undamged, didn't)		HT Manto	Cu	580	1.1		1.1	19th c	20	Py			0.18	0.31	0.00	0.49		0	0.492227908	0
2	0.49	1	El Cobre New Dam	Cu	DS	CST	19	350,000	1	A	EQ	43	1965	28/Mar/65	350,000	12		ICOLD, WISE , Blight Fourie 2004	pipeline. The downslope bund overtopped and			Cu										0.02	0.13	0.00	0.15		0	0	0.14666
3	0.15	1	La Patagua New Dam, Chile (La Patagua - private)	Cu	US	T	15		1	A	EQ	69	1965	28/Mar/65	35,000	5		ICOLD, Rico	breached, releasing tailings that flowed down to			Cu										0.01	0.13	0.00	0.14		0	0	0.13928
3	0.14	1	Los Maquis No. 3	Cu	US		15	43,000	1	A	EQ	71	1965	28/Mar/65	21,000	5		ICOLD, Rico	an elevation of 65m near the Rhondda River.		HT Manto	Cu	580	1.1		1.1	19th c	20	Py			0.04	0.02	0.00	0.06		0	0	0.05742
3	0.06	1	Bellavista, Chile	Cu	US	T	20	450,000	1	A	EQ	12	1965	28/Mar/65	70,000	1		ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)			Cu										0.00	0.03	0.00	0.03		0	0	0.02606
3	0.03	1	Hierro Viejo, Chile	Cu	US	T	5		1	A	EQ	55	1965	28/Mar/65	800	1		ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)			Cu										0.00	0.00	0.00	0.00		0	0	7.9E-05
3	0.00	1	Ramayana No. 1, Chile	Cu	US	T	5		1	A	EQ	99	1965	28/Mar/65	150			ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)		Strat	Limestone										0.00	0.00	0.00	0.00		0	0	0
		1	Cerro Blanco de Polpaico, Chile	Limestone	WR	R	9		2	A	EQ	26	1965	28/Mar/65				ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)			Cu										0.00	0.00	0.00	0.00		0	0	0
		1	El Cerrado, Chile	Cu	US	T	25		2	B	EQ	42	1965	28/Mar/65				ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)			Cu										0.00	0.00	0.00	0.00		0	0	0
		1	Los Maquis No. 1	Cu	US	T	15		2	B	EQ	70	1965	28/Mar/65				ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)			Cu										0.00	0.00	0.00	0.00		0	0	0
		1	Sauce No. 1, Chile	Cu	US	T	6		2	A	EQ	104	1965	28/Mar/65				ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)			Cu										0.00	0.00	0.00	0.00		0	0	0
		1	Sauce No. 2, Chile	Cu	US	T	5		2	B	EQ	105	1965	28/Mar/65				ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)			Cu										0.00	0.00	0.00	0.00		0	0	0
		1	Sauce No. 3, Chile	Cu	US		5		2	B	EQ	106	1965	28/Mar/65				ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)			Cu										0.00	0.00	0.00	0.00		0	0	0
		1	Sauce No. 4, Chile	Cu	US	T	5		2	B	EQ	107	1965	28/Mar/65				ICOLD	The talings failures of March 28, 1965, were from La Ligua, Chile, earthquake. This accounts for a sigificant part of the large number of earthquakes in the period of 1960-1970. About half of the failed dams were abandoned, and half were located at operating mines. (see Villavicencio et al, 2014)			Cu										0.04	0.13	0.00	0.17		0	0	0.17302
3	0.17	1	Cerro Negro No. (3 of 5)	Cu	US	T	20	500,000	1	A	EQ	29	1965	1965	85,000	5		ICOLD, WISE, Rico	dam failied due to EQ		Strat	P										0.00	0.00	0.00	0.00		0	0	0
		1	American Cyanamid, Florida #2	P					1	A	U	4	1965	1965				ICOLD				Cu										0.00	0.00	0.00	0.00		0	0	0
4	0.00	1	Cerro Negro No. (1 of 5)	Cu	US	T	46		2	B	EQ	27	1965	1965				ICOLD	Cracking due to EQ			Cu										0.00	0.00	0.00	0.00		0	0	0
4	0.00	1	Cerro Negro No. (2 of 5)	Cu	US	T	46		2	B	EQ	28	1965	1965				ICOLD	Cracking due to EQ		HT Manto	Cu	580	1.1		1.1	21st c	22	Py			0.00	0.00	0.00	0.00		0	0	0
		1	El Cobre Small Dam - El Soldado (Penarroya)	Cu	US	T	26	985,000	2	B	EQ	46	1965	1965				ICOLD				?										0.00	0.00	0.00	0.00		0	0	0
		1	N'yukka Creek, USSR	?	WR	E	12		2	A	FN	89	1965	1965				ICOLD			Strat	P										0.00	0.00	0.00	0.00		0	0	0
		1	Unidentified, Idaho, USA	P	DS	E	18		2	A	SI	150	1965	1965				ICOLD				Pb,ZN,Au					1956	0.074	pb			0.01	0.06	0.00	0.07				
		1	Castano Viejo, Argentina, Minera Castano Viejo,National Lead Company S.A.	Pb,ZN,Au	wood	T	9	26,500	1	A	SE		1964		17,600	2		Zabala et. al 2018 (43) ;Rodriguez Pacheco(44)	no contemporaneous docuementation or images but forensically appears to be due to rupture of decant pipe causing a sataturation and liquefaction of tailings 3 deaths reported at several sources but not clear ocurred as a result of the failure			Al										0.00	0.00	0.00	0.00		0	0	0
		1	Alcoa, Texas, USA	Al			19	4,500,000	1	A	U	2	1964	Oct/64				ICOLD				U										0.00	0.00	0.00	0.00		0	0	5.3E-05
3	0.00	1	Utah Construction, Riverton, Wyoming, USA	U					2	A	OT	174	1963	16/Jun/63	100			ICOLD				U										1.74	0.00	0.00	1.74		1.739907089	0	0
1	1.74	1	Mines Development, Edgemont, South Dakota, USA	U					1	A	U	80	1962	11/Jun/62	3,300,000			ICOLD				Sn										5.99	0.12	12.21	18.32		18.31718096	0	0
1	18.32	1	Huogudu, Yunnan Tin Group Co., Yunnan	Sn	US				1	A	U		1962	1962	11,356,230	5	171	Wei			Strat	Gypsum										0.02	0.00	0.00	0.02		0	0	0.01996
3	0.02	1	American Cyanamid, Florida	Gypsum					1	A	U	3	1962	1962	37,854			ICOLD; Beavers 2013.	A gypsum stack dike break occurred at American Cyanamid Phosphate Complex in Brewster, Florida. Approximately 3 billion gallons of process water were released into Hooker's Prairie. The water was contained and limed on-site before the water was discharged into the South Prong of the Alafia River. (An Overview of Phosphate Mining and Reclamation in Florida, Casey Beavers, University of Florida thesis, April 2013)			0										0.00	0.00	0.00	0.00		0	0	0.00015
3		1	Almivirca,Quiruvilca, Peru				40		1		EQ	135	1962	1962	280			" in Bulletin 121	asume same as "unidentofied			U										0.00	0.00	0.00	0.00		0	0	0
		1	Union Carbide, Maybell, Colorado, USA	U					1	A	U	171	1961	6/Dec/61				ICOLD			Strat	Coal										0.00	0.02	0.00	0.02		0	0	0.01649
3	0.02	1	Tymawr, United Kingdon #1	Coal					1	A	OT	124	1961	xx/12/61		1		ICOLD Bulletin 121 P 137	Lagoon had been formed in the toe of a pile of		Strat	Coal										0.00	0.00	0.79	0.79		0	0.785714286	0
2	0.79	1	Jupille, Belgium	Coal					U	U	U		1961	1961			11	Blight & Fourie, 2004	Cause - Fly ash dum faulure due to removal of toe support of dump. 11 deaths, houses destroyed.																				
2			Luciana Tailings Failure Satanna Spain						1	A	SI		1960	1-Aug-60	300,000	0.5	18	Fernadez-, 2017) (	static liquefaction established 2017 thorugh forensic study			Pb										0.00	0.00	0.00	0.00		0	0	0.00443
3	0.00	1	Lower Indian Creek, MO, USA	Pb	US	E			2	A	SI	72	1960	1960	8,400			ICOLD				U										0.32	0.00	0.00	0.32		0	0.316346743	0
2	0.32	1	Union Carbide, Green River, Utah, USA	U					1	A	OT	170	1959	19/Aug/59	600,000			ICOLD				u					1946		U			0.32	1.03	0.21	1.56		1.556273483	0	0
1	1.56	1	Mailuu-Suu #7 tailings dam (Kyrgyzstan)	u				1,200,000	1	A	EQ		1958	16-Apr-58	600,000	40	3	wikipedia [34]	the national border into Uzbekistan then into the heavily populated Fergana Valley. exact number of deaths not given but there were definitely multiple deaths so use the minimum criteria "3" to indicate criteria met																				
2		1	Millpo, Peru		US		60		1		EQ		1956					Pacheco,ICOLD	several deaths		Wits	Au										0.00	0.00	0.00	0.00		0	0	0
		1	Grootvlei, South Africa	Au	US	T			1	A	SI	54	1956	1956				ICOLD			Strat	P										0.00	0.00	0.00	0.00		0	0	0
		1	Unidentified, Peace River, Florida, USA 3/52	P	WR	E	8		1	A	SI	165	1952	Mar/52				ICOLD				PB/ZN																	
2		1	Casapalca,Minera Del Centro Peru,Huarochiri Province,Peru	PB/ZN	US	T	60		1	B	EQ	107	1952					Pacheco,ICOLD	several deaths,																				
		1	Chinchan, yauliyacou Mine, Peru	Ag								135	1962					ICOLD			Strat	P										0.00	0.00	0.00	0.00		0	0	0
		1	Unidentified, Alfaria River, Florida, USA 2/52	P	WR	E	8		1	A	SI	156	1952	Feb/52				ICOLD			Strat	P										0.00	0.00	0.00	0.00		0	0	0
		1	Unidentified, Peace River, Florida, USA 9/51	P	WR	MW	6		1	A	SE	167	1951	Sep/51				ICOLD			Strat	P										0.00	0.00	0.00	0.00		0	0	0
		1	Unidentified, Peace River, Florida 7/51	P	WR	MW	30		1	A	SE	166	1951	Jul/51				ICOLD			Strat	P										0.58	0.00	0.00	0.58		0.57996903	0	0
1	0.58	1	Unidentified, Peace River, Florida, USA 2/51	P	DS	E			1	A	SE	168	1951	Feb/51	1,100,000			ICOLD			VMS	Pb Zn	170			5.693021381	1909	60	PY			0.08	0.00	0.00	0.08		0	0.079086686	0
2	0.08	1	Sullivan Mine, Kimberley, BC, Canada	Pb Zn	US	T			1	A	SI	66	1948	1948	150,000			ICOLD			PCD	Cu	1400	0.33	0.04	0.362083742	1947	25	Py			0.00	0.00	0.00	0.00		0	0	0.00256
3	0.00	1	Castle Dome, Arizona, USA	Cu	US	T			1	A	SE	25	1947	29/Sep/47		0		ICOLD			Vein	Au							Py			0.02	0.00	0.00	0.02		0	0	0.02109
3	0.02	1	Hollinger, Canada	Au	US	T	15		1	A	FN	58	1944	1944	40,000			ICOLD				Cu	4				1882		PY			0.00	0.00	0.00	0.00		0	0	0
		1	Captains Flat Dump 3, Australia	Cu		T			1	A	U	20	1942	1942				ICOLD			PCD	Cu	3500	0.75	0.35	1.21073274	1865	400	Py			0.00	0.00	0.00	0.00		0	0	0
		1	Kennecott, Utah, USA	Cu	US	T			1	A	FN	63	1942	1942				ICOLD			PCD	Cu	3500	0.75	0.35	1.21073274	1865	370	Py			0.00	0.00	0.00	0.00		0	0	0
		1	Kennecott, Garfield, Utah, USA	Cu	US	T			1	A	SI	62	1941	1941				ICOLD				Pb										5.27	0.00	0.00	5.27		5.272445724	0	0
1	5.27	1	St. Joe Lead, Flat Missouri, USA	Pb	US	T	15		1	A	OT	115	1940	1940	10,000,000			ICOLD				Au Ag										0.00	0.28	21.43	21.71		21.71062271	0	0
1	21.71	1	Los Cedros, Tlalpujahua, Michoacán, México	Au Ag	US	T		9,200,000	1	B	ST		1937	27-May-37		11	300	Macias et al, 2015	The 27 May 1937 catastrophic flow failure of gold tailings at Tlalpujahua, Michoacán, Mexico, J. L. Macías, P. Corona-Chávez, J. M. Sánchez-Núñez, M. Martínez-Medina, V. H. Garduño-Monroy, L. Capra, F. García-Tenorio, and G. Cisneros-Máximo. Nat. Hazards Earth Syst. Sci., 15, 1069–1085, 2015 www.nat-hazards-earth-syst-sci.net/15/1069/2015/ More than 300 deaths cited but exact number not given		Wits	Au										1.48	0.00	0.00	1.48		1.476284803	0	0
1	1.48	1	Simmer and Jack, South Africa	Au	US	T			1	A	SI	110	1937	1937	2,800,000			ICOLD			PCD	Cu	12000	1		1		35	Py			1.99	0.00	0.00	1.99		1.992984484	0	0
1		1	Barahona, Chile	Cu	US	CST	61	20,000,000	1	A	EQ	9	1928	Oct/28	3,780,000			ICOLD; Smith Taiilngs Disposal & Liquefaction 1969				Au										0.09	0.00	0.00	0.09		0	0	0.0949
3	0.09	1	Unidentified, South Africa	Au					1	A	U	136	1917	1917	180,000			ICOLD			PCD	Cu	12000	1		1		2.5	Py			0.00	0.00	0.00	0.00		0	0	0
		1	Agua Dulce, Sewell, VI Region, Rancagua, Chile	Cu			61		1	A	OT		1915	15-Jun-15				Villavicencio	Strong rains and overflow																				
												68																											
												0.235294118																											

SEVERITY CLASSIFICATIONS (COL A & B) (Revised Bower 04/18)

1	Very Serious Tailings Dam Failures = multiple loss of life (~20) and/or release of ≥ 1,000,000 m^3 total discharge, and/or release travel of 20 km or more	56
2	Serious Tailings Dam Failures = loss of life and/or release of ≥ 100,000 m^3 semi-solids discharge,and or runout >.9km	63
3	Minor Tailings Dam Failures = Engineering/facility failures w release <100,000m3 other than those classified as Very Serious or Serious, no loss of life	118
4	Potential Failure Other Tailings-Related Significant Incidents w/o release(mostly 2A and 2B)	10
	Not assgnable due to lack of information on toxicity of tailings known to be associated with beneficiation process	
		=======
		247

The failure severity codes were developed in 2014 to faciitate trend analysis and meaningful examination of failure consequence . ICOLD Bulletin 121 makes it very clear that increasing severity/consequence was a main motivation in creating the failures data base and ,to some extent, the faiure type codes did indicate severity with "1's" being major events, 2's being lesser events involving component failures that did not result in a break or failure. The categories "serious" and "very serious" was obvious by inspection. In all cases possible the severity rating was based on release,runout and deaths, consistent with the purpose of these variables in the orignal ICOLD Bulletin 121. It was clear however in authoritative descriptons that some incidents for which no data was given for release run out or deaths were in fact clearly either very serious or serious and were classified on the basis of these descriptions.(with sources cited and links given).Where there is not sufficent naarive to clearly ndicate severity no severity code is given. Where serius txins were known t be presnt in th etailings but inadqruate details given the pale yellow higghlight indiates concern without adequate data.

LOCUS OF FAILURE (Column B)

1 TSF Dam Wall Failure
2 TSF Impoundment Component
3 TSF External Component/Operation
4 ATSD-All Failures & Significant Events at

COLOR CODING FOR TAILINGS DEPOSITION COL E

Thickened Tailings
paste tailings

ICOLD INCIDENT CLASSIFICATIONS COLUMNS K-M

ICOLD DAM TY	Upstream
US	Downstream
DS	Centerline
CL	Water retention
WR	Not reported
NR	

MATERIAL KEY

T	Tailings
CST	Cycloned Sand
MW	Mine waste
E	Earthfill
R	Rockfill

INCIDENT TYPE KEY

1A	Active Dam Failure
1B	Inactive Dam Failure
2A	Active TSF Incident
2B	Inactive TSF Incident
3	Groundwater Contamination from ar

Type "1" always designates a failure in the dam itself involving an unplanned releas of content.The amount of releas is not reported for

Type 2 refers to failure o r observed problem of components within the impoundment or any extrenal part other than the dam itself whether or not a release ocurred

Type 3 refers to unplanned seepages discovered and corrected some of which involved a substantial leaks overtime

INCIDENT CAUSE CLASSIFICATIONS (COL M)

SI	Slope instability - static failure	• A constant load that causes deformation up to the point a dam partially or completely fails. Often caused by partial saturation of areas of the dam that are designed to remain dry.
SE	Seepage - seepage and internal erosion	• Erosion of dam material by water passing through areas of the dam that are designed to remain dry.
FN	Foundation - structural and	• Failure related to building the dam on a surface that does not supply sufficient support for the weight of the dam. An example is a layer of clay under a dam.
OT	Overtopping	• Water flowing over the top of a dam. (Tailings dams are made of erodible material, and overtopping will cause erosion and failure of the dam.)
ST	Structural - structural inadequacies, inadequate or failed decants	• Design errors, or failure of a designed component to function as designed. Failed decants (to drain water from the impoundment) are a common cause.
EQ	Earthquake - seismic instability	• Dams are designed to withstand earthquakes, but if the earthquake is larger than that which was predicted, the structure can be destroyed by shaking.
MS	Mine Subsidence	• If the dam or impoundment is built over an underground mine, collapse of the underground mine workings can lead to release of the impounded tailings.
ER	Erosion - external erosion	• Simple erosion of a dam face, typically due to precipitation runoff, that is not corrected and leads to a dam failure.
U	Unknown	• Many of the older dam failures that were not sufficiently documented may fall into this category.
	static liquefaction confired strongly ondicated	.ICOLD UNEP Expert panel did not create a cause of failure code "static liquefaction".we are reviewing whether to add.

GENERAL NOTE

We have retained all of the fields created by UNEP/ICOLD in their orignal compilation of 221 failures and accdents in Bulletin 121. Although no defintions were presented in Bulletin 121 their meaning is clear in the decsriptions presented especially the distinctions in Column J betwen "failures"(all type 1) and "accdents" (all type 2). These were UNEP/ICOLD applied only to the o riginal 221.We have applied these codes distinguishing accidents and failures to the best of ur ability and understanding of their orgnal meaning to all pre-2000 faiures and accidents not enumerated in Bulletin 121 and to all post 1999 events. **WISE, who took up reorting and mainteneace of a public record post 2000 dropped almost all of the descsriptors but added a separate column for parent corporation which we hope to add to this file..**

We found small variations source to source on total release, run out, deaths and other details, but we found no ambiguities or inconsistencies that precluded a clear classification as "Serious" or "Very Serious".

Overall we found much more detailed accounts of "consequence" in local compilations or regional or national studies. WISE & ICOLD occasionally included details on consequence, or linked to sources detailing consequence. Our bibliography includes a more extensive list of materials related to the consequence of TSF failures

COLUMN M-INCIDENT NUMBER

The incident numbers were assigned in Bulletin 121 for each of the 221 incidents in the compilation.

They exist therefore only for pre 2000 incidents and only for those pre 2000 that were included in the orginal compilaton.

Per Bulletin 121, 1-186 were from the USCOLD survey of US only events ; 187 -221 were compiled by ICOLD/UNEP

SOURCES: (Col T U)Primary Confirmation of Failure Event

(1) AGU Blogosphere. American Geophysical Union, http://blogs.agu.org/landslideblog

(2) G.E. Blight & A.B. Fourie, A Review of Catastrophic Flow Failures of Deposits of Mine Waste and Municipal Refuse, Proceedings International Workshop, "Occurrence and Mechanisms of Flow-like Landslides in Natural Slopes and Earthfills," Sorrento, 19-36, Picarello (ed), Patron, Bologna, 2004

(3) ICOLD. International Committee on Large Dams, Bulletin 121 "Tailings Dams Risks of Dangerous Occurrences Lessons Learned From Practical Experiences"

(4) Piplinks. "Chronology of Tailings Dam Failures In The Philippines (1982-2007)," accessed January 2015 at http://www.piplinks.org

(5) Repetto, Robert "Silence is Golden, Leaden and Copper Disclosure of Material Environmental Information in the Hardrock Mining Industry" Yale School Of Forestry & Environmental Studies, July 2004 accessed November 2014 at http://environment.research.yale.edu/documents/downloads/o-u/repetto_report_execsum.pdf

(6) Rico, M., Benito, G., Díez-Herrero, A. "Floods From Tailings Dam Failures" Geological Hazards Unit, Spanish Geological Survey (IGME), Madrid, Spain

Deposit Type (Col W)

PCD- Porphyry Copper Deposit. Mineralization occurs as disseminations, in veinlets, and breccias. Always some pyrite in unoxidized/enriched zones, enargite can occur in upper reaches
HT Manto- High-Temperature Manto - mineralization hosted by volcanic rocks, especially confined to certain volcanic layers forming a tabular body
Skarn- High-temperature mineralization hosted by limestone, which was altered due to heat
Placer- gold, and other heavy minerals like tin, occur as small grains in unconsolidated sediments
Laterite- Fe-rich soils in tropical climates that contain elevated quantities of Bauxite (aluminum oxide) and nickel
VMS- Volcanogenic Massive Sulfide; herein, deposits formed at coean floor; majority of ore deposit is sulfides with a very high content of pyrite
VEIN- Typically a subvertical tabular body; herein includes mineralization in faults and breccias
WITS- Free gold in a lithified conglomerate typical of deposits in the Witswatersrand, S Africa near Johannesberg
Magmatic- Sulfide mineralization formed in layers as magma cools; commodity, e.g, platiunum group metals, generally confined to a layer
SSC- Stratiform sedimentary-rock hosted copper deposit; mineralization generally confined to a stratigraphic unit; very little or no pyrite
Strat- Stratiform. commodity either is the straigraphic unit, e.g., coal, iron, or confined to that unit, e.g., phosphate

Est. Size- (Col y) tonnage that encompasses the mineralization that may have the reasonable expectation of economic extraction; principal

Cu, %- (Col Z)grade of copper in percent; principal source as above
Au, ppm- (Col AA)grade of gold in ppm (or g/t); principal source as above
CuEq, %- (Col AB)equivalent coppr grade in percent adding gold grade; prices of $2.00/lb copper, $1,100/oz gold, $14.00/oz Ag, $1.00/lb Pb, $1.00/lb Zn, $4.00/lb Ni, $6.00/lb Mo used
1st prod- (Col AC)year that mine started operations and production; based on production series from USGS Mineral Commodity Summaries, American Metal Statistics, and Annual Reports
Est. throughput- calculated by dividing copper production by estimated copper grade from start to year of event using aforementioned sources

Adverse Minerals- (Col AE)Gangue minerals known to potentially cause environmental issues:
Py Pyrite- Iron sulfide that upon the addition of water and oxygen, leaches to form sulfuric acid and iron in solution; other sulfide minerals, e.g., chalcopyrite, bornite, will also leach
En Enargite- Copper-arsenic sulfide that upon oxidation or leaching will release arsenic and copper into the ecosystem
St Stibnite- Antimony sulfide
Ga Galena- Lead sulfide
Bi Bismuthinite- Bismuth sulfide
Asp- Arsenopyrite- Arsenic-iron sulfide
Co- Cobalt
U- Uranium
PY - indicates very high volume of pyrite in ore

		Overall Stats						
sum indx	138.90	44.05	183.71	366.64		348.55	15.57	#VALUE!
avgindx	0.43	#VALUE!	0.59	#VALUE!		1.10	0.05	#VALUE!
		Reference Decade 1991-2000						
sum indx	37.07	10.11	7.14	54.33				
avgindx	0.65	0.19	0.13	1.01				

The index values differentiate magnitude amongst the three severity codes

Complete doumentation on the index is available from Bowker Associates(LNBowker@BowkerAssociates.org). The difference in total scores for each of the three varaiables indicates the releative incidence of reporting on the variable. (ie not every record has a documented entry for each of the three variable) We determined that no weightng was necessary to insure that each variable is equally represented

WORLD MINE TAILINGS FAILURES—FROM 1915

supporting global research in tailings failure root cause, loss prevention and trend analysis

ABOUT THE DATABASE

This database records all failures and significant adverse events in all components involved in the deposition and storage of mineral tailings, including post-extraction downstream-generated tailings, e.g. at smelters or refineries.

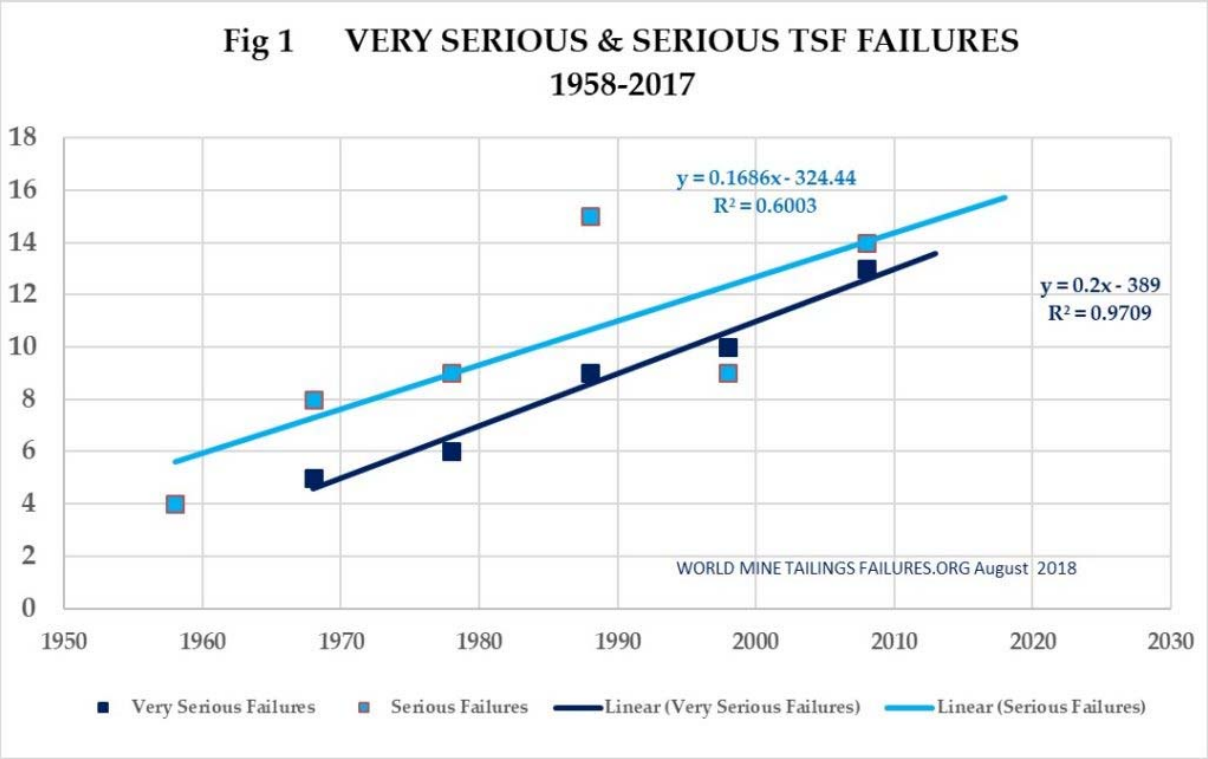
The original impetus for creation of the ICOLD/UNEP 2001 compilation Bulletin 121 was an increasing frequency of high-consequence tailings failure events post 1990. That the trend of high-severity tailings failures has continued upward

is indisputable. Without major changes to law and regulation, and to industry practices, and without new technology that substantially reduces risk and increases loss control, our current prediction is for 19 Very Serious Failures between 2018 and 2027.

We ask all users to read all guidance and commentary provided here before planning and publishing a work using this database.

DOWNLOAD NOW

Current as of March 1, 2019



History & Purpose Of Failures Database

The purpose of the database is to provide a meaningful resource of factual authoritative data for analysis of trends, causes, and consequences, with a view

to the changes that will result in effective loss prevention related to tailings management. The aim is to give voice to the narratives of every significant failure, not replace or overshadow the existing narratives.

Of course, it is important to note at the outset that, while tailings failures are a leading cause of the most consequential mine failures to communities of origin, to the environment, and to the investors whose trust finances production of the minerals the world needs, large and significant losses occur even at facilities with no on-site tailings or with adequate and even state-of-the art tailings management. This database is important because it is a surrogate for all loss. It is the only known publicly available compilation of loss, the only window we have into the legal frameworks and corporate practices that create high-risk and high-loss conditions.

The core of the database is the ICOLD/UNEP compilation by an international expert panel convened between 1995 and 2001, and published in 2006. WISE continued the global compilation by integrating all the Bulletin 121 failures and posting all new failures reported to them. The WISE chronology dropped most of the Bulletin 121 data descriptors and now reports only “significant” events since 1960.

World Mine Tailings Failures (WMTF) expanded the original Bulletin 121 compilation with independently researched, authoritatively compiled failures from 1915 onward, and integrated all WISE updates and additions through 2015, reformatting to the full Bulletin 121 layout. Missing descriptors in the WISE and ICOLD/UNEP compilations were filled in element by element from many sources, principally legal documents and technical reports.

The statistical value of ICOLD/UNEP dam-descriptive and cause-of-failure data elements has not been fully established or explored, but WMTF continues all of them.

The data are meaningful only at aggregations of 10 years. No other aggregation level holds up for any kind of meaningful analysis or presentation.

Presentation of the number of "failures" for a given year is meaningless. **No comparisons by country or company or resource sector are meaningful without production data (failures per ton of processed ore or failures per ton of finished product) for a period of 10 years or more.**

Three main expansions give voice to the failure narratives in terms of both cause and consequence: severity coding, magnitude index development, and the inclusion of economic history.

SEVERITY CODING

The ICOLD/UNEP expert panel intended to distinguish failure events by severity, but the established coding did not lend itself to statistical analysis. They distinguished "failures" from lower consequence "accidents," but this two-layer severity class had no structure that supported meaningful analysis, especially trend and correlation analysis. Within the designation "failures," ICOLD/UNEP intended, and we have continued, to record all failures of any component of a tailings management system.

The Bulletin 121 international panel established three measures of severity (release, runout, and deaths), which also frustrated statistical analysis.

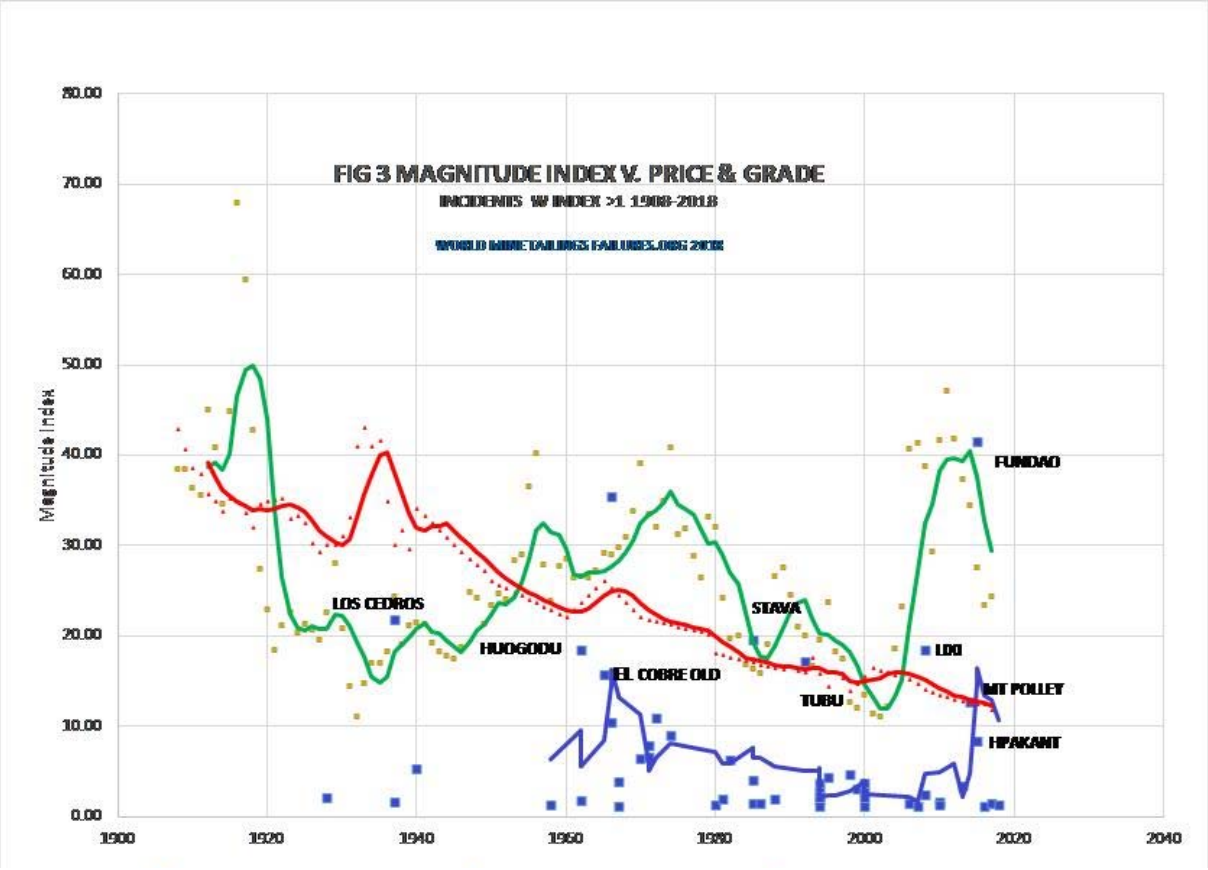
A four-level severity code system has therefore been created for WMTF from 1 ("very serious") to 4 ("potential failure," meaning an observed condition that, if left unattended, could evolve to failure over time). The four-tier system relies primarily, but not exclusively, on the three severity variables created by ICOLD/UNEP (release, runout, and deaths), but it also places great reliance on authoritative narrative. At present, only two of the classes, "very serious" and "serious," perform well in statistical analysis and it seems clear in correlation and other analyses that the trends for both severity levels are shaped by a common set of root causes in mine-specific and global economics.

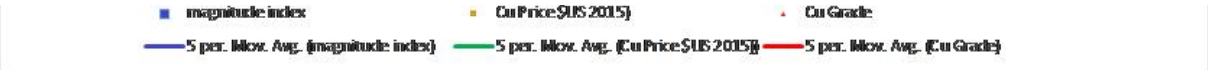
Figure 1 above shows present linear trend lines and Figure 2 below shows the actual values for release, runout, and deaths by decade through 12/31/2017.

FIG 2 TSF DAM FAILURES BY DECADE FROM 1915 As Known 08/01/2018												
Decade	count by severity code					count by severity indicators			facility descriptors			
	Very Serious Failures	Serious Failures	Minor Failures	Potential Failure Condition	All Failures potential failures	Cumulative Release	Cumulative Runout (km)	Deaths	Avg Ht m	Avg Storage (M cum)	# w ht	#w stor cap
	1	2	3	4	count	M Cub m	km	count	m	M cub m		
2008-17	13	14	15	0	42	95.8	832	435	45	40,895,903	13	11
1998-07	10	9	13	0	32	20.9	326	52	22	14,298,571	5	7
1988-97	9	15	29	5	58	56.5	116	88	29	7,526,143	33	14
1978-87	6	9	28	3	46	22.3	60	347	25	9,761,640	36	25
1968-77	5	8	14	0	27	24.2	275	317	25	2,511,700	44	10
1958-67	7	4	16	2	29	25.6	96	1,053	18	1,950,800	29	10
1948-57	1	3	0	0	4	1.1			22	0	5	0
1938-47	1	1	2	0	4	0.2			15	0	2	0
1928-37	2	0	0	0	2	12.8	11	300	61	29,200,000	1	0
1918-27	0	0	0	0	0	0.0	0	0	0	0	0	0
1908-17	2	0	0	0	2	4.0	0	0	61	0.0	1	0
	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======
TOTAL/AVERAGE	56	63	117	10	246	263.2	1,716	2,157	66	5,758,443	169	77
WORLD MINE TAILNGS FAILURES.ORG August 2018												
97 records with no information on release runouts or deaths are not given a classicication other than locus of failure as indicated by ICOLD assigned codes												

MAGNITUDE INDEX

The severity coding alone allows examination of only the *frequency* of high-severity incidents over time, but not *the degree of severity*. Although, as shown in Figure 2, the decadal summaries of release, runout, and deaths give an impression of increasing severity, it was not possible to do any meaningful statistical analysis with the data in this form.





An index is an econometric tool, especially used in trend analysis, which allows disparate data elements to be unified via reference to a base year or period and then combined by aggregation, with or without weighting, as evaluated by the index developer. This approach was used to build the magnitude index setting 1991 to 2000, the "red flag" decade of Bulletin 121, as the reference period. For each incident, each element (release, runout, deaths) was expressed as a ratio to the reference average, after which all three index scores were combined to form a single numerical index. It was determined that raw scores gave each element an equal weight (i.e., no weights were needed). Complete technical documentation is available to anyone interested from compiler@worldminetailingsfailures.org.

The index proved to be a very valuable statistical tool with strong correlations to price and grade as shown in Figure 4 above. The relationships over time clearly show that *magnitude increased as grades fell and prices rose,* dispelling a popularly cited paper, asserting without econometric analysis, that failures occur in lagged response to falling prices.

The magnitude index also, as expected, correlated significantly with storage capacity and dam height at failure. (Larger facilities are, of course, expected to cause more damage when they fail, which is not the same as larger facilities having an inherently greater propensity to failure. Data are not presently available to evaluate the latter.)

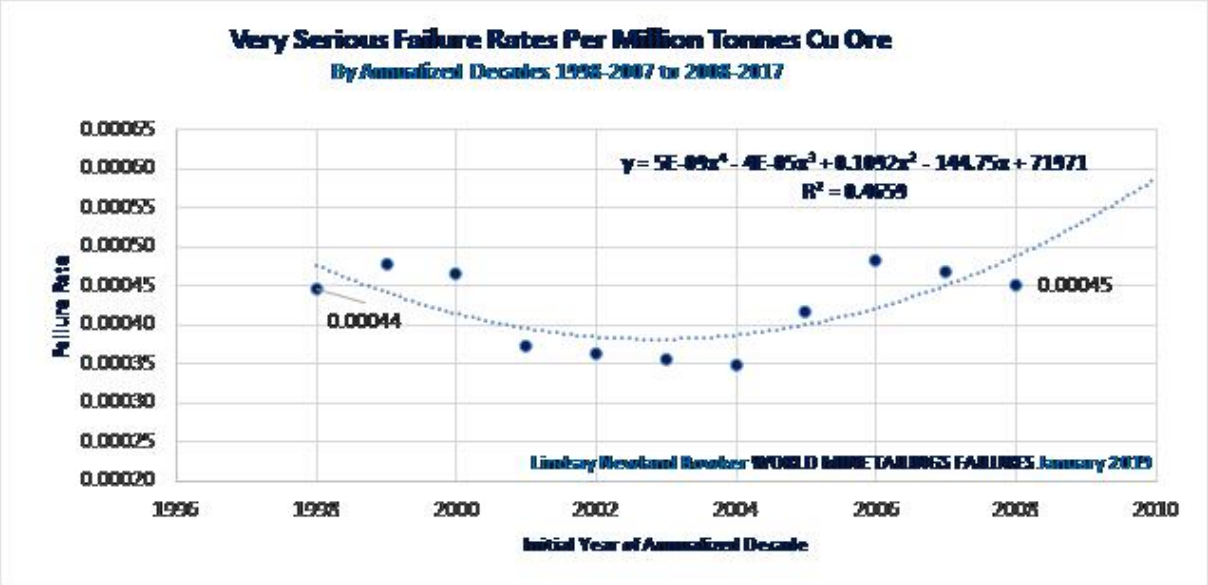
We invite, and hope ourselves to do, much further exploration of the magnitude index. At this point, we are satisfied that it is a vetted and valid data element with an important place in the database and in future research into cause and consequence.

We assign severity code based on narratives and on authoritative documentation of release, runout, and deaths. However, we not do not code *magnitude* if there is

not sufficient complete information on release, runout, and deaths, as it relies exclusively on the given numerical values of these elements.

INCREASING FAILURE RATE

The increase in failure rates per million tonnes of ore produced from 0.00044 (1998-2007) to 0.00045 (2008-2017) appears to be significant and to forecast a continuing upward trend.



ECONOMIC HISTORY

The ICOLD/UNEP expert panel acknowledged the powerful and important role that mine-specific and global economics played in the failure trend to which they were pointing. Most papers on cause, while tending to focus on engineering causes, recognize the adverse effect of falling grades, the resulting increase in mining costs per ton, and the attending squeeze on margins.

The predecessor of this *database* was a *data set* developed for three research papers exploring these effects of mine-specific and global economics in depth on the frequency and severity of catastrophic failures.

Bowker Chambers (2015) Bowker, L.N. and Chambers, D.M. The Risk, Public Liability, and Economics of Tailings Storage Facility Failures. Earthworks Action 2015.

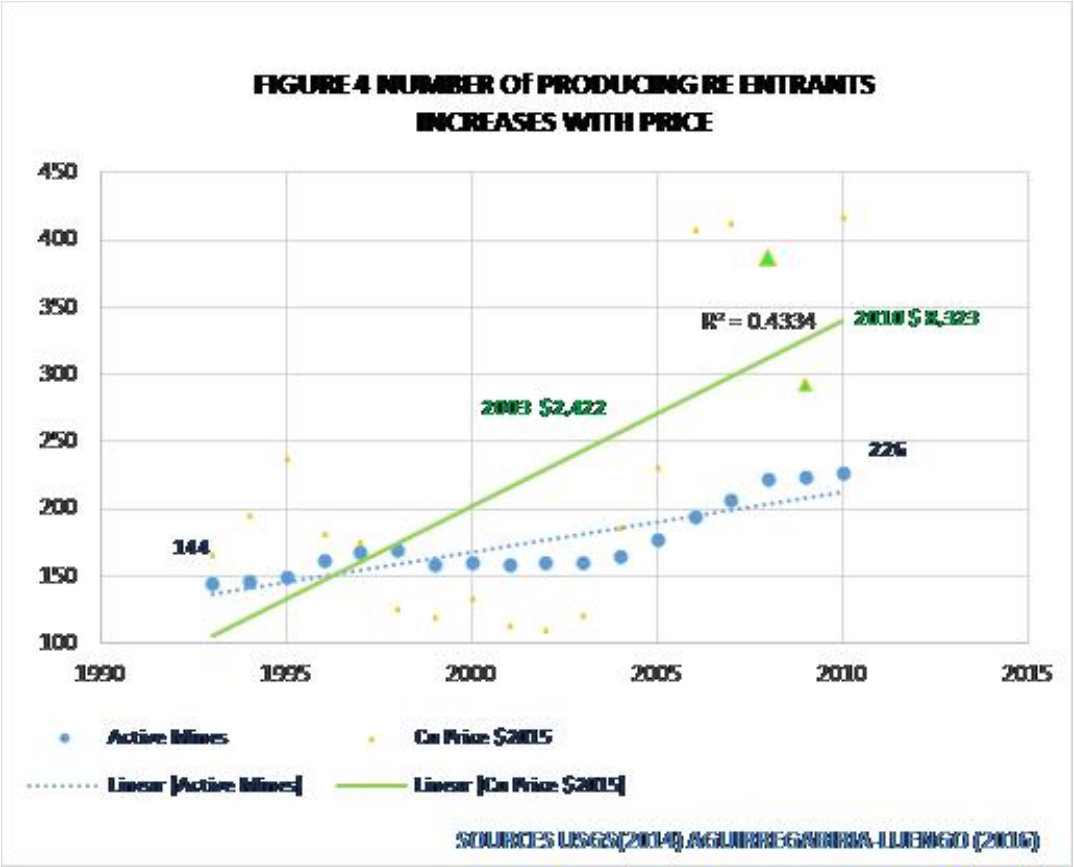
This mapped the world trend of frequency of “very serious” failures against the world trend in falling grades, establishing through canonical correlation analysis the likely existence of a strong linear relationship in data known as of 12/31/2009.

Bowker Chambers (2016) Bowker, L.N. and Chambers, D.M. Root Causes of Tailings Management Failures: The Severity of Consequence of Failures Attributed to Overtopping 1915–2015.

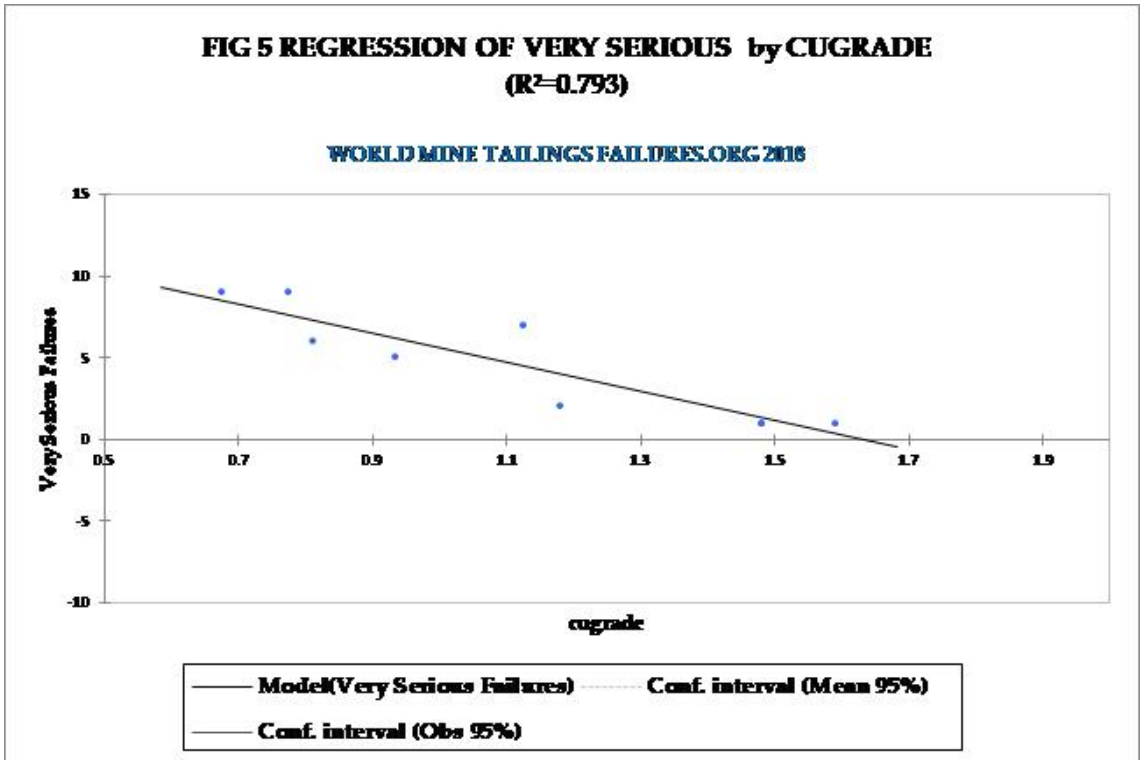
This used the same data set as Bowker and Chambers (2015) and examined the distribution of “very serious” failures across all thee ICOLD/UNEP expert panel-established cause-of-failure elements, finding that, except for codes associated with liquefaction (earthquake and slope instability), the distribution of high-severity failures was essentially the same, suggesting a common root case, previously posited as global and mine-specific economics.

Bowker Chambers (2017) Bowker, L.N. and Chambers, D.M. In The Dark Shadow of The Supercycle: Tailings Failure Risk & Public Liability Reach All Time Highs, *Environments* **2017**, *4*(4), 75; doi:10.3390/environments4040075

Bowker and Chambers (2017) used a greatly expanded data set of pre-2010 failures and included all known failures through 12/31/2015 and the addition of economic history of the mines at which failures occurred. These data were contributed by Dr. Bill Williams, a noted long-experienced economic geologist, from his own files. Dark Shadows (Bowker and Chambers, 2017) was therefore able to reconfirm key findings of Bowker and Chambers (2015, 2016) with a more complete data set for a longer period, as well as to examine the role of mine-specific economics. **Dark Shadows showed that, contrary to previously asserted and widely-cited work, high-consequence failures are more frequent in periods of rapid sustained price rise due to the greater participation of marginal mines as producers.**



The strong linear relationship between grade and frequency of high-severity failures was also revealed in linear regression (Fig. 5)



While still very sparse, the data presently available do support meaningful, although limited, inquiry and analysis. One of our development goals is to expand data to include at least more details on already known "serious" and "very serious" failures.

To explore failures in the context of global mineral economics trends, a parallel mineral economics database was created and is also available free in Excel file format. The parallel database provides annual data on copper grade, world mine production, price, and estimated world ore production from 1915. Extensive technical documentation is embedded in the download file at this site.

Download Mineral Economics Data Now

DATABASE MANAGEMENT

The framework for management and continued development of the database is given in our bylaws. World Mine Tailings Failures is presently incorporated as a nonprofit corporation in the state of Maine and we are in the process of filing for incorporation under U.S. laws as a 501(c)(3).

Reflecting the scope of our chartered mandate to provide a multifaceted analysis of all authoritative work about or with a direct bearing on mine tailings failures, the work of compilation is conducted by five principal volunteer compilers each with primary responsibility for compilation and analysis on one of five facets of cause and consequence. The core team of volunteer stewards is supported by a broader team of tailings experts who have volunteered to serve as peer reviewers and contributors. Our Board also reflects the balance of expertise of compilers and is responsible for general oversight of our work as well as for approval of all policy and database development plans and budget priorities.

THE COMPILERS

Chief Compiler & Executive Director Lindsay Newland Bowker (Bowker Associates Science & Research in the Public Interest, USA) has four decades in empirically-based law and policy, heavy construction risk management, and risk finance that framed and informed her noted work in the economic causes of Tailings Storage Facility (TSF) failures. It is primarily Lindsay's work that has evolved the database to its present form, assembled the team of stewards for its future development, and framed the mandates of the nonprofit corporation established to care for and further develop the database.

Chief Compiler, Engineering, Roberto Lorenzo Rodriguez (Instituto Geológico y Minero de España, Spain) is a recognized expert in tailings risk management, most notably in areas of causes (ultimately related to consequences) that have not received needed attention in law, policy, and practice. He has authored 146 papers with 524 citations. The aim of his present research is to identify opportunities and strategies for loss prevention and risk minimization.

Chief Compiler, Environmental Consequences, Steven H. Emerman (Malach Consulting, LLC, USA) has 31 years of experience teaching hydrology and geophysics, and has 66 peer-reviewed publications in these areas. Dr. Emerman's company specializes in evaluating the environmental impacts of mining on behalf of mining companies, as well as governmental and nongovernmental organizations. Dr. Emerman is multilingual and so can access and solicit studies , legal documents, and technical documentation about environmental consequences that might be available only in local or non-English publications.

Chief Compiler, Community of Origin Consequences, Cristiana Losekann (Department of Social Sciences, Universidade Federal do Espírito Santo, Brazil**)** does her main work in the interface between social movement and political change, and in the disempowerment that results from loss of community. Cristiana's work on the community and social impacts of the Fundão failure bring forward aspects of community and citizen loss beyond the customary discussion and response of compensation to rarely acknowledged issues of adequate disaster response and relief, and loss of voice through the dispersion of displacement.

Chief Compiler, Economic Causes & Consequences of Failures, Bill Williams (Mine Analyst and Developer, USA**)** is an economic geologist with over 35 years of experience in the exploration, development, and exploitation of oil and gas and mineral deposits, mostly in the Americas and Europe. He currently serves as a consultant and advisor to the mining industry, most recently with Zinc One Resources, Inc., and Forrester Metals, Inc. He is a former CEO, President, and Director of Orvana Minerals Corp., prior to which he was a Vice-President for Phelps Dodge Exploration, overseeing activity in the Americas. He holds a Ph.D. in Economic Geology from the University of Arizona and is a licensed Professional Geologist. Bill has been a major contributor to the present form of the database, adding the section on mine-specific economic context from his own extensive personal files.

Acting Chief Compiler, Governance, Lindsay Newland Bowker is still seeking a permanent volunteer for this important post at WMTF that will document how existing law and policy affected the formation of a failure event and the response to it.

We welcome and encourage all contributions with proper citations and documentation, especially from individuals with technical expertise who speak Chinese, Portuguese, Spanish, Swedish, Norwegian or other foreign languages, and who are on the ground in countries where mine production is occurring. We do foreign language searches for tailings failures and mine failures, but without multilingual input from associates, we are not capturing all relevant information. We provide primary sources for every entry.

Our aim is to provide more complete data on each failure with a bearing on cause and consequence, not to provide a 100% complete list of all failures that have ever occurred.

Dr. Dragana Nisic and **Angel Brimo** have been actively involved in helping frame and launch WMTF and will be part of a larger distinguished panel of experts who have agreed to serve as both contributors and peer reviewers. We are in the

process of formalizing this larger pool of collaborative expertise as an Advisory Committee.

We have invited a very distinguished panel of experts in different stakeholder sectors to serve on our Board of Directors and the compilers will actively seek and welcome their guidance on future development of the WMTF. The Board will be formalized shortly and then announced.

We would welcome additional adjuncts and associates in each category and always welcome informed input.

Next Steps

Federal Nonprofit Status

Free public access databases are usually compiled and maintained by governmental organizations who determine content and access. What was a data set, and is now a database, used by researchers, NGOs, governmental agencies, mining consultants, investment portfolio managers and advisers, and even grassroots organizations, has no natural governmental umbrella among any existing global organizations. It is too important to rely on what time can be given to it outside of other mainstream work, as has been the case to date. Incorporation as a nonprofit allows a suitable structure for expanding and formalizing a broader stewardship for the database, as well as providing a structure through which others can help finance its basic needs and future development.

We are already a nonprofit in Maine and are now in the process of obtaining our federal status as a 501(c)(3).

REBUILDING THE NARRATIVE

The data are only meaningful to the extent that they accurately summarize or present key elements in narrative, and capture or present those data elements most closely associated with cause and consequence, and with mitigation of harm. The story of every failure is the complete narrative, which changes over time, bringing new insights, new facts, and new data. A principal goal is to rebuild narratives for all consequential failures, expanding from only engineering analysis to the role (positive or negative) of law and policy, and mine-specific and global economics, as well as to a fuller description of consequences, both human and community of origin, and environmental.

Each of the original Bulletin 121 failures had a small narrative. To date, except for brief narratives presented in the appendix of Bowker and Chambers (2015), the narrative in the failures database has been represented only in the bibliography of resources used to develop the data record for every failure.

Our aim here at WMTF is to create a complete narrative, failure by failure.

We will publish the narratives one by one, as they become available, in a to-be-added section on narratives.

Additional Data Elements

The volunteer compilers will propose to the Board their recommendations for data element expansions and develop a budget estimate and project description for each proposed addition. We anticipate only very limited funding support.

The data elements created by the UNEP/ICOLD expert panel have not been fully explored as to their value in analyzing causes and trends. It is clear that some elements, especially “runout” are not sufficiently clear as indicators of severity.

It is clear, though, that the data descriptors are somewhat out of date, especially on the TSF itself and the characteristics of the tailings and their degree of

consolidation and saturation at failure. It would be helpful to have a clearer, better coded, picture on the condition of tailings at deposition and the means of deposition.

Our aim will be to prioritize the addition of new data elements according to deliberative and analytical value, seeking guidance and help from all stakeholder sectors and from our eminent Board of Directors.

ESTABLISH LINKAGES WITH OTHER GLOBAL DATABASES

There are no other failure-specific, publicly available, global databases. However, there are many other global databases that can link to characteristics of national or provincial governance, such as indices on public benefits of the minerals sector by nation, and indices on the responsible mining policies of individual mining companies. Re-coding and additional coding of the deposit, the parent company, and country can facilitate these linkages by other researchers, even if the external databases do not contain elements that themselves belong in the failures database. One possible near-term objective, for example, might be to add latitude and longitude and the USGS unique deposit ID.

MANY THANKS & FUTURE FINANCIAL NEEDS

We thank Dr. David M. Chambers for sharing part of a generous unsolicited grant from a small foundation, given specifically in support of the work that Dr. Chambers and Lindsay Newland Bowker have done together on the failures database. Dr. Chamber's donation from this grant created this website and funded its basic web hosting and incorporation costs for the first three years.

We will shortly add a description of several small projects where funding would help with important expansions. The database needs and welcomes this financial support.

The chief compiler and associate compilers receive no salaries or other form of remuneration. Through funding, though, we hope to be able to retain research assistants to assist in the main research and coding work of each development goal. Also we need annual funding for the statistical analysis packages we use for analysis and presentation of the database. Our plan is to create a page on WMTF compiler-recommended, Board-approved development goals with a description and budget for each, so that donors can match their gifts of support with their own main interests, work and commitments.