



Classification of reported failures (excluding China & USSR)

Posted on July 16, 2013 in Flood and Spillway

[Printable version](#)

ICOLD Bulletin 109, Appendix 1

1.Presentation

Reported failures are classified under the following headings :

- Dam category : gravity, arch, buttress and multiple arch, embankment
- Cause of failure ; for embankment dams: overtopping during construction, first filling, operation (by overtopping or internal erosion)
- Height (higher/lower than 30 metres)
- Dates of failure and construction (pre-/post-1930).
- Reservoir capacity, dam length and number of lives lost are also shown where known.

2. Failures

Most reports of failures were taken from ICOLD Bulletin 99 “Dam Failures Statistical Analysis”. However, about twenty of the failures mentioned in the Bulletin were not classified, through lack of data or because they were not due to the Irerein classified causes, and 15 of the failures in this Appendix do not appear in Bulletin 99 (mark X).

Many failures of dams of moderate height have probably gone unreported ; very few failures of large dams 10-15m high have been reported, although they represent 20 per cent of ail large dams. In addition, there are few reports on the 700 Japanese dams built before 1930 or the thousands of dams in the non-industrialised countries impounding less than 10 hm3. These three groups together

Other articles about Water Savings (Nile, Niger ...)

- It is possible to increase by over thirty per cent the nile water availability
- Low cost technologies to improve reservoirs storage

represent one-third of all large dams and 5 per cent of reported failures, so that 50 to 100 large-dam failures might have gone unreported.

3. Dam Numbers in Tables

Figures for the number of >30m dams built are reliable.
For <30m dams, there is a large margin of uncertainty on the number built, mainly in the height range 10-15m, especially embankment types. The figures in the tables (2 000 pre-1930, 7 000 post-1930) are estimates for 15-30m dams and do not allow for 10-15m structures for which failures do not seem to be generally reported.

Gravity Dams (Concrete or Masonry)/
Barrages-Poids (Béton ou Maçonnerie)

<30 m

400 built before 1930 : 11 failures
1500 built after 1930 : 1 failure

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³)	Comments Commentaires	Number of Victims Nombre de Victimes
-------------------------------	-----------------	-------------------------------------	--	-----------------------	------------------------	--	--------------------------	---

First filling failures / Ruptures au premier remplissage
>10hm³

Austin I	USA	1893	1893	18	330	/	M	?
Bayless	USA	1911	1909	16	160	1.3	C 80	
Granadillar	Spain	1934	1930	22	170	0.1	M	8

Failures in operation / Ruptures en service

Sig	Algeria	1885	1858	21	/	3	U M	10
Bouzey	France	1895	1880	22	520	7	M	100
Angels	USA	1895		15	120	/	M	1
Elmali	Turkey	1916	1893	23	298	1.7	F M	?
Tigra	India	1917	1917	25	1340	124	F M	1000
Elguiau (W)	GB	1925	1908	12	1000	4	C	10
Zerbino	Italy	1935	1924	16	70	10	F C	100
Pagara	India	1943	1927	27	1440	100	F M	?
Chikkahole	India	1972	1966	30	670	11	F M	?

>30 m

350 built before 1930 : 11 failures
1500 built after 1930 : 0 failure

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³)	Comments Commentaires	Number of Victims Nombre de Victimes
-------------------------------	-----------------	-------------------------------------	--	-----------------------	------------------------	--	--------------------------	---

First filling failures / Ruptures au premier remplissage
>10hm³]

Puentes	Spain	1802	1791	69	291	13	M	600
Cheurfas	Algeria	1885	1884	42	/	17	M	10
Elwha River	USA	1912	1912	33	135	9	M	0
Kundli	India	1925	1924	45	160	1.3	M	?
St Francis	USA	1928	1926	62	213	47	C	450

Failures in operation / Ruptures en service

Fergoug I	Algeria	1881	1871	33	300	30	FM	200
Fergoug II	Algeria	1927	1885	43	300	30	FM	0
Mohne (war) (X)	Germany	1943	1913	40	/	134	M	1200
Eder (war) (X)	Germany	1943	1914	48	400	200	M	100 ?
Xuriguera	Spain	1944	1902	42	165	1.1	FM	7
Khadakwasla	India	1961	1879	33	1400	137	UM	1000

C=Concrete / Béton

M=Masonry / Maçonnerie

U=Upstream dam failure / Rupture du barrage amont

F=Failure due to flood / Rupture par crue

Arches (First Filling Failure) /
Voûtes (Ruptures au premier remplissage)

Existing Dams

Barrages existants

600>30m / 300<30m

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³)	Comments Commentaires	Number of Victims Nombre de Victimes
-------------------------------	-----------------	-------------------------------------	--	-----------------------	------------------------	--	--------------------------	---

>10hm³]

Vaughn Creek	USA	1926	1926	19	95	?	/	/
Malpasset	France	2959	1954	66	222	47	/	420
Idbar	Yugoslavia	1960	1959	38	108	1.9	/	/

No arch failed in operation / Pas de rupture en service

Butresses and Multiple Arches /
Contreforts et Voûtes Multiples

Existing Dams

Barrages existants

200>30m/300<30m

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³)	Comments Commentaires	Number of Victims Nombre de Victimes
-------------------------------	-----------------	-------------------------------------	--	-----------------------	------------------------	--	--------------------------	---

First filling failures /
Ruptures au premier remplissage
>10hm³]

Ashley	USA	1909	1908	18	133	0.1	B	-
Stony River	USA	1914	1913	16	330	7	/	-
Austin II	USA	1915	1915	20	388	21	B	8
Gleno	Italy	1923	1923	35	225	5	MV	600
Komoro	Japan	1928	1927	16	96	0.1	B	7
Selford	Sweden	1944	1943	21	200	1.8	B	-
Vega de Terra	Spain	1959	1955	33	270	7.3	B	140

Failures in operation / Ruptures en service

Rutte (X)	Italy	1965	1952	15	/	0.3	MV	-
Leguaseca	Spain	1987	1958	20	70	0.1	MV	7

B=Butress/ Contreforts
MV=Multi - Arch / Voûtes multiples

Fill Dams /

Barrages en Remblai

Failure under construction by overtopping (Height and volume are those of the completed dam, not those at the failure time)

() gives the height at time of failure, if known

Rupture par submersion pendant la construction (La hauteur et le volume correspondent au barrage terminé)

() donne la hauteur lors de la rupture

<30 m

2000 built before 1930 / 2000 construits avant 1930

7000 built after 1930 / 7000 construits après 1930

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³) >10hm³]	Fill Remblai	Number of Victims Nombre de Victimes
Owen	USA	1915	17	247	60	E	/
Blyderiver	South Africa	1924	21	340	2.2	E	/
Paris (X)	USA	1939	17	/	/	/	/
Cheoha Creek (X)	USA	1970	28	/	11	/	/
Elansdrift	South Africa	1975	28	600	3.2	E	10

>30m

150 built before 1930 / 150 construits avant 1930

2800 built after 1930 / 2800 construits après 1930

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³) >10hm³]	Fill Remblai	Number of Victims Nombre de Victimes
Waghad	India	1883	(32) 32	/	17	E	/
Goose Creek	USA	1900	(20) 64	-	/	R	/
Red Rock (X)	USA	1910	32	/	16	/	/
Little Field (X)	USA	1929	(37) 37	91	/	R	/
Puddingstone	USA	1930	55	/	22	/	/
Oros	Brazil	1961	(35) 54	620	730	E/R	/
Panshet	India	1961	(49) 51	740	214	E	1000
Hell Hole	USA	1964	(30) 125	/	2600	R	0
Mac Cloud © (X)	USA	1964	70	200	43	E/R	/
Sempor	Indonesia	1967	60	228	56	R	200
Piedras	Spain	1968	40	620	60	/	/
Odiel	Spain	1970	35	154	3.3	R	/
Toa Vaca (X)	USA	1970	65	530	68	/	/
Xonxa	South Africa	1974	(24) 48	300	158	/	/
S. Tomas	Philippines	1976	43	/	/	/	80
Hans Strydom (C)	South Africa	1980	(18) 57	525	150	R	/

E=Earthfill / Terre

R=Rockfill / Enrochement

C=Cofferdam / Batardeau

First Filling of Fill Dams (by internal erosion) /**Barrages en Remblai – Ruptures au premier remplissage (par érosion interne)**

< 30 m

2000 built before 1930 / 2000 construits avant 1930

7000 built after 1930 / 7000 construits après 1930

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³) >10hm³]	Fill* Remblai*	Foundation Fondation	Number of victims Nombre de victimes
Dale Dyke	GB	1864	1863	29	380	3.2	E	-	230
Molteno	SA	1882	1881	15	800	0.2	E	-	0
Mena	Chile	1885	1888	17	200	0.1	E	R	100
Lake Francis	USA	1899	1899	15	300	0.8	E	R	-
Bila Desna	Czecho	1916	1915	18	240	0.4	/	/	65
Ema	Brazil	1940	1932	18	370	10	E	S/R	/
Fred Burr	USA	1948	1947	16	100	0.6	/	S	/
Lower Khajuri	India	1949	1949	16	/	43	E	/	/
Battle River	Canada	1956	1956	14	550	15	E	S/R	/
Little Deer Creek	USA	1963	1962	26	110	1.8	E	R	1
Jennings Creek 3	USA	1963	1962	21	92	0.4	R	E	/
Jennings Creek 16	USA	1964	1960	17	110	0.3	R	R	/
Kedar Nala	India	1964	1964	20		17	E	-	/
Sheep Creek	USA	1970	1969	18	330	1.4	E	S	/
Manivali	India	1976	1975	18	-	4.8	E	-	/
Mafeteng	Lesotho	1988	1988	23	500	?	E	R	/

>30 m

150 built before 1930 / 150 construits avant 1930

2800 built after 1930 / 2800 construits après 1930

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³) >10hm³]	Fill* Remblai*	Foundation Fondation	Number of victims Nombre de victimes
Apishapa	USA	1923	1920	35	178	24	E	S/R	/
Corpus Christi	USA	1930	1930	31	1240	79	E	S	/
Mena Teton	USA	1976	1976	93	900	300	E	S/R	11

*

Fill / Remblai :

E = Earthfill / Terre

R = Rockfill / Enrochement

Foundation / Fondation :

S = Soft / Meuble

R = Rock / Rocher

Failure in Operation of Fill Dams (by internal erosion) /
Barrages en Remblai – Rupture en service (par érosion interne)

< 30 m

2000 built before 1930 / 2000 construits avant 1930

7000 built after 1930 / 7000 construits après 1930

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm ³) >10hm ³	Fill * Remblai*	Foundation Fondation	Number of victims Nombre de victimes
Bilberry	GB	1852	1845	20	90	0.3	E	/	80
Cuba	USA	1868	1851	15	/	0.5	/	/	/
Mill River	USA	1874	1865	13	180	/	/	/	140
Utica	USA	1902	1873	21	/	?	E	/	0
Avallon	USA	1904	1893	17	-	-	E/R	/	/
Green Lick	USA	1904	1901	19	259	0.6	E/R	/	0
Black Rock	USA	1909	1907	21	208	18	E/R	R	/
Jumbo	USA	1910	1905	18	1200	29	E/R	/	/
Hatchtown	USA	1914	1908	18	240	15	E	/	0
Horse Creek	USA	1914	1912	17	5000	21	E/R	/	0
Hebron I	USA	1914	1913	17	1120	/	E	S	/
Lyman	USA	1915	1913	19	250	43	E	S	8
Lake Toxaway	USA	1916	1902	19	120	13	E	R	0
Leeuw Gamka	SA	1928	1920	15	540	10	/	-	0
Castlewood	USA	1933	1890	28	183	4.3	E	R	2
Lake Francis II	USA	1935	1901	24	400	2.3	E	R	/
Anaconda	USA	1938	1898	22	/	0.2	E	S	0
Sinker Creek	USA	1943	1919	21	330	3.3	E	R	/
Stockton	USA	1950	1950	28	100	0.5	/	-	/
Toreson	USA	1953	1898	15	96	1.4	E	/	/
Ahraura	India	1954	1954	26	650	61	E	/	/
Pampulha	Brazil	1954	1941	18	350	18	E	S	0
Mill Creek	USA	1957	1889	20	84	0.3	E	R	/
Alamo Arroyo	USA	1960	1960	21	-	6.6	E	S	/
Hyogiri	Korea	1961	1940	15	110	0.2	E	R	139
Smart Syndicate	SA	1961	1912	28	2800	98	E	R	/
Emery	USA	1966	1850	16	130	0.5	E	R	/
Nanak Sagar	India	1967	1962	16	19300	210	E	/	100
La Laguna	Mexico	1969	1912	17	675	4.3	E	S/R	0
Caulk Lake	USA	1973	1950	20	134	0.7	E	R	/
Wheatland	USA	1973	1960	13	2000	11	/	/	/
Hinds Lake	Canada	1982	1980	12	5200	7500	E	R	0
Kantale	Sri Lanka	1986	1869	27	2500	135	E	R	127
Quail Creek	USA	1988	1984	24	610	50	E	/	0

Failure in Operation of Fill Dams (by internal erosion) /
Barrages en Remblai – Rupture en service (par érosion interne)

> 30 m

150 built before 1930 / 150 construits avant 1930

2800 built after 1930 / 2800 construits après 1930

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³) >10hm³	Fill * Remblai*	Foundation Fondation	Number of victims Nombre de victimes
English	USA	1883	1878	30	100	18	R	R	/
Graham Lake	USA	1923	1922	34	335	200	E	S	/
Baldwin Hills	USA	1963	1951	71	198	11	E	S	5
Walter Bouldin	USA	1975	1967	51	2268	/	E	/	0
Ghattara	Libya	1977	1972	38	217	5.5	E	S/R	0
Ruahihi	New Zealand	1981	1981	32	67000	31	R	S/R	/
Embalse Aromos	Chile	1984	1979	42	220	60	E	S/R	0

* Fill / Remblai

E = Earthfill / Terre

R = Rockfill / Enrochement

Foundation / Fondation

S = Soft / Meuble

R = Rock / Rocher

Fill Dams / Barrages en Remblai

Failures in operation by overtopping / Ruptures en service par submersion

>30 m

150 built before 1930 / 150 construits avant 1930

2800 built after 1930 / 2800 construits après 1930

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm ³) >10hm ³	Fill Remblai	Number of victims Nombre de victimes
Torside	GB	1855	1854	31	270	6.7	E	S
Walnut Grove	USA	1890	1888	33	120	11	R	129
Sweetwater	USA	1916	1911	35	200	54	E	/
Lower Otay	USA	1916	1901	46	170	52	R	30
Graham Lake	USA	1923	1922	34	330	220	/	/
Kaddam	India	1959	1957	40	/	215	E	G
Rincon (X)	Paraguay	1959	1945	50	1100	9000	/	/
Swift	USA	1964	1914	57	225	37	E/R	19
Dantiwada	India	1973	1969	61	137	460	E	/
Euclides da Cunha	Brazil	1977	1960	61	312	13	E	G
Sales de Oliveira	Brazil	1977	1958	40	660	25	E	U
Tous	Spain	1982	1980	77	780	50	R	G 20

E = Earthfill / Terre

R = Rockfill / Enrochement

U = Failure of Upstream Dam / Rupture de barrage amont

G = Jamming of Gates / Non-fonctionnement des vannes

S = Spillway defect / Défaillance du déversoir

Fill Dams / Barrages en Remblai

Failures in operation by overtopping / Ruptures en service par submersion

<30 m

2000 built before 1930 / 2000 construits avant 1930

7000 built after 1930 / 7000 construits après 1930

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³) >10hm³]	Fill Remblai	Number of victims Nombre de victimes
Blackbrook I	GB	1799	1797	28	160	0.2	E	/
Killington	GB	1836	1820	18	250	3.4	E	/
Tabia	Algeria	1865	/	25	/	/	/	/
Iruhaike	Japan	1868	1633	28	700	18	E	1200
South Fork	USA	1889	1852	21	/	18	E/R	2200
Johnstown	USA	1889	1842	22	/	19	/	G
Chambers Lake	USA	1891	1885	15	213	/	E	S
Lake Vera	USA	1905	1880	15	51	/	R	/
Chambers Lake II	USA	1907	1885	15	240	10	E	S
Wisconsin	USA	1911	1909	18	80	24	R	0
Hebron II	USA	1914	1913	17	1120	x	E	/
Lookout Shoals	USA	1916	1915	25	830	49	E	/
Mammoth	USA	1917	1916	23	/	13	E	S 1
Oversholser	USA	1923	1920	16	247	18	R	/
Oklahoma	USA	1923	1920	16	365	26	/	/
Scott Falls	Canada	1923	1921	15	250	11	R	U
Mac Mahon	USA	1925	1924	17	137	0.1	E	/
Dykstra	USA	1926	1903	15	/	/	R	/
Balsam	USA	1929	1927	18	91	?	E	/
Briseis	Australia	1929	1926	17	137	1	R	11
Wagner Creek	USA	1938	1912	15	98	0.7	E	1
Heiwaikē	Japan	1951	1949	22	82	0.2	E	100
Ashizawa	Japan	1956	1912	15	/	/	E	/
Kaila	India	1959	1955	26	213	14	E	S
Kharagpur	India	1961	1956	24	/	55	E	/
Ogayarindo	Japan	1963	1944	24	100	0.16	E	/
Cazadero	USA	1965	1906	21	55	16	R	/
Ovcar Banja	Yugoslav	1965	1952	27	/	3	E	G
Wesley E Seale	USA	1965	1958	25	1804	374	/	G
Pardo	Argentina	1970	1949	15	60	0.1	R	25
Lake Barcroft	USA	1972	1913	21	62	3	E	0
Whitewater Brook	USA	1972	1949	19	137	0.5	E	/
Lower Idaho	USA	1976	1914	15	275	/	/	U
Bolan	Pakistan	1976	1960	19	530	89	E/R	20
Dhanibara	India	1976	1975	20	/	61	E	/
La Paz	Mexico	1976	/	10	1600	x	/	80
Machu	India	1979	1972	26	3900	101	E	G 2000
Gotvan	Iran	1980	1977	22	710	x	/	200
Dibbis (X)	Irak	1984	1966	17	650	50	/	/
Noppikoski	Sweden	1985	1967	19	175	0.7	E	G 0
Spitskop	SA	1988	1975	17	760	61	E	0
Bagauda	Nigeria	1988	1970	20	2100	22	E	/
Tierpoort Dam (X)	S. Africa	1988	1923	20	116	33	/	/
Mitti (X)	India	1988	1982	17	900	19	E	0
Belci	Romania	1991	1982	18	420	12	E	G 20

Name of Dam Nom du Barrage	Country Pays	Year of Failure Année de Rupture	Year of Completion Année d'Achèvement	Height Hauteur (m)	Length Longueur (m)	Volume of Reservoir Volume de Retenue (hm³) >10hm³]	Fill Remblai	Number of victims Nombre de victimes
Torside	GB	1855	1854	31	270	6.7	E	S
Walnut Grove	USA	1890	1888	33	120	11	R	129
Sweetwater	USA	1916	1911	35	200	54	E	/
Lower Otay	USA	1916	1901	46	170	52	R	30
Graham Lake	USA	1923	1922	34	330	220	/	/
Kaddam	India	1959	1957	40	/	215	E	G
Rincon (X)	Paraguay	1959	1945	50	1100	9000	/	/
Swift	USA	1964	1914	57	225	37	E/R	19
Dantiwada	India	1973	1969	61	137	460	E	/
Euclides da Cunha	Brazil	1977	1960	61	312	13	E	G
Sales de Oliveira	Brazil	1977	1958	40	660	25	E	U
Tous	Spain	1982	1980	77	780	50	R	G 20

E = Earthfill / Terre

R = Rockfill / Enrochement

U = Failure of Upstream Dam / Rupture de barrage amont

G = Jamming of Gates / Non-fonctionnement des vannes

S = Spillway defect / Défaillance du déversoir

Fill Dams / Barrages en Remblai

Failures in operation by overtopping / Ruptures en service par submersion

<30 m

2000 built before 1930 / 2000 construits avant 1930

7000 built after 1930 / 7000 construits après 1930

G = Gates Jamming / Non-fonctionnement des vannes

U = Upstream dam Failure / Rupture de barrage amont

S = Spillway defect / Défaillance du déversoir

E = Earthfill / Terre

R = Rockfill / Enrochement

 [Printable version](#)

- ICOLD (International Commission On Large Dams)