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RESERVOIR SAFETY ADVICE

TASKS A AND B: ANNEX TO FEASIBILITY REPORTS

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CONTENTS

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Rev	Date	Details	By	Checked	Approved
R01	16th June 2003	Issue for Internal Review	AJB	-	
A01	1st July 2003	Approved for issue to client with feasibility report for Task A	AJB	JDG	AJB
A02	5th Nov. 2003	Updated with issue of Task B Feasibility Report	AJB	JDG	AJB

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ANNEX 1 : BIBLIOGRAPHY

Key to Bibliography

Column

D **Subject :** Single letter code:-

		code in annual review
AP	Appurtenant works	D
CD	Concrete dams	B
ED	Embankment Dams;	A
EE	Expert Elicitation	
EQ	Earthquake engineering/ seismic	E
EP	Emergency planning	
G	Geotechnical;	
IR	Incident reporting	
L	Legislation	G
H	Hydrology;	C
O	Others;	
R	Risk assessment	F
S	Statistics	
W	Wind	

E Identified as part pf work on

ID	Incident database
IE	Internal Erosion
RSP	Res safety practice
IS	Integrated System

H **Number :** filed in KBR project file under this reference number

Author	Year	Title, Publication reference etc	Subject	Identified as part of	Remarks/ Short description of content	KBR Number
ACHTERBERG D	1999	BOR dam safety programme. 19th USCOLD lecture Series (conference). Pp 41-51	R	IS		
ACREMAN, MC and HORROCKS, RJ	1990	Flood frequency analysis for the 1988 Truro floods. J. Inst. Water & Environ. Manage. (4), 62-69.	H	IS		
ADVISORY COMMITTEE ON DANGEROUS SUBSTANCES	1991	Major hazards aspects of the transport of dangerous substances HMSO. 58pp	R	IS	Recommendation which were considered to be of value in reduction of ALARP risk; 5 general, 11 specific and 6 arising from suggestions by members. Ball & Floyd, 1998 give more current general views on risk	1
AICE (Amer. Inst. Chem. Eng	1996	Int conf on process Safety management and Inherently safer processes	R			584
ALAM S	2002	Improving sedimentation management using multiple dams and reservoirs. The International Journal On Hydropower & Dams, Vol 9, Issue 1	H	RSP	Problems facing hydropower reservoirs in sediment-rich areas around the world. Discusses ways to delay the sedimentation process, reduce risks of damage, improve economic feasibility and sustainability.	
ALCRUDO F	2002	A state of the art review on mathematical modelling of flood propagation. 12 pages text; 10 pages of references	DB	IS	Appears to be mainly review of theory, none of papers seem to build up a database of real flash flood/ dam break routing	597
ALE, B J M (1991)	1991	"Risk analysis and risk policy in the Netherlands and the EEC". Journal of Loss Prevention in the Process Industry, vol. 4	R	IS		2
Allen, P.J.,	1994	Dam Break Breach Mechanisms, ANCOLD Bulletin No.97, pp26- 38, Australian National Committee on Large Dams	DB	IS	Includes recommended procedure for determining the size and rate of growth of a dam breach, in both embankment and concrete dams	542
ALONSO EE	1997	Flow and hydraulic fracture in earth fill dams. ICOLD Q73 R34. Florence pp521-549	ED	IE	summary of some of factors affecting internal erosion	659
AMBRASEYS NN	1988	Engineering seismology. Mallet-Milne lecture .Jour. Earthquake Engineering and Structural dynamic. (Special issue) Vol. 17B. Pp 1-105. Pub John Wiley.	E	IS	first Mallet Milne lecture	545
AMBRASEYS NN & MENU JM	1988	Earthquake induced ground displacements. Earthquake Engineering and Structural dynamic. Vol. 16. Pp985-1006. Pub John Wiley.	E	IS	Gives maximum displacements under earthquake for probabilities of exceedance of 1, 5, 16 and 50%.	534
AMDAL T	2001	New Norwegian guidelines for risk assessment. Hydropower & dams. issue 2. Pp62-66	R	IS		233
AMDAL T & RIISE D	2000	Possibility of failure for Venemo dam, Norway. An analysis with focus on the reliability of the flood diversion works. ICOLD Congress Beijing Q76 R38, pp569-584	R	IS	probability of failure is governed by cascade failure of upstream dam (2.3E-4/a), other causes only 0.18E-4	535
AMS	1982	12th conference on severe local storms. American Meteorological society. Texas. January.	O	IS	Referenced in ESDU, 1990 - Pages 55 to 58 comprise contribution by Elsom & Meiden on "tornadoes in the UK"	
ANCOLD	1994	Guidelines on risk assessment. Australian National Committee on Large Dams (ANCOLD).	R	IS	Modified by Position paper 1998. Second draft under review & due for publication 2001/02	3
ANCOLD	1998	Guidelines for design of dams for earthquake. 90pp plus 4 appendices	EQ	IS		
ANCOLD	2000	Guidelines on the assessment of the consequences of dam failure. May. 15pp plus 13pp in 4 appendices	R	IS		600
ANCOLD	2000	Guidelines on selection of acceptable flood capacity for dams. March. 36pp plus 38pp in 3 appendices	H	IS		601
ANCOLD	2001	Guidelines on risk assessment. Australian National Committee on Large Dams (ANCOLD). Draft. July 188pp	R	IS		
ANDERSON G R & TORREY VH	1995	Function-based condition indexing for embankment dams. ASCE J Geotech Eng. 121(8) 579-58	ED	IS	Write-up of USAC Research (1999)	236
ANSELL, T. ARCHIBALD, J. DAGPUNAR & L. THOMAS, P. ABELL & D. DUNCALF	2000	'Assessing the Maintenance in the UK Water Industry: A Case Study". Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 1. Pages 283-289. Published by A.A. Balkema.	R	ID	fitting a reliability curve to performance of a gravity filter. Joint paper of Univ Edinburgh with last 2 authors from Yorkshire water.	572
ARCHER, DR	1987	Improvement in flood estimates using historical flood information on the River Weir at Durham. Proc. BHS First National Hydrology Symposium, Hull, 14-16 September, 1987. 5.1-5.9	H	IS		
ARCHER, DR	1999	Practical application of historical flood information to flood estimation. Proc. IAHS Symp. Hydrological extremes: understanding, predicting, mitigating. Gottschalk, L, Olivry, J-C, Reed, D and Rosbjerg, D (Eds), Birmingham, July, 1999. IAHS Publ. No.	H	IS		
ASH RA, BOWLES DS, ABBEY S HERWEYNEN		Risk assessment: a complex exercise but worthwhile tool. ANCOLD Bulletin No 117. pp87-96	R		RA for 3 dams in SE Queensland	
ATKINSON JH, CHARLES, JA & MHACH HK	1990	Examination of erosion resistance of clays in embankment dams. QJEG 23(2). Pp103-108	ED	IE	results of dispersion testing on 4 UU puddle clays - 1 is dispersive	644

Author	Year	Title, Publication reference etc	Subject	Identified as part of	Remarks/ Short description of content	KBR Number
ATTEWILL I, SPASIC-GRIL L	2001	Lake sarez Risk analysis. Dams & Reservoirs 11(1) may. Pp18-21	R	IS	Overall return period of failure of natural dam of 177 to 832 years	243
AUSTIN, BN, CLUCKIE, ID, COLLIER, CG & HARDAKER, PJ	1995	Radar-based estimation of probable maximum precipitation and flood. A report for the Water Directorate, Dept of the Environment. Met Office, Bracknell. 123pp	H	IS		325
AU-YEUNG Yin	1989	Risk assessment of system of dams. Proc Nat'l Conf Hydraulic Engineering. ASCE iSBN0872627195 pp1096-1101	R	IS	Assessment of cascade of 3 dams	623
BABBTT D H & MRAZ D M	1999	Emergency drawdown capability. 19th USCOLD Annual lecture series (conference). Pp 277 - 291.	AP	IS	describes California state criteria for sizing outlets, and demonstrates the need for bottom outlet by describing emergency conditions that developed at 4 dams	516
BABTIE	2000	Floods and Reservoir safety. Research report for DETR. Sept.	H	IS	Extend MacDonald & Scott comparison of FSR/FEH to further 18 reservoirs. Identifies provisional revision to FRS. Makes 6 recommendations for further research	319
BABTIE	2001	Extension to Climate change impacts; extension of work to consider effect on embankment stability. Advice Note on rainfall induced instability. 22pages	H	IS		322
BABTIE	2002	Climate change impacts on the safety of British Reservoirs. Research contract for DETR. 39pp plus7 appendices. Available on web at www.defra.gov.uk	H	IS	Final draft at April 2001; Final Jan 2002. Based on UKCIP98 - concluded that most reservoirs show +5% sensitivity in total surcharge level to joint worst case projection of storm rainfall and wind-speed for the 2050's horizon	210
BABTIE	2002	Embankment dams upgrade. Final draft version submitted to DEFRA Feb 2002. 200pp	ED	IS	Applicable to older dams with no signs of distress - aim to be initial assessment of margin against slope instability and internal erosion. Compares subject dam to "baseline dam", latter has well defined characteristics	256
BAHR N J	1997	System safety engineering and risk assessment - a practical approach. Pubs Taylor & Francis. (USA) 250pp	R	IS	author states purpose is to give engineers a comprehensive practical guide on how to build safety into their products and industrial processes.	230
BAKKER, VR, KOCHEL, RC and PATTON, PC	1988	Flood Geomorphology. Wiley, New York, 503pp.	H	IS		
BALL, D J and FLOYD, P J	1998	Societal risks. Report for HSE RAPU by Prof Ball & Dr Floyd. 79pp.	R	IS	33 pages in main report, plus 3 appendices on mathematics, & development of social risk criteria. Includes 13 FN curves form different organisations	4
BARRY & CHORLEY	1976	Atmosphere, weather and climate. Publs Methuen & Co Ltd.	W	IS	page 290 gives basic data on cyclones	529
BASCO D R	1987	Improved robustness of the NSW DAMBRK Algorithm. Hydraulic Engineering. Pp776-781	DB	IS	describes project to develop more stable routing algorithm	595
BASS KT	1982	Spillways and flood estimation. BNCOLD conf pp5-12	H	IS		334
BAYLISS, AC and REED, DW	2001	The use of historical data in flood frequency estimation. Report to MAFF, March 2001 www.nwl.ac.uk/feh/historical_floods_report.pdf	H	IS		362
BEAK C, FINDLAY J W & AIKMAN DI	1997	Experience of Failure mode, Effect and criticality analysis on UK Hydropower schemes. Hydropower 97, Trondheim.	R	IS	collection of case histories	262
BEDMAR A P & ARAGUAS LA	2002	Detection and prevention of leakage from dams. AABalema. 400pp			Considers foundation only, not fill. Authors expert in radioactive isotopes as tracers. Authors are members of Isotope hydrology section of Spanish government, formerly etch officers at IAEA, Vienna.	690
BERMAN j & IAN GRAY	2000	'Proving a New Event Management System: Incident Management in the Water Industry'. Pages 405-411. Published by A.A. Balkema. Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 1.	R	ID	How Thames Water improved their event management system	569
BESLEY P	1999	Overtopping of seawalls: design and assessment manual. R&D technical report W178. Research Contractor HR Wallingford for Environment Agency. Report available from WRC. 37pp	W	IS	Covers estimation of both mean and peak overtopping discharge, and concept of tolerable overtopping discharge.	522
BESLEY P, ALLSOP, ACKERS, HAY_SMITH & MCKENNA	1999	Waves on reservoirs and their effects on dam protection. Evening meeting at ICE on March 1999, reported in Dams & Reservoirs December 1999. Pp3-13	W	IS	Good summary of current knowledge, including good set of references	523

Author	Year	Title, Publication reference etc	Subject	Identified as part of	Remarks/ Short description of content	KBR Number
BETTZIECHE V, HEITEFUSS C	2002	Rehabilitation of old masonry dams at full reservoir level - A comparison of successful rehabilitation projects. British Dam Society Conference	CD	RSP	Rehabilitation measures called for the construction of inspection galleries. Different techniques were employed from manual driving to drill and blast method and the use of a tunnel boring machine. Costs and techniques are compared to arrive at a cost competitive solution.	
BINNIE & PARTNERS	1986	Modes of dam failure and flooding and flood damage following dam failure. Final Contract Report to DoE Contract No PECD/7/7/184.	H	IS	20mm thick!. mainly literature reviews, but also included some analysis with DAMBRK	205
BINNIE & PARTNERS	1991	Estimation of flood damage following potential dam failure: guidelines. 1989 Report for DOE Contract no 7/7/259. Published by foundation for Water Research FR/D 0003 March 1991	DB	IS	develop ranking method for hazard, with equation using factors including dam height, reservoir volume, valley slope and distance to downstream community	5
BINNIE & PARTNERS	1992	Review of methods and applications of Reservoir hazard Assessment. Contract PECD 7/7/309. Final Report. Jan. 82pp	R	IS	literature review of both Hazard and "methods which involve an assessment of the risk of a dam failure	602
BINNIE G M	1981	Early Victorian water engineers. Publs Thomas Telford. 310pp	ED	IS		
BINNIE G M	1987	Early dam builders in Britain. Thomas Telford. 181pp	ED	IS		
BIRD, F E Jnr and GERMAIN, G L	1990	Practical loss control leadership. Institute Publishing, Atlanta.	R	IS		6
Bishop, A. W.	1946	The leakage of a clay core-wall. Trans. Inst. Water Engineers.Vol 51, 97 - 131.			Leaage from King George V, due to prolonged drawdown in war leading to dessication cracks in upper part	
Blackwell, Howsam & Walker	1995	Borehole performance in alluvial aquifers: particulate damage. QJEG No 28, Supplement 2, S151-S162		IE		916
Blackwell, Howsam & Walker	1995	Permeability impairment around boreholes in micaceous aquifers. QJEG No 28, Supplement 2. S163-S175				917
BLIGHT GE	1997	Interactions between the atmosphere and earth. 37th Rankine lecture. Geoetchnique 47(4) 715-767				909
BNCOLD	1975	Proc symp Inspection, operation and improvement of existing dams.	ED	IS	37 papers in five technical sessions; includes discussions on recently published FSR and draft of FRS	501
BOOTMAN A P & WILLIS A	1977	Extreme two day rainfall in Somerset, Wessex Water Authority	H	IS		
BOWLES D S & ANDERSON L R	2001	Dam safety risk assessment: what can we currently use it for? ICOLD 69th annual meeting, Dresden. Workshop Vol. 1 pp410-427	R	IS		273
BOWLES DS		Advances in the practise and use of portfolio risk assessment. ANCOLD Bulletin 117 pp21-32	R			556
BOWLES DS, ANDERSON LR, GLOVER TF	1998	The Practice of dam safety risk assessment and management: its roots, its branches and its fruit. Proc USCOLD Lecture Series (Conf). Pp79-94	R	IS	General overview of risk assessment for dams, little detail	512
BOWLES DS, ANDERSON LR, GLOVER TF & CHAUHAN SS	1998	Portfolio risk assessment: A tool for dam safety risk management. USCOLD lecture Series (Conf). Pp 317-334	R	IS	general discussion of advantages of PRA - no detail on the process	514
BOWLES DS, ANDERSON LR, GLOVER TF & CHAUHAN SS	1999	Understanding and managing the risks of ageing dams: principles and case studies. Nineteenth USCOLD Annual Meeting and Lecture, Atlanta, Georgia, May 16-21, 1999. Pp233-258	R	IS	p244 onwards is case history of 2 RA projects in Australia	515
BOWLES DS, ANDERSON LR, GLOVER TF, TARBOX, WAITE, YIN AU-YEUNG	1990	Evaluation of dam safety at a series of hydropower dams including risk assessment. Proc 6th BDS Conf, Nottingham. pp119-125 Publs Thomas Telford.	R	IS	Study of four dams on Bear River, where some failed to met FERC guidelines for flood and earthquake. Study cost $0.5M but claimed to save capex of $10M, by demonstrating that owners proposals for upgrading were reasonable	
BOWLES DS, PARSONS AM, ANDERSON LR & GLOVER TF	1998	Portfolio risk assessment of SA Water's Large dams. Proc ANCOLD Annual meeting, Sydney, NSW, Australia. ANCOLD Bulletin No. 112, August 1999	R	IS	summarises results of portfolio risk assessment for SA Water's 17 large dams, designed to provide a baseline assessment of the existing dams and initial prioritisation of future investigations and possible risk reduction measures	533
Bowles, D.S., Anderson, L.R. and Glover, T.F.	1997	A Role for Risk Assessment in Dam Safety Management, Proceedings of the Third International Conference HYDROPOWER 97, Trondheim, Norway, June	R	IS		
BRAUN J	1990	Filters and drains. Chapter 10 of Advances in Rockfill structures. NATO Advanced study institute. June.	ED	IS	proposes statistical techniques applied to filter and drain design	290
BRAUNS J & WITT KJ	1988	Proposal for an advanced concept of filter design. Discussion paper published in 1988 on the 9th European conference on soil mechanics and foundation engineering held in Dublin in Aug 1987. Pp1376-1379	ED	IS	Attempt to apply probability to filter design (summary of theses in German by Witt, 1986)	297
BRE	1994	Register of British dams. Report BR 261, 55pp.	L	IS		
BRE	1996	Reservoirs and risk. Building Research Establishment Client Report CR 130/96, Watford.	L	IS		7

Author	Year	Title, Publication reference etc	Subject	Identified as part of	Remarks/ Short description of content	KBR Number
BRINDED M	2000	perception vs. analysis - how to handle risk. The 2000 Lloyd's Register lecture 23pp. Publ Royal Academy of Engineering.	R	IS	Includes figure of UKOOA risk decision framework used by Hartford on p16	679
BRISCOE A, GEORGE A A, CARTER I C, GRUNDY P	2002	Refurbishment of outlet tunnel and associated pipework at Piethorne Reservoir. British Dam Society Conference	AP	RSP	Rehabilitation of an outlet tunnel in a dam built in 1858. This paper explores the techniques used.	
BRITISH DAM SOCIETY CONFERENCE.	2002	Reservoirs in a changing world. The International Journal On Hydropower & Dams, Vol 9, Issue 5	L	RSP	The largest biennial conference to date. A report of the proceedings that took place at Trinity College, Dublin, 4-7 September. Topics included safety and risk, hydraulic structures and hydrology, seismic performance of dams, concrete and masonry dams, development and construction of dams, embankment dams, performance and repair of upstream membrane dams.	700
BROWN A J, BRUGGEMANN	2002	Arminou Dam, Cyprus and construction joints in diaphragm cut-off walls. Geotechnique, Vol.11, Nov.	ED	RSP	A case study of a diaphragm cut-off under an embankment dam. The paper discusses the occurrence of bentonite infill on construction joints and the possibility of hydraulic fracture on the low strength joints. Significant paper because diaphragm walls (slurry trench technique) are becoming a common remedial measure for existing dams.	
BROWN A J, TEDD P, FRANCIS M, GEAKE P, GOSDEN J	2002	DEFRA Research Contract "Reservoir Safety - Floods and Reservoir Safety Integration". Ref: XU0168 Rev A05	R	RSP	Part of an ongoing programme into reservoir safety in the UK. A feasibility study for quantitative risk assessment of dams which provides a framework to rank and quantify the various threats to dam safety, focused primarily at the assessment of existing dams.	722
BROWN AJ & GOSDEN J D	2000	"Safety issues at small reservoirs". Dams 2000 British Dam Society Conference Bath. pp 159-172 Thomas Telford.	ED	IS		
BROWN AJ & GOSDEN J D	2002	"A review of systems used to assess dam safety". Dams 2002 British Dam Society Conference Dublin. Thomas Telford.	R	IS	Overview of strategy and future direction of management of dam safety in UK	715
BROWN AJ & TEDD P	2003	The annual probability of a dam safety incident at an embankment dam, based on historical data. Int. Journal of Hydropower and Dams. Vol 10 issue 2. pp122-126.	ED	ID		
BROWN G I	1996	The Guinness History of Inventions. Guinness Publishing. 256pp	O	IS		
BSI	1991	Reliability of systems, equipment and components. BS 5760 Part 5. Guide to failure modes, effects and criticality analysis (FMEA and FMECA). British Standards Institution.	R	IS		235
BSI	1997	loading for buildings - part 2: code of practice for wind loads. 93pp	W	IS		540
BUREAU OF METEOROLOGY, AUSTRALIA	various	Various hydrology Report series and Bulletins on PMP etc. Available on web at www.bom.gov.au/hydro/has	H	IS		349
BUREAU OF RECLAMATION	1990	Criteria and guidelines for evacuating storage reservoirs and sizing low level outlet works. ACER tech memorandum No . 16pp	EP	IS	table 4 gives general guide, which requires lowering from full reservoir to 75% height in 10 to 20 days for high hazard, high risk to 60 to 90 days for low hazard low risk	635
BUREAU OF RECLAMATION	1997	Guidelines for achieving public protection in dam safety decision making.				673
BUREAU OF RECLAMATION	1998	Risk analysis Methodology Appendix N prediction of embankment dams breach parameters. A literature review and needs assessment. DSO-98-004			See Wahl, 1998	627
BUREAU OF RECLAMATION	1998	Risk analysis Methodology Appendix A			See Vick 1999	674
BUREAU OF RECLAMATION	1998	Risk analysis Methodology Appendix O Estimating potential for life loss caused by uncontrolled release of reservoir water.30 Sept 2002. Trial version				677
BUREAU OF RECLAMATION	1999	Dam safety risk analysis methodology. Version 3.3. 48 pages US DEPT OF INTERIOR,	R	IS	Methodology for conducting risk analysis. Supported by 22 appendices (six available at Jun 2001). Note there is separate, simpler, risk based rating tool, termed Risk based profiling system (RBPS)	502
BUREAU OF RECLAMATION	1999	A procedure for estimating Loss of life caused by dam failure. DSO-99-06. Author Wayne Graham. Sept 43pp	EP	IS	based on data from US dam failures. Table 7 gives recommended fatality rates, which depend on flood severity, warning time and "flood severity understanding"	655
BUREAU OF RECLAMATION	2001	Risk based profiling system (RBPS). Available on Internet at www.usbr.gov/dsis/risk/. US DEPT OF INTERIOR,	R	IS		503

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BUREAU OF RECLAMATION	2001	Risk analysis Methodology Appendix H: Estimating Hydrologic Risk 7 pages plus 15 page appendix on "Guidelines for interpreting preliminary flood frequency analysis reports"				675
BUSSEL M N	1996	The era of the proprietary reinforcing systems. Proc ICE. Structs and Buildings. 116. Aug/ Non. 295-316.	ED	IS	One of 14 papers on Historic concrete in ICE Special issue	
BUTCHER A.P. & POWELL JJM	2001	50 years of BRE studies of flood embankment behaviour. 36th DEFRA Conf. keeled. 08.3.1- 08.3. 11	R	IS	mechanism of failure of flood embankment	245
CALVER A	2001	Generalised River flood frequency estimation using continuous simulation. Paper 6.3. 36th Conf of river and coastal engineers Keele	H	IS		342
CANADIAN DAM ASSOCIATION	1999	Dam safety guidelines. Publs. Canadian Dam Assoc.	L	IS	11 sections dealing with procedures for safety review as well as technical issues. The Commentary section not included in 1999 edition; as to be replaced by Procedures and Good Practice Manual	
CARDOSO AS & FERNANDES MM	2001	Characteristic values of ground parameters and probability of failure in design according to Eurocode 7. Geotechnique Aug. 51(6). 519-531	G	IS	parametric study of spread footings & embankments on soft foundation to evaluate reduction factors applied to soil parameters to ensure target probability of failure is achieved	258
CARGILL A & PRICE D	2001	Comparison of FEH and FSR estimates of design flood magnitudes in Scotland Paper 6.4. 36th Conf of river and coastal engineers Keele	H	IS		337
CARTER I C, CLAYDON J R, HILL M J	2002	Improving the watertightness of Winscar Reservoir. British Dam Society Conference	ED	RSP	A case study of the approach to improve the watertightness of the 2 layer upstream membrane embankment dam.	
CASSIDY J J	2000	Gated spillways and dam safety. Hydropower & dams. Issue 6. P71-75	AP	IS	summary of Q79 at Beijing ICOLD	229
CASSIDY, K	1988	"The National and international framework of legislation for major industrial accident hazards". In: Preventing Major Chemical and Related Process Accidents. Institution of Chemical Engineers Symposium Series, no 110.	R	IS		9
CATTANACH JD, CHIN WQ, SALMON GM	1997	A new approach to probable maximum flood studies. Conf Hydropower 97. Pubs Balkema. Pp521-529	H	IS	Work by BC Hydro on extreme flood events for dam safety	358
CENTRE FOR ENVIRONMENTAL AND RISK MANAGEMENT (CERM)	1997	Risk ranking. University of East Anglia HSE Contract Research report 131/1997	R	IS		10
CHADWICK, A and MORFETT, J	1993	Hydraulics in Civil and Environmental Engineering. E&FN Spon.	AP	IS		11
CHALMERS R W	1990	Woodhead Reservoir- remedial works. Proc 6th BDS Conf. Nottingham. Pp 135-140	ED	IS	Description of increase in spillway capacity by raising crest and adding throttle to most upstream of 5 dams in Longendale cascade	
CHARLES J A	1997	Special problems associated with earthfill dams. General Report for ICOLD Q73, Florence. Vol 22, pp 1083-1198	ED	IE	Excellent summary of state of knowledge, good set of references	649
CHARLES J A	2001	Internal erosion in European embankment dams. ICOLD European Symposium, Geiranger, Norway, supplementary volume pp19-27	ED	IE	Repeated in Charles 2002, BDS conference	639
CHARLES J A	2002	Internal erosion in European embankment dams. British Dam Society Conference	ED	RSP	This paper discusses the work carried out by a European Working Group in Internal Erosion in Embankment Dams. This group was formed in 1993 and has looked at the hazard posed by internal erosion to existing dams. Several case histories are discussed which identify the features critical in predicting the possibility of internal erosion.	709
CHARLES J A	2002	A historical perspective on reservoir safety legislation in the UK. British Dam Society Conference	L	RSP	Demand for reservoir safety legislation arose in the 19th century after 2 dam failures caused major loss of life. This paper describes the steps taken to create dam safety legislation in the UK.	710
CHARLES J A		The significance of problems and remedial works at British Earth dams. BDS Conf pp123-141			earliest(?) mention of settlement, drawdown indices, plus rule of thumb re hydraulic fracture	670
CHARLES J A	1997	"Acceptable risk and reservoir safety". Dams and reservoirs, Vol. 7, July, pp 7-12.	R	IS		12
CHARLES J A	1998	Internal erosion in European embankment dams - Progress report of Working Group on internal erosion in embankment dams. Proc conf dam safety, Barcelona. Publs Balkema. 1567-1576	ED	IS	mainly case histories, plus distribution of emb dams (pre & post 1950) in Europe	268
CHARLES J A & WRIGHT C E	1996	European dam safety regulations from a British perspective. BDS Conf The Reservoir as an asset.	L	IS		
CHARLES J A and BODEN J B	1985	The failure of embankment dams in the United Kingdom. Proc. Symp. on Failures in Earthworks, pp 181-202. Thomas Telford, London.	ED	IS	Useful assessment of British dam failures	553

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CHARLES JA, TEDD P & WATTS KS	1992	The role of instrumentation and monitoring in safety procedures for embankment dams. Proc BDS Conf. pp311-320 Pub Thomas Telford	ED	IE		686
CHARLES, J A, ABBISS, C P, GOSSCHALK, E M and HINKS, J L	1991	An engineering guide to seismic risk to dams in the United Kingdom. Building Research Establishment Report BR 210, Watford. Launched at BDS meeting at ICE Jan 1992, reported in dams & Reservoirs June 1992, pp6-17	EQ	IS		13
CHARLES, J A, TEDD, P	2000	Reservoir safety: review of publications 1999-2000, Dams & Reservoirs, vol. 10, no 3, December, pp 38-44.	L	IS	Covers publications Oct 1999 to Sept 2000	
CHARLES, J A, TEDD, P [compilers]	1991	Bibliography of British dams. Building Research Establishment, Report BR 310, 50pp.	L	IS		
CHARLES, J A, TEDD, P and SKINNER, H D	1998	"The role of risk analysis in the safety management of embankment dams". In: The prospect for reservoirs in the 21st century. Thomas Telford.	R	IS		14
CHARLES, J A, TEDD, P, HUGHES, A K and LOVENBURY, H T	1996	Investigating embankment dams: a guide to the identification and repair of defects. BRE Report 303.	ED	IS		15
CHEETHAM, D W	1994	Dealing with vandalism – a guide to the control of vandalism. CIRIA SP91, London.	R	IS		16
CHEN & ANDERSON	1986	Development of a methodology for estimating embankment damage due to flood overtopping. Final Report by Simon Li associates for federal Highway Administration & Forest Service, Washington DC	DB	IS	Describes literature review and large scale model test to simulate flood overtopping of highway embankments. Test conditions included with & without pavement/grass cover and range of headwater/ tailwater	547
Cheng ST	1993	Statistics on dam failures. Reliability and uncertainty analysis in Hydraulic design. Edited yen BC & Tung YK. Pp97-105	R	ID		593
CHOW, V T	1986	Open channel hydraulics. McGraw Hill.	AP	IS		17
CHRANLEY et al	2000	Assessing and managing risk in a democratic society. See Society for Risk analysis				224
CHRISTIAN J T, LADD, C C & BAECHER G B	1994	Reliability applied to slope stability analysis ASCE J Geotech Eng. 120(12) 2180-2207	S	IS	Application of probabilistic methods to slope stability	237
CIRIA	1991	Manual on the use of rock in coastal and shoreline engineering. CIRIA Special Publication 83/ CUR Report 154. 607pp	O	IS	Includes estimate of overtopping discharge; however these have been superseded by Besley, 1999	
CIRIA	1996	Control of risk - A guide to the systematic management of risk from construction. Special Publication 125. 66pp	R	IS	as title -prepared by Halcrow; Tool Box 2 on Risk registers and risk assessment most useful	202
CIRIA	1996	Design of flood storage reservoirs. CIRIA Book 14, London. 187pp	L	IS	see Hall et al 1993	
CIRIA	1999	The observational method in ground engineering: principles and applications. Report 185. 214pp. Nicholson D, Tse C-M & Penny C	G	IS	Focus is savings in construction of new projects rather than surveillance to ensure safety of existing. Concludes method should not be used where there is insufficient time to implement fully and complete the planned modification or emergency plans	
CIRIA	2000	Risk management for UK reservoirs Report NoC542. 213pp.	L	IS	See summary in this report. Contains methods for a) rapid dam break, b) 'quantify' impact of flooding downstream, c) FMECA as risk assessment methodology	
CIRIA	2001	Infrastructure embankments - condition appraisal and remedial treatment. Report C550. Authors Perry J, pedley, M & Reid M. 232pp	G	IS	Includes qualitative risk assessment (Table 2.1, p43) which uses ALARP to classify as negligible/ low risk (routine inspection), medium risk (increased inspection, assessment required) or unacceptable risk; probability of failure (p70), condition appraisal (Fig 4.1, p82) and partial SF (Table 6.2, p153)	
CIWEM	2002	Risk assessment for environmental professionals	R	IS		
CLARK C	2002	Safety revisions. International Water Power & Dam Construction, May	H	RSP	New PMP estimates for the whole of Great Britain	728
CLARK P	1990	Estimation of flood damage following potential dam failure. Lecture Notes for lecture 9 of course on DAMBREAKUK. January.	R	IS	Gives origin of 7m2/s rule for total structural damage	546
CLAVER A & LAMB	2001	Generalised River flood frequency estimation using continuous simulation. Paper 6.3. 36th Conf of river and coastal engineers Keele	H	IS	Possible replacement for FEH!	
CLAYDON J.R. , R.A. WALKER & A.J. BULMER	1994	Contingency Planning for Dam Failure'. Reservoir Safety and the Environment. Proceedings to the eighth conference of the British Dam Society held at the University of Exeter, 14-17 September 1994. Pages 224 235. Published by Thomas Telford Services Ltd.	DB			566

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CLAYDON, J R, WALKER, R A and BULMER, A J	1994	"Contingency planning for dam failure". In: Reservoir safety and the environment, Proceedings of the 8th British Dam Society Conference pp 224-35. Thomas Telford, London.	DB	IS		18
CLAYTON	2001	Managing geotechnical risk: time for change? Geotechnical Engineering. ICE. Jan 149(1). Pp3-11	R	IS	proposes changes from intensive ground investigation to risk management system including observational method	247
CLAYTON	2001	Managing geotechnical risk - improving productivity in UK building and construction. Report prepared under the DETR partners in technology programme for the ICE. Thomas Telford, London. 80pp.	R	IS		
CLUCKIE ID	1990	Extreme flood assessment. Weather 45(4) 126-132	H	IS		330
CLUCKIE, I D and PESSOA, M L	1990	Dam safety: an evaluation of some procedures for design flood estimation. Hydrological Sciences Journal, 35, 5, p547-569	H	IS		331
COLES SG & TAWN JA	1994	Statistical methods for multivariate extremes: an application to structural design (with discussion). Appl Statist 43(1) pp1-48 (Disc 31-48)	S	IS	useful paper on joint probability	532
COLLIER C G & HARDAKER P J	1995	Estimating Probable Maximum Precipitation using radar with a storm model approach. In Proc. BHS Fifth National Hydrology Symposium, Edinburgh 1995. 4.31-4.38. British Hydrological Society, Wallingford	H	IS		347
COLLIER C G & HARDAKER P J	1996	Estimating Probable Maximum Precipitation using a storm model approach J Hydrology 183, 227-306	H	IS		329
COMBELLES ET AL	1985	Measures destines a ameliorer la secutiee des ouvarges hdyraucliques des barrages. 15th ICOLD. Q59. R46.	AP	IS	quote French practice that bottom outlets should be capable of reducing load on dam by 50% in 8 days	
CONATY E, LONG M	2002	Long term behaviour of Portumna embankments. British Dam Society Conference	ED	RSP	Geotechnical analysis of settlement of the flood protection banks.	
COOK NJ	1982	Towards better estimation of extreme winds. J. Wind Eng. and Industrial aerodynamics. 9. Pp295-323	W	IS	discusses Fisher Tippett distribution vs. Gumbell	521
COOK NJ	1999	Wind loading. A practical guide to BS6399-2 Wind loads on buildings. Pub Thomas Telford 243pp	W	IS		530
COOK NJ & PRIOIR MJ	1987	Extreme wind climate of the United Kingdom. J. Wind Eng. and Industrial aerodynamics. 26. Pp365-372	W	IS	extreme appears to be the 50 year wind. Analysis of 50 sites in UK	520
COOKE & SILJKHUIS	2003	Expert judgement in the uncertainty analysis of Dike Ring failure. In case studies in reliability and maintenance. Blischke & Murthy (Eds) Wiley. 331-350. Also on Delft website ssor.twi.tudelft.ntl/~risk/br/research.html	R		includes examples of style of questions and analysis of results	666
COOKE R M	1991	Experts in uncertainty: Opinion and subjective probability in science. Oxford. Oxford Univ Press 321pp	EE	IE		651
COOKE RM & GOOSSENS LJH	2000	Procedures Guide for structured engineering judgement. Research Report of EC on nuclear science and techncilology.53pp	R	AI		552
COOKE, JAGER, LEWANDOWSKI	2003	Reliability model for underground gas pipelines. . In case studies in reliability and maintenance. Blischke & Murthy (Eds) Wiley. 432-446. Also on Delft website ssor.twi.tudelft.ntl/~risk/br/research.html	R			665
Cooper GA	1987	The Reservoir Safety Programme in Northern Ireland – IWES Summer Conference, Torquay –				922
CULLEN, LORD	1990	The Public Inquiry into the Piper Alpha Disaster. Department of Energy Report. HMSO. London.	R	IS		19
CULLEN, N	1990	Risk assessment of earth dam reservoirs (SAC 9790). Report No DoE 0002-SW/3, DOE reference no :PECD 7/7/191. Water Research Centre, Swindon. 69pp	R	IS	earlier drafts in 1989. See summary in this report.	21
CYGANIEWICZ J M	2000	USBOR risk based profiling system. ICOLD Beijing Selected contribution to discussion on Q76. Vol. V, pp90-93	R	IS	good summary of USBR RBPS	
CYGANIEWICZ J M, SMART JD	2000	BOR use of risk analysis and risk assessment in dam safety decision making. ICOLD Beijing Q76 R23. Vol. . 1. Pp 351-368	R	IS	describes BOR methodology for risk analysis. Process for evaluating tolerability of this risk given in Henning et al, 1998	536
DA SILVEIRA A F, REDRO J O & GOMES A S	1993	Engineering guide to hazard and performance evaluation of dams. Water Power & dam construction. March. Pp35-36	R	IS	provides a table for 'risk evaluation index' that integrates all threats to dams. Has 10 facets of dam condition/ environment & hazard, 6 grades of condition.	
DAKE, K and WILDAVASKY, A	1991	Individual Differences. In: The Analysis, Communication and Perception of Risk (Ed Garrick, B J and Geklers W C). Plenum Press, New York.	R	IS		22
DALES M Y & REED D W	1989	Regional flood and storm hazard assessment. Report No 102, Institute of Hydrology, Wallingford March. 159pp	H	IS	DOE research Report. Concludes that spatial dependencies highly relevant where reservoirs are closely grouped, and risk of design exceedance is 1/6 of that calculated if assumed to be independent. Conversely when an event does happen it is likely to affect several sites.	

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DAMS AND RESERVOIRS	2002	Appointments to panels set up under the reservoirs Act 1975. , Vol.12, No.1	L	RSP	A guide prepared by the Reservoirs Committee of the Institution of Civil Engineers for applicants seeking to be appointed or reappointed to panels under the Reservoirs Act 1975 and for the interview panel of the Reservoirs Committee.	719
DAMS AND RESERVOIRS	2002	The World Bank Position On The Report Of The World Commission On Dams. Vol.12, No.2	L	RSP	The banks reaction to the WCD report.	
DANIELL W E, TAYLOR C A	2002	Assessing the Seismic Performance of UK Intake/Outlet Towers. British Dam Society Conference	EQ	RSP	Seismic analysis of reinforced concrete intake tower in Scotland. Analysis included a seismic "walk-down" inspection, ambient vibration tests and finite element analyses. Results indicated a non-linear response and requirement for further detailed analysis to assess the seismic capacity of the tower.	702
DAVID EVES	1966	International Conference and Workshop on Process Safety Management and Inherently Safer Processes October 8-11, 1966, Orlando Airport Mariott Hotel, Orlando, Florida. ' A European Perspective on Safety Management Goals'. Pages 457-463. Published by American Institute of Chemical Engineers.	R			559
DAY R A	2001	Factored material properties and limit state loads - unlikely extreme or impossible pretence. Proc ICE Geotechnical Engineering. Issue 4, 2090210	R	IS	ultimate load and design material properties are mathematical concepts that have no physical interpretation	279
DEFRA	1999	Flood and Coastal Defence Project Appraisal Guidance: Economic Appraisal (FCDPAG3), London, MAFF (moved to DEFRA). Interim Guidance published March 2003, following issue of revised Green Book (Appraisal and evaluation in central government)	R	IS	Sets out techniques for cost benefit analysis	678
DEFRA	2000	Flood and Coastal Defence Project Appraisal Guidance - Approaches to risk.(FCDPAG4) 76pp MAFF	R	IS	One of six Guidance notes covering all aspects of project appraisal of flood and coastal defence projects in England and Wales. Summarises tools and techniques, rather than setting standards	
Defra	2002	Scheme prioritisation System. LDW 14 (4/02). Flood management Division. 8 pages www.defra.gov.uk/corporate/regulat/forms/flood/ldw14.htm).	R	IS	System for prioritising flood defence schemes; includes factors for social deprivation	676
DEFRA	2003	Interim Guidance on FCDPAG3 published March 2003, following issue of revised Green Book (Appraisal and evaluation in central government), London,				678
DEFRA	2003	Regulatory Impact assessment for water Bill				688
DEKAY M.L. & MCCLELLAND G H	1993	Predicting loss of life in cases of dam failure and flash flood. Risk Analysis 13(2). 193-205	H	IS	reviews work to date; proposes LLOL based on warning time and 'forcefulness' of waters; used as standard by ANCOLD (see Macdonald, NNCOLD, 1997)	221
DELLIOU	2001	The French organisation for emergency planning. Proc ICOLD European Conf. Pp217-222	R	IS	system for inundation maps & emergency plans for major dams (H>20m, reservoir >15hm3)	
DEMPSTER K J, LANNEN N	2002	Breaclaich Dam - upstream face joint bandage sealant and wavewall refurbishment works. British Dam Society Conference	ED	RSP	Monitoring of the dam showed deterioration of the concrete panel joints and increasing levels of leakage. This paper describes the investigation and works carried out.	
DEMPSTER K J, MORISON A C, GALLOCHER S C, BU S	2002	Seismic assessment of Scottish dams. British Dam Society Conference	E	IS	A seismic assessment of the 90+ dams of various types owned by Scottish and Southern Energy. Assessment of key dams which was then extrapolated to the other dams of similar type.	701
DEPARTMENT OF WATER RESOURCE	1988	Dams Safety Committee of New South Wales. 'General Guidelines for Determining Flooding Conditions Resulting from the Failure of Small Dams.	DB			581
Dept OF TRANSPORT	2002	Establishing a rail accident investigation branch. Consultation paper.100pp	R	RSP	summarises main issues and existing/new legislation in relation to accident investigation	687
DETR	1995	A Guide to risk assessment and risk management for environmental protection. HMSO. 92pp	R	IS	explores underlying principle of assessing environment; risk	201
DETR	1999	Code of practice on the dissemination of information on major infrastructure developments. HMSO, London.	R	IS		22
DETR	2000	Background and Departmental Response to the September 2000 Research Report (by Babtie). 10pp	H	IS	On internet. Comments on six recommendations of Babtie report.	320
Dewey RL & Gillette DR	1993	Prediction of embankment dam breaching for hazard assessment. Proc Geotechnical special publication 35. pp131-144	DB		Authors work for USBR. Includes a) conditions for sufficient erosion to form breach (quotes Riley, 1986); b) Von Thun & Gillette, 1990 re breach characteristics (unpublished USBR internal note)	592
Dewey, R.L. and Oaks, R.A	1990	The Determination of Failure of an Embankment Dam During Overtopping. Draft Technical Memorandum, N0. MISC-3620-1 US Bureau of Reclamation, 1990. 2nd revisions. 30pp	ED	IS	Desk study of conditions that would cause overtopping failure; including depth of overtopping, slope protection type and duration of overtopping.	549

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DISE KM	1998	Risk analysis of a seepage/piping issue. Proc Annual USCOLD Conf. Pp 471- 494	R	IS	presents BOR process for detailed risk assessment. Main value is that Figure 4 summarises and references work at Stanford University around 1985 on historic probability of failure of US dams	541
DOE	1991	Program manual for DAMBRK UK. 140pp approx	DB	IS	No 23 from P tedd	608
DONNELLY C R, NALDER N, PAROSCHY N, PHILLPS M	2002	Issues and Controversies Associated With Dam Removals. Bulletin, Vol.13, No.1, Canadian Dam Association	R	RSP	A discussion on the problems associated with decommissioning of a dam. Topics covered include environmental, economic and safety issues. Decommissioning a dam does not automatically benefit the environment.	725
DORNSTADTER J	1997	Detection of internal erosion in embankment dams. Q73 R7. ICOLD Florence. Pp87-101	ED	IE	case studies for use of temperature measurement	660
DOUGLAS K, SPANNAGLE M & FELL R	1998	CONGDATA: Analysis of concrete and masonry dam incidents. UNICIV Report, the University of new South Wales, Australia.	R	IS		294
DOUGLAS K, SPANNAGLE M & FELL R	1998	Estimating the probability of failure of concrete and masonry gravity dams. ANCOLD Conf on dams. 10pp	CD	IS		
DOUGLAS K, SPANNAGLE M & FELL R	1999	Analysis of concrete and masonry dam incidents. Hydropower & dams. Issue 4. Pp 108-115	R	IS	summary of research project	277
DOUNIAS GT, DEDE V & VAUGHAN PR	2000	Use of river gravel for the core filter of Evinos dam. Proc Conf 3 rd International conference geofilters. Warsaw June 2000. Publs Wolski & Mlynarek. Pp297-304 Pubsl A.A Balkema		IE	50mm down river ravel used as filter.	904
Dounias, G. T., Potts, D. M. & Vaughan, P. R.	1996	Analysis of progressive failure and cracking in old British dams. *Geotechnique*, Vol 46, No 4, 621-640. Discussion 1998 48(2) 299-300				911
DRISCOLL R & SIMPSON B	2001	EN1997 Eurocode 7 : Geotechnical Design. Proc ICE. Civil Eng. Nov. Vol. 144 Special issue 2. Pp49-54	G	IS	review and summary of pre-standard, due for conversion to full European standard by 2003	283
DTI	1993	Dam safety in Europe. A Report on the Overseas Scientific and technical Expert Mission Scheme (OSTEMS) Mission to Europe April/ May 1993. 120pp	L	IS	25 page main report, with 9 appendices, one for each of Portugal, Spain, Ireland, Switzerland, Austria, Finland, Sweden plus itinerary and persons met.	209
DTLR	2001	Planning Policy Guidance Note 25. Development and flood risk. Publs The Stationary Office.60pp	R	IS	Little of relevance to dam safety, mainly aimed at development control relating to fluvial and coastal flooding	
DUNCAN J M	2000	Factors of safety and reliability in geotechnical engineering. ASCE Journal of Geotechnical and Geoenvironmental engineering, vol. 126, no 4, April, pp 307-316. Discussion, vol. 127, no 8, August, pp 700-721.	G	IS	The term "Reliability" is used incorrectly to denote "probability of failure" (compared to deterministic analysis which gives a safety factor. Otherwise good introduction, includes example application to stability and settlement problems	267
DUNNICLIFF J	1988	Geotechnical Instrumentation for monitoring field performance. 577pp. Wiley-Interscience	G	IE	The best currently available textbook on field instrumentation	
DUPAK D D	2001	Dam Safety Assessment: *The Biggest Risk You Take is Not Knowing the Risk*. Bulletin, Vol.12, No.3, Canadian Dam Association	R	RSP	A discussion on how to determine dam safety risk, what methods/approaches should be taken? What tools are available and who should carry out the assessment?	716
DUTTON	2001	British waterways dams - the last 25 years. Talk to BDS on 9th Oct 2000, reported in dams & reservoirs 11(2) pp19-27	ED	IS		265
DUTTON D	2001	British Waterways' Dams - The Last 25 Years. Dams and Reservoirs, Vol.11, No.2. pp19-27	ED	RSP	A summary of remedial works carried out over the last 25 years. The paper provides examples of several of the remedial projects completed.	685
DUTTON D P M	2002	The use of temperature measurements for detection of leakage in embankment dams - British Waterways experience. British Dam Society Conference. Dublin. Pp394-402	ED	RSP	Over the last 2 years ground temperature sensing has been used to investigate issues of water at 6 dams and 9 canal embankments; leakage was positively identified at 11 sites. subsequent ground investigations confirmed the findings of the temperature sensing.	914
DWYER I J, S NADARAJAH, D W REED, J A TAWN & C W ANDERSON	1994	A problem of dependence in multivariate extremes. Ann. Geophysicae 12, Supp. II, C393.	H	IS	Abstract of one of 4 papers with output from Joint probability research for DOE	351
E&P FORUM	1996	Risk assessment data directory	R	IS		24
ENSTON R P, LATHAM D C	2002	The release of large diameter draw-off and control valves. British Dam Society Conference	AP	RSP	A new technology to release in situ stuck water valves without interrupting control or flow processes. The technology can be applied to all valves and all sizes. 4 examples are presented.	
ENVIRONMENT AGENCY	1999	Interim draft Guidance on the Environmental risk assessment aspects of COMAH safety reports. May. 89pp	R	IS		208

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ESDU	1990	World-wide extreme wind speeds. Part 1: origins and methods of analysis. Engineering Services data Unit. Data Item 87034. 47pp. Issued December 1987, with amendments A & B October 1990	O	IS		
EU	1996	The control of major accident hazards involving dangerous substances. Council Directive 96/82/EC.	R	IS	COMAH	25
FAHLBUSCH	2001	Spillway design floods and dam safety. Hydropower & dams. Issue 4 pp 120-127	H	IS		339
FAULKNER D S	1999	Rainfall Frequency Estimation, Flood Estimation Handbook Volume 2, Institute of Hydrology, Wallingford UK	H	IS		
FAULKNER D S & PRUDHOMME, C	1997	Rainfall frequency estimation in England and Wales, Phase 2: Production. R&D Draft Technical Report to Environment Agency, Project W5A-008	H	IS		
FAULKNER, D.S JONES, D.A	1999	The FORGEX method of rainfall growth estimation. III:Examples and confidence intervals. Hydrology and Earth System Sciences, 3(2), Pages 205 - 212	H	IS		310
FAULKNER, D.S PRUDHOMME, C	1998	Mapping an index of extreme rainfall across the UK. Hydrology and Earth Systems Sciences, 2(2-3), P 183-194	H	IS		307
FAULKNER, D.S ROBSON, A.J	1999	Estimating floods in permeable drainage basins. Hydrological Extremes: Understanding, Predicting, Mitigating (Proceedings of IUGG 99 Symposium HIS, Birmingham, July 1999) IAHS Publ. No. 255. Pages 245 - 250.	H	IS		314
FAULKNER, D.S STEWART, E.J BLACK, K.B BAYLISS, A.C		The flood estimation handbook tools. Pages 2.3.1 to 2.3.10	H	IS		305
FELDMAN A I, CHARLWOOD R G	2002	The Need for Basic Measurements in Dynamic Monitoring of Dams. Bulletin, Vol.13, No.3, Canadian Dam Association	EQ	RSP	A further discussion on the use of Strong Motion Instruments (SMI) in large dams to measure the seismic safety. This paper is based on the Wieland paper and extends the discussion on SMI instruments.	724
FELL R	2000	Embankment dams - some lessons learnt, and new developments. The 1999 E. H. Davis lecture. Australian Geomechanics. March. Pp5 -47	ED	IS		226
FELL R, BowlesDS ANDERSON LR & BELL G	2000	The status of methods for estimation of the probability of failure of dams for use in quantitative risk assessment. ICOLD Q76 R 15. Vol. 1 pp 213-236. Correction in Volume 5 page 73	R	IS		538
FELL R, WAN CF, CYGANIEWICZ J, FOSTER M	2001	The time for development and detectability of internal erosion and piping in embankment dams and their foundations. Research report for Univ new South Wales Report R-399. 38pp	ED	IE		610
FEMA	1998	Federal Guidelines for dam safety: selecting and accommodating inflow design floods for dams. FEMA 94 October. 30pp plus appendices	AP	IS		657
FEMA	1998	Federal Guidelines for dam safety: Hazard potential classification systems for dams. FEMA 333 October. 8pp plus 2 appendices; Appendix B is copy of six existing classification system information	EP	IS		
FEMA	1999	The National dam safety programme in Fiscal years 1998-1999 41pp available on web at FEMA website	R	IS	Good summary of agencies involved in US, and currents state of dam safety practice in US	289
FEMA	2001	Report on Speciality Workshop on Risk assessment for dams. ASDSO/FEMA. Hosted by Institute for dam safety risk management, Utah state university			Scoping of future research needs	672
FEMA		Report on Speciality Workshop 1: Plant and animal impacts on earthen dams			Scoping of future research needs	671
FERC	1991	Engineering Guidelines for the evaluation of hydropower projects. Chapter IV Embankment dams The Division of Dam Safety and Inspections,	ED	IS		249
FERC	1993	Engineering Guidelines for the evaluation of hydropower projects. Chapter II selecting & accommodating inflow design floods for dams. 40pp The Division of Dam Safety and Inspections, http://www.ferc.fed.us/hydro/docs/EngGuide/Guidelines.htm	R	IS	Provides engineering guidelines for evaluating dams. Includes selection of inflow design flood (IDF) and determination of PMF although the latter chapter is now being updated. Indicates that site specific or region PMP estimates are appropriate to refine general estimates made in use of the NOAA Hydro meteorological reports HMR 51 & 52.	249
FERC	2000	Engineering Guidelines for the evaluation of hydropower projects. Chapter III Gravity dams. 39pp+ app. Peer Review version June The Division of Dam Safety and Inspections, Federal Energy Regulatory Commission.	ED	IS		249

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FINNISH EMVIRAOEMANTL INSTITUTE	2001	RESCDAm. Development of rescue actions based on dam break analysis. On web at www.ymparisto.fi/eng/research/eurproj/rescdam	DB		2 year research project to develop emergency planning for dams, based on a large dam in Finland.	557
FLEMING E	2002	Some aspects of early Irish dam construction. British Dam Society Conference	L	RSP	Discussion of dams built before 1870. Helpful reference material for other dams built around the UK before 1870.	
FLEMMING J H and ROSSINGTON D T	1985	Repair of Greenbooth dam following localised settlement in the crest. Transactions of 15th International Congress on Large Dams, Lausanne, vol. 4, pp 875-897.	ED	IS	Description of incident	652
FORLAND EJ & KRISTOFFERSEN	1989	Estimation of extreme precipitation in Norway. Nordic Hydrology 20, 257-276	H	IS	describes estimation of PMP by different methods	349
FOSTER M & FELL R	1999	A framework for estimating the probability of failure of embankment dams by piping using event tree methods. UNICIV report. DRAFT. April 300pp	R	IS		212
FOSTER M & FELL R	2000	Use of event trees to estimate the probability of failure of embankment dams by internal erosion and piping. ICOLD Q76 R 16. Vol. 1 pp 237-260	R	IS		
FOSTER M FELL R and SPANNAGLE	1998	Report by University of New South Wales, Analysis of embankment dam incidents. Report No R-374. Sept. 282 pages	IR	IS	develop UNSW method for estimating probability of failure due to piping	207
FOSTER M FELL R and SPANNAGLE	1998	Risk assessment - estimating the probability of failure of embankment dams by piping. ANCOLD 98 Conference on dams. 11pp plus 4page supplement giving example of application of the UNSW method	DE	IS	This includes proposed correction factors to average probability of failure, which are not given in the Canadian geotech J.	509
FOSTER M FELL R and SPANNAGLE	2000	Statistics of embankment dam failures and accidents. Canadian Geotechnical Journal. Vol. 37 No 5, pp1000-1024	IR	IS	Statistical analysis of failures and accidents concentrating on piping and slope stability	26
FOSTER M FELL R and SPANNAGLE	2000	A method for assess the relative likelihood of failure of embankment dams by piping. Canadian Geotechnical Journal. Vol. 37 No 5. PP1025-1061	ED	IS		27
FREAD, D	1977	"The development and testing of a dam-break flood forecasting model". In: Proceedings of dam-break flood modelling workshop, pp 164-97. US Water Resources Council, Washington DC.	DB	IS		28
FROEHLICH D C	1987	Embankment dam breach parameters. Proc Conf national Conf on Hydraulic Eng. Williamsburg Virginia 570-575	DB			591
FROEHLICH D C	1989	Peak outflow from a breached embankment dam. Proc National Conf on Hydraulic Eng pp136-141	DB			589
FROEHLICH D C	1995	Peak outflow from breached embankment dam. ASCE Journal of water resources planning and management. 121 (1). Pp90-97	DB		Statistician - includes comments on confidence limits	588
FROEHLICH D C	1995	Embankment dam breach parameters revisited. Int. Water Res Eng Conf. Vol 1. pp887-891.	DB			590
FRY J.J. , P. BRUN & P. ROYET	1994	'Internal Erosion Problems in some old Embankment Dams in France'. Reservoir Safety and the Environment. Proceedings of the eighth conference of the British Dam Society held at the University of Exeter, 14-17 September 1994. Pages 23-34. Published by Thomas Telford Services Ltd.	ED			564
FULLER WA	1914	Flood flows. Transactions of the American Society of Civil Engineers ASCE 77. pp564-617.	H	IS		
FUNNEMARK E, ODGAARD, E, EKJE SA	2000	Risk analysis of the valldalen dam. ICOLD Q76 R39. Vol. 1 pp587-606	R	IS	used event trees to calculate probability of failure of 93m high rockfill dam with central moraine core in Norway	654
GARRICK, B J and GEKLERS, W C	1991	"Individual differences in risk perception". In: The analysis, communication and perception of risk (Ed Garrick, B J and Garrick, B J and Geklers, W C). Plenum Press, New York.	R	IS		29
GARY KENNEY	1966	International Conference and Workshop on Process Safety Management and Inherently Safer Processes October 8-11, 1996, Orlando Airport Mariott Hotel, Orlando, Florida. 'Regulatory Issues in U.S. and Europe on PSM and Inherent Safety'. Pages 481-488. Published by American Institute of Chemical Engineers.	L			561
GELFARD AE, MALLICK< BK, DEY DK	1995	Modelling expert opinion arising as a partial probabilistic specification. Journal American Statistical Association	R	IS		680
GOLOB L & J. LE GUEN	2000	Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 1. 'Operationalising the Precautionary Principle - The Health and Safety Executive's Precautionary Approach': Pages 229-233. Published by A.A. Balkema.	L			573

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GOOSENS LHJ, COOKE RM, KRAAN BCP	1998	Evaluation of weighting schemes for expert judgment studies. PSAM proceedings (Moselh and Bari eds(. Springer pp 1937-1942 Also on Delft website ssor.twi.tudelft.ntl/~risk/br/research.html	R		compares equal and performance based weighting schemes	668
GORDON J L	2002	Lessons Learned: *The Persistent Dam Slope Failure. HRW, Vol.10, No.5*	ED	RSP	The importance of discussion and debate of design work. People responsible for design work should ensure that they are all satisfied and understand the proposed design. Complete acceptance of a design provided by a specialist should always be checked and reviewed.	
GORDON J L	2002	Lessons Learned: *The Broken Turbine Headcover Bolts. HRW, Vol.10, No.4*	AP	RSP	An article that highlights the importance of regular inspections of ancillary equipment that are continuously or regularly exposed to high loadings. Especially significant in hydropower generation.	
GOSSCHALK E M, SEVERN R T, CHARLES J A and HINKS J L	1994	An engineering guide to seismic risk to dams in the United Kingdom, and its international relevance. Soil Dynamics and Earthquake Engineering, vol. 13, pp 163-179.)	EQ	IS		
GRAHAM, W J	1998	Estimating loss of life due to dam failure. 18th Annual USCOLD lecture Series Managing the risks of dam project development, safety and opinion, Buffalo, New York August 1998. Pp183-207	R	IS	Gives equations for estimating LOLL (procedure used by BOR). Quoted in RMUKR (p52) as the basis of definition of near valley as first 5km	30
GRAHAM, W J	2000	Should dams be modified for the probable maximum flood. Journal of the American Water Resources Association. Vol. 36, No 5. Pp953 -963	H	IS		96
GRAHAM, W J	2000	Placing risks in perspective. Int. water power & dam construction. Dec 38-39	H	IS		348
GREEN, WEINMANN KUCZERA, NAATHN, LAURENSON	2002	Probabilities of extreme rainfall - past, present and future ANCOLD 2002 Conf. Pp 63-74	H	IS		355
GREGORY, K, LEWIN, J, and THORNES, JB	1987	Palaeohydrology in practise. Wiley	H	IS		
GUMBEL EJ	1958	Statistics of extremes. Columbia University press	H	IS		
HAGAN, V K	1982	"Re-evaluation of design floods and dam safety". In: Transactions of 14th International Congress on Large Dams, Rio de Janeiro, vol. 1, pp 475-491	H	IS		31
Hagen V K	1982	RE-evaluation of design floods and dam safety. Proc 14th ICOLD. Rio de Janeiro	DB			
HAGON, D O	1984	"Use of frequency-consequence curves to examine conclusions of published frequency analysis and to define broad criteria for major hazard installations". Chemical Engineering Research and Development, VOL 62, P 381.	H	IS		32
HAIMES YY, BARRY T, LAMBERT	1993	Proceedings of workshop "when and how can you specify a probability distribution when you don't know much?" . Pub in Risk Analysis, 1999. 14(5) 661-762	R	IS	five white papers formed basis of discussion; and printed as revised papers after workshop. This copy relates only to the workshops and not the five commissioned papers	222
HAIMES YY, BARRY T, LAMBERT	1999	Proceedings of second workshop in 1997 "when and how can you specify a probability distribution when you don't know much?" II. Pub in Risk Analysis, 1999. 19(1) 43-145	R	IS	six white papers formed basis of discussion; and printed as revised papers after workshop	223
HALCROW	2001	Sedimentation in Storage reservoirs. Research report for DEFRA. 91 pages exc. figs and appendices. Available on web at www.defra.gov.uk	H	IS		518
HALE, GOOSENS, COSTS & MATOS	2000	Expert judgment for assessment of management influences on risk control. Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 2. pp107701082	EE			586
HALL J W, LE MASURIER J W, BAKER E A, DAVIS J P, TAYLOR C A	2002	Multi-attribute performance monitoring for reservoir systems. British Dams Society Conference	L	RSP	This paper presents a methodology for managing the performance of complex data systems. The methodology covers both business and operational decisions.	
HALL, J.W., DAVIS, J.P., TAYLOR, C.A., DURGAPRASAD, J., DAWSON, R.J. and BAKER, E.	2001	Performance-based asset management for complex infrastructure systems, in ICOSSAR '01, Proceedings of the Eighth International Conference on Structural Safety and Reliability, Newport Beach, California, June 17-22, 2001, electronic proceedings	R	IS	A good description of the problem, but difficult to see the useful application in asset management.	48
HALL, M J, HOCKIN, D I AND ELLIS, J B	1993	Design of flood storage reservoirs. CIRIA Book 14, London. First published 1993 by Butterworth, CIRIA reprint 1996. 186pp.	L	IS	Supersedes CIRIA Tech Note TN100 - Guide to the design of storage ponds for flood defence in part urbanised catchment areas	33

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HARGRAVES G, MCCONNELL R, RUFFINI J		Estimating rare storms in the tropics and sub-tropics. ANCOLD Bulletin 114 pp25-33	H			352
HARRIET LONKA	2000	Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 2. 'Risk Assessment Procedures used in European Union, Countries and Norway': Pages 1363-1367. Published by A.A. Balkema.	R			574
HARTFORD DND, LOU JK	1994	Consequence based safety evaluation of an earth dam for floods and earthquakes. Canadian Dam Safety Conference			first 'trial' application to Alouette Dam, subsequently retracted	658
HARTFORD O ND, STEWART R A	2002	Risk assessment and the safety case in dam safety decisions. British Dam Society Conference	R	RSP	This paper discusses how complex dam safety decisions can be made in terms of a "safety care". Concepts are discussed with experience taken from other industries and situations where decisions concerning management of risk are significant public concerns.	711
HARTFORD, DND	1997	Dam risk management in Canada – a Canadian approach to dam safety. International Workshop on Risk-based Dam Safety Evaluations, NNCOLD, Oslo.	L	IS		34
HARTFORD, DND	1998	This dam risk business - the challenge of implementation - managing the risks of risk assessment. ANCOLD Bulletin 110. Dec. pp7-42. (paper presented at the 1998 conference on dams in Sydney)	R	IS		275
HARTFORD, DND	2000	Dam risk and the owner's dilemma. Int. Water Power and Dam Construction 52(9) pp18-23	R	IS		49
HARTFORD, DND	2000	Risk management in dam safety practice. Presentation to one day meeting of BDS. London. 18th may 2000	R	IS	Series of overheads and handouts used in presentation	211
HARVEY, B H (chairman)	1976	First Report of the Advisory Committee on Major Hazards HMSO, London	R	IS		35
HARVEY, B H (chairman)	1979	Second Report of the Advisory Committee on Major Hazards. HMSO, London.	R	IS		36
HARVEY, B H (chairman)	1984	Third Report of the Advisory Committee on Major Hazards. HMPS, London.	R	IS		37
HAUGH B	2002	Turlough Hill-Upper Reservoir: Condition of the lining after 30 years. British Dam Society Conference	ED	RSP	A study of the performance of the asphaltic concrete lining at the pumped storage scheme. The paper describes the lining, operating history, investigations, repairs, possible causes of cracking and remedial options.	
HEITEFUSS C, KNY H J	2002	Underwater work as a means for the rehabilitation of large hydraulic structures under full operation and unrestricted water supply. British Dam Society Conference	AP	RSP	This paper discusses the techniques used to carry out underwater work and the modification of the hydraulic structures to successfully allow these methods to be carried out.	
HENDERSON, F M	1966	Open Channel Flow. Macmillan, New York.	AP	IS		38
HENNING C, DISE K & MULLER B	1997	Achieving public protection with dam safety risk assessment practices. ASCE Conf Risk based decision making in water resources VIII, Santa Barbara. Pp19-32	R	IS	gives BOR risk evaluation criteria, termed "Public protection guidelines". Risk analysis process given in Cyganiewicz & Smart, 2000	539
HERBERT DM, LOVENBURY HT, ALLSOP NWH READER RA	1995	. Performance of blockwork and slabbing protection for dam faces. Report SR345 HR Wallingford in association with CIRIA.	ED	IS	see also yarde et al, 1996	
HEWLETT, H W M, BOORMAN, L A and BRAMLEY, M E	1987	Design of reinforced grass waterways. CIRIA Report 116, London.	AP	IS		39
Heywood et al	2002	Capital maintenance Planning. A common Framework. Research contract managed by UK Water Industry Research. Report No 02/RG/05/3. In four volumes. 1: Overview 20pp; 2: The Common Framework Planning process (74pp); 3: Technical Appendices (235pp); 4: Record of company testing (165pp)	O	IS		90
HICKS MA, SAMY K	2002	Reliability based characteristic values: a stochastic approach to Eurocode 7. ground Eng Dec pp30-34	R	IS		
HILL PI, NATAHN RJ, WEINMANN PE, GREEN JH		Improved estimation of hydrologic risks for dams - Impacts of the new flood guidelines. ANCOLD Bulletins 114. pp49-59	H			353
HINKS	2003	Small reservoirs on large catchments. Presentation to Supervising Engineers forum, reproduced in Dams and Reservoirs	H	IS		360
HINKS J	2001	What to do if failure looks likely. Dams and Reservoirs, Vol.11, No.2 Oct pp32-33	R	RSP	A discussion of approaches to undertake when failure is likely. Recommendations are taken from various different agencies.	718

Author	Year	Title, Publication reference etc	Subject	Identified as part of	Remarks/ Short description of content	KBR Number
HIRST	1998	Risk assessment - a Note on F_N curves. Expected number of fatalities and weighted indicators of risk. Journal of Hazardous materials. 57 pp169-175	R	IS	One of background references given in Ball & Floyd	681
HIRST IL, CARTER DA	2002	A worst case methodology for obtaining a rough but rapid indication of the societal risk from a major accident hazard installation. Journal of hazardous materials Vol 92(3) pp223-237	R	IS	Provides a method of integrating the worst accident scenario at a COMAH site to provide the full risk integral. Publ by two methods of HSE HID	650
HM Treasury	1997	Appraisal and Evaluation in Central Government (The Green Book), London, The Stationary Office.	R	IS		
HMSO	1994	Dealing with Disaster: 2nd edition. HMSO, London.	R	IS		40
HMSO	2000	The BSE Enquiry : the Report. In 16 volumes. Available on web at http://www.bseinquiry.gov.uk/index.htm	R	IS	Volume 15 (Government and public administration) includes description and definitions of risk analysis	548
HMSO	1975	Reservoirs Act. HMSO, London.	L	IS		41
HMSO	1984	A guide to the control of industrial major accident hazards regulations. HMSO HSR 21, London.	R	IS	superseded by COMAH (HMSO, 1999)	42
HMSO	1991	Water Resources Act 1991. HMSO, London.	L	IS		43
HMSO	1999	Control of major accident hazards. HMSO, Statutory Instruments 1999 No 743, London.	R	IS	UK application of EU, 1996. COMAH; see also associated ACoP and guide on emergency planning (HSE, 1999, Emergency planning for major accidents)	44
Ho KKS. Leroi e, Roberds B	2000	Quantitative risk assessment: application, myths and future direction. Proc Conf on geotechnical and geological engineering, GeoENG 2000, Melbourne. Vol 1 pp269-312	R	IE	Use of QRA for assessing risk from slopes and retaining walls in Hong Kong	629
HOEG K	1996	Performance evaluation, safety assessment and risk analysis for dams. International Journal on Hydropower and Dams, vol. 3, no 6, pp 51-58.	R	IS	2 main parts; first discusses high pwp in core of same dams- suggests due to initial low degree of saturation of fill, with air trapped in pores; second looks at risk	95
HOME OFFICE		Dealing with Disaster 3rd Edition. ISBN 185-893-9208. 57pp	EP	IS	sets out how central and local government should deal with major incidents	606
HOPKINS J K, TEDD P, BRAY C	2002	Colliford and Roadford dams: Performance of the asphaltic concrete and the embankments. British Dam Society Conference	ED	RSP	This paper reviews the performance of the last 2 dams to be constructed with asphaltic concrete membranes and compares their with other asphaltic membrane dams in the UK & Eire.	
HORTON, RE	1936	Hydrologic conditions as affecting the results of the application the method of frequency analysis to floods. US Geol. Surv. Water Supply Paper, No 771, 433-50.	H	IS		
HOUSE, PK, WEBB, RH, BAKER, VR and LEVISH, DR	2001	Ancient floods, Modern Hazards: Principles and application of Paleoflood hydrology. Water Science and Application Series, Vol. 5, 2001. American Geophysical Union	H	IS		
HR Wallingford	2002	Risk, performance and uncertainty in flood and coastal defence - A Review. R&D technical report FD2302/TR! (HR Report SR587). Publ DEFRA Flood management Division. Available on www.defra.gov.uk/environ/fed	R	All		604
HR Wallingford	2002	Risk levels in coastal and river engineering - see Mockett & Smith				
HSC	1988	Comments received on The tolerability of risk from nuclear power stations.98 pages	R	IS	Comments from 24 organisations, plus 3 appendices of HSE inputs	253
HSC	1988	Safety assessment principles for nuclear plants 47pages	R	IS		254
HSC	2001	Strategic plan 2001-2004. Work in major Hazard Industries. 8 pp. On HSE website	R	IS		647
HSC	2002	Draft Policy statement on permissioning regimes. Consultative document. Issued 12 Sept 2002, for 12 week consultation period	R	IS	The press release said "it will cover any new permissioning regimes which may be proposed or operated by HSC which feature the preparation of safety cases or safety reports and licensing"	
HSE	1989	Risk criteria for land use planning in the vicinity of major industrial hazards. HMSO, London.	R	IS		45
HSE	1991	Major hazard aspects of the transport of dangerous substances. HMSO, London.	R	IS		253
HSE	1991	Study group on human factors. 2nd report - Human reliability assessment - a critical overview. Author ACSNI	R	IS		528
HSE	1992	The tolerability of risk from nuclear power stations. HMSO, London. 61pp. First produced 1988. Rev 1992	R	IS	produced in response to recommendation of Layfield in Sizewell B public enquiry that HSE formulate and publish guidelines on tolerable risk to workers/ public.	
HSE	1995	Generic terms and concepts in the assessment and regulations of industrial risk. HMSO, London	R	IS		
HSE	1996	Major Accident Hazards: HSE's approach to land use planning advice. HMSO, London.	R	IS		46
HSE	1998	Public perception of risks associated with major accident hazards. Contract research report 194/1998. 137pp	R	IS	case studies round 7 major hazard sites. Group discussion of local residents and Q-sort exercises	250

Author	Year	Title, Publication reference etc	Subject	Identified as part of	Remarks/ Short description of content	KBR Number
HSE	1999	Safe handling of chlorine from drums and cylinders. HSEG 4093pp	R	IS	Includes appendix describing emergency plan (as understood by HSE). See also HSG 28 H122:H1361999) on bulk chlorine	270
HSE	1999	Emergency Planning for major accidents. COMAH Regulations 1999. Publication No HSG191. 58pp	R	IS		272
HSE	2000	Regulating higher hazards: exploring the issues. a) published as a draft for discussion 28 Sept 2000.(DDE15) 61pp b) summary of response 6 pages (Annex to HSC/02/51)	R	IS	Describes system of 'safety case' and 'permissioning regimes' in four high hazard industries subject to regulation; and how these differ from general HS regulation	537
HSE	2001	Reducing risks, protecting people. Finalised Dec 2001 74pp *(Discussion paper published May 1999 .80pp. Subsequent drafts published after consultation on 20th Oct 2000 (HSE internal only), 19 April 2001(as HSE Board Paper HSE/01/26) and 17th July 2001 (HSC paper HSC/01/Po20) - All on Internet on HSE website*	R	IS	summarises HSE approach to management and regulation of risk, including concepts of tolerability of risk.	232
HSE	2001	Principles and guidelines to assist HSE in its judgements that duty-holders have reduced risk as low as reasonably practicable. 7 pages. On HSE website	R	IS		525
HSE	2001	Assessing compliance with the law in individual cases and the use of good practice (framework for operating directorates on compliance with HSE at work Act 1974). 5 pages.	R	IS		527
HSE	2001	Policy and guidance on reducing risks as low as reasonably practicable in Design. 6 pages. On HSE website	R	IS		645
HSE	2001	Policy and guidance on reducing risks as low as reasonably practicable in Design. 6 pages. On HSE website	R	IS		
HSE	2002	COMAH safety Report assessment manual. Issue 2.0 (Jan 2002) on HSE website Produced by Hazardous Installations Directive for use by Inspectors (+ publicly available)	R	IS	At one sided is 25mm thick	611
HSE	2002	Draft Policy statement on permissioning Regimes. Draft for consultation issues 12 Sept. 2002	R	IS	Address some of issues behind Regulating higher hazard industries	637
HSE	2003	Transport fatal accidents and FN-curves 1967-2001. Prepared by Andrew Evans of University College London for HSE. HSE Research Report 073. 30pp Available on Internet at HSE site	R	IS	Provides historically based FN curves for road and rail, and estimates reduction that would have been prevented if Automatic train prevention had been used	638
HSE	2003	Hazardous Installations Directive (HID) Index of activities. 3 pages. On website	R	IS		646
HSE		COMAH Safety Reports: Information about the extent and severity of the consequences of identified major accidents. SPC/permissioing/06. V2. 4 pages. On website (publication date not given) Produced by Hazardous Installations Directive	R	IS	defines policy line on minimum information to be provided under COMAH reg	641
HSE		HID's approach to "as low as reasonably practicable (ALARP) decisions. SPC/permissioing/09. 8 pages. On website (publication date not given) Produced by Hazardous Installations Directive	R	IS	defines policy line on whether ALARP satisfied when assessing safety cases. Clause 9 of Annex defines limits for unacceptable, broadly acceptable regions in FN space	642
HSE		Guidance on ALARP decisions in COMAH. SPC/permissioing/12. 20 pages. On HSE website (publication date not given) Produced by Hazardous Installations Directive	R	IS	provides "supplementary sector specific" interim guidance on application of R2P2 in the COMAH context. Includes 1. Guidance on CSSL; 2. CBA (cost benefit analysis) examples	643
HUGHES R A N, KELLY P	2002	Remedial works at Brent Reservoir to address leaking sluice gates. British Dam Society Conference	AP	RSP	This paper looks at the options used to solve the problem of the leaking gates and discusses the method selected. This paper also discusses how the work was completed within an area designated as a Site of Special Scientific Interest.	704
HUGHES, A K	1981	The erosion resistance of compacted clay fill in relation to embankment overtopping PhD thesis, University of Newcastle upon Tyne	ED	IS		50
HULLA j & KADUBCOVA	2000	Erosive filtration in the flood embankments subsoil. Proc Conf 3 rd International conference geofilters. Warsaw June 2000. Publs Wolski & Mlynarek. Pp305-312 Pubs A.A Balkema		IE	Describes improvements to flood banks to R Danube, following two failures in 1965.	905
ICE	1933	Interim Report of the Committee of floods in relation to Reservoir Practice.42 pages	H	IS		323
ICE	1960	Reprint of ICE, 1933,with additional data on floods recorded in the British isles between 1832 and 1957	H	IS		324
ICE	1975	Flood Studies Conference. ICE May. 106pp	H	IS	discuss just published FSR	326
ICE	1996	Floods and reservoir safety: 3rd edition. Thomas Telford, London. 63pp. Errors & omissions given in Dams & reservoirs Nov 1997 page 12. Launch meeting reported in dams & Reservoirs June 1996, pp26-28	H	IS	Sets out guidance for floods, based on FSR	326
ICE	1998	RAMP - Risk analysis and management for projects. Joint working party of ICE & The faculty & Institute of Actuaries. Public Thomas Telford. 112pp	R	IS	52 pages main text, plus 9 appendices. Focuses on evaluation and control risk in major projects	204

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ICE	1998	An application note to 'an engineering guide to seismic risk to dams in the UK'. Thomas Telford, London. 39pp	R	IS	Addendum to Charles et al, 1991	263
ICE	2000	A guide to the Reservoirs Act 1975. Thomas Telford, London.	L	IS		
ICOLD	1974	Lessons from dam incidents	IR	IS		
ICOLD	1983	Deterioration of dams and reservoirs : Examples and their analysis. 367pp	R	IS		
ICOLD	1988	World Register of dams	L	IS		
ICOLD	1988	Dam Design Criteria - the philosophy of their selection. Bulletin 61. 83pp	R	IS	This bulletin arose out of the difficulties of interpreting results of analysis by the Finite Element method and other sophisticated computer methods, which gave results that "could not be judged by the criteria and design of the more primitive age". The task "proved more difficult than initially envisaged" and took about 10 years	
ICOLD	1989	Selecting seismic parameters for large dams. Bulletin 72. 73pp	E	IS	Defines OBE and MDE	519
ICOLD	1990	Dispersive soils in embankment dams. 53pp	ED	IE		648
ICOLD	1992	Selection of design flood. Bulletin 82. 233pp	H	IS	Good source of references on methods and international design standards for estimating floods and selection of design flood. Suggests PMF has AEP of 10-4 to 10-9. (p155). Discuses the use of ancient data, empirical envelope curves, flood frequency analysis, rainfall-runoff methods including PMP and rainfall frequency analysis, transfer function models (unit hydrograph) and the Gradex method.	327
ICOLD	1994	"Ageing of dams and appurtenant works". ICOLD Bulletin 93. 237pp	AP	IS	No quantification of effect of ageing on probability of failure. Definitions vary from this report; see table 3.1 of main report.	
ICOLD	1995	"Dam failures: statistical analysis". ICOLD Bulletin 99. 73pp	IR	IS		266
ICOLD	1997	Dams less than 30m high - cost savings and safety improvements. Bulletin 109. 179pp	IR	IS	Contains useful summaries of failure statistics, and suggests imminent failure flood has probability 100 times less than design flood	296
ICOLD	1998	Dam-Break Flood analysis. Bulletin 111. 301 pages	H	IS		
ICOLD	2000	"Rehabilitation of dams". ICOLD Bulletin 119. 245pp	ED	IS		
ICOLD	2001	Non-structural risk reduction measures. Bulletin E02 (available on Internet). Chairman F lemperiere. 50pp	R	IS	Sections on risk assessment, training, structural monitoring, emergency planning, early warning systems, maintenance and modified operations	
ICOLD	under prep	Risk assessment in dam safety management. a) Version 10 - August 2000 - 100pp b) Version 2.1 August 2001 - 88pp plus 38pp for Chp 4	R	IS	Circular from Chairman on Committee of dam safety sent circular around 2 May 2001 asking for factual statement of current practise regarding use of risk analysis or assessment for dams	295, 298, 299
IDRISS I M	2002	Review of field based procedures for evaluation liquefaction potential during earthquakes. Notes given out at BGS meeting London. 44pp	EQ	IS		
IH	1978	Methods of Flood Estimation: A Guide to the Flood Studies Report. Institute of Hydrology Report No 49. Wallingford, UK. March. 50pp	H	IS		
IH	1999	Flood Estimation Handbook (in five volumes). Institute of Hydrology, Wallingford, UK	H	IS		344
INDRARTNA BD & LOCKE M	2000	Analytical modelling and experimental verification of granular filter behaviour. Special Lecture at Proc Conf 3 rd International conference geofilters. Warsaw June 2000. Publc Wolski & Mlynarek. Pp3-26. Pubsl A.A Balkema		IE		901
INSTITUTION OF CHEMICAL ENGINEERS	1985	Nomenclature for hazard and risk assessment in the process industries. IChemE, London.	R	IS		
INSTITUTION OF ENGINEERS, AUSTRAL	1997	Australian Rainfall and runoff. 2nd Edition (first edition was in 1987). Published in 8 books	H	IS		391
INTERNATIONAL LABOUR ORGANISATION	1988	MAJOR HAZARD CONTROL - A PRACTICAL MANUAL. 300pp	R	IS	Safety aspects of siteing, planning, design, construction & operation of (chemical) plants. Prepared following Bhopal disaster.	252
JOHANSEN, VICK, RIKARTSEN	1997	Risk analysis of three Norwegian rockfill dams. Conf Hydropower 97. pp431-442	ED	IE	risk analysis illustrated by internal erosion incidents at three moraine-clay rockfill dams	661
JOHANSSON B, JOHANSSON S, NILSSON R	1996?	Investigations and report of the embankment dam at Porjus power station. Copy of paper from DD, source not available		IE	sinkhole on upstream side of crest in 22m high Swedish moraine core dam. Investigations included GPR, cross-hole radar, temperature measurements	692

Author	Year	Title, Publication reference etc	Subject	Identified as part of	Remarks/ Short description of content	KBR Number
JOHNSON C.W.	2000	Viewpoints and Bias in Accident Reports': Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 2. Pages 1395-1402. Published by A.A.Balkema.	IR	ID		575
JOHNSON C.W.	2000	'Using Case-Based Reasoning to Retrieve Incident Report': Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 2. Pages 1387-1393. Published by A.A. Balkema.	IR	ID	Results of EPSRC funded research into incident database analysis	576
JOHNSTON, T A, MILLMORE, J P, CHARLES, J A and TEDD, P	1999	An engineering guide to the safety of embankment dams in the United Kingdom. Building Research Establishment Report 363, Watford. 2nd edition	ED	IS		56
JONES, D.A	1997	Plotting positions via maximum-likelihood for a non-standard situation. Hydrology and Earth Systems Sciences, 1(2) P 357 - 366	H	IS		312
KADANE J B	1998	Experiences in Elicitation. The Statistician, 47 Part 1, pp21-35, Discussion 55-68	O	IS		598
KALKANI E C	1998	A matter of co-operation. Int. Water Power & dam construction. Dec pp33-36	R	IS	describes ASDSO	
KAPPELMEYER	2000	Example of ground temperature measurements for leakage detection		IE		693
KENNARD	1982	Dam practice - Good and Bad. BNCOLD Conf. Pp89-102	L	IS		260
KENNARD, M F, OWENS, C A, and READER, R A	1996	Engineering guide to the safety of concrete and masonry dam structures in the UK. CIRIA Report 148, London.	CD	IS		57
KENNARD, PENMAN, VAUGAHN	1967	Stress and strain measurements in the clay core at balder head dam. ICOLD. Q34 R9		IE		921
KENNEDY & B. KIRWAN, R SUMMERSGILL & K. REA	2000	Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 1. 'Making HRA a More Consistent Science'. Pages 341-349. Published by A.A. Balkema.	R			570
KIRCHSTEIGER, G. COJAZZI	2001	Project Plan Discussion Paper: 'Development of a Compass for Risk Management', Ver.3 - 04/01. Summary Paper of an International Workshop held at Stresa & Ispra, Italy, 22-25 May 2000 Organised by European Commission, Directorate General Joint Research Centre (DG JRC), Institute for Systems, Informatics and Safety (ISIS), Ispra, Italy. ' Promotion of Technical Harmonisation on Risk-Based Decision Making' Final/8-2000. Consensus Report: Proposal Towards a Project on the Development of A Compass for Risk Analysis. Ver.3 - 02/01.	R			580
KITE P	2002	The Challenges for Reservoir Owners and Panel Engineers in Learning From the Autumn 2000 Floods. Dams and Reservoirs, Vol.12, No.2	R	RSP	A report on the affect of flooding in autumn 2000, the role of flood defence, the role of reservoirs, lessons learned from autumn 2000 and risk management.	720
KOCHEL, RC and BAKER, VR	1988	Palaeoflood analysis using slackwater deposits. In Flood Geomorphology, Baker, Kochel and Patton (eds). Wiley, 1988	H	IS		
KREUZER H	1998	Uncertainty assessment of the barton-Choubey Shear Envelope. In two parts. Proc European conf, Barcelona. Publs A.A.Balkema. Vol. 1. Pp353-367	R	IS		278
KREUZER H	2000	The use of risk analysis to support dam safety decisions and management. General report. Transactions of 20th International Congress on Large Dams, Beijing, September, vol. 1, pp769-896	R	IS	Good summary of approach by different countries and main points in papers	91
KREUZER H	2000	Risk analysis for existing dams: merits and limits of credibility. Hydropower & dams, issue 1, pp 49-53	R	IS		276
Kuperman, S. C., Re, G., Canholi, A. P., Nakandakari, M. K., Luiz, M. W.,	1996	Dam safety, a new approach. International Water Power and Dam Construction, IWPDC Publishing, March. Pp18-20	R	IS	Description of qualitative approach to dam safety adopted by the Brazilian utility Cia de Saneamento Basico de Sao Paulo (SABESP). - estimate both hazard potential (depending on location and design) and the actual performance (based on inspections and analyses)	511
LAFITTE R	1993	Probabilistic risk analysis of large dams: its value and limits. Water Power and Dam Construction, March, pp 13-16.	R	IS		93
LAFITTE R	1996	Classes of risk for dams. International Journal on Hydropower and Dams, vol. 3, no 6, pp 59-65.	R	IS		94

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LASZLO N & TOTH S	2001	Dike failures in the last 200 years in Hungary. Proc 36th DEFRA Conf, Keele pp 08.4.1- 08.4.10	R	IS	Statistics of failures of dikes along Danube over last 200 years. Concludes number of failures reduced drastically in 20th century, originally overtopping worst, but now failure of foundation and at structures becoming predominant	244
LAURENSON, EM and KUCZERA, GA	1999	Annual exceedance probability of probable maximum precipitation, Aus. J. Water Resources, 3(2), 167-176.	H	IS		
LAVE B. L. & BALVANYOS	1998	Risk analysis and management of dam safety. Risk analysis 18(4). 455-462	H	IS	argue that design flood should be based on cost benefit analysis of damage, rather than PMF	220
LAW F M	1992	A Review of spillway design flood standards in European countries, including freeboard margins and prior reservoir level. Proc BDS conf. Pp 191-201	H	IS	Establishes that no country in Europe routinely and specifically requires PMF as the reservoir spillway design flood apart from the UK. It indicates that research on PMP/PMF is ongoing in a number of countries implying an interest and a concern in this concept but no clear stated intention to move fully to the incorporation into design requirements	321
LAW, FM, BLACK, AR, SCARROTTt, RMJ and MILLER, JB	1998	BHS Chronology of British Hydrological Events: Database hosted by Dundee University http://www.hydrology.org.uk/	H	IS		
LE DELLIOU	1998	dam legislation in some European countries. Proc Conf dam safety, Barcelona. Vol. 2. Pp 1533- 1539	L	IS	Includes summary of physical characteristics of European dams	
LEES F P	1996	Loss prevention in the process Industries. Hazard identification, assessment and control. 2nd Edition. Publ Butterworth Heinemann, Oxford. In 3 volumes, each about 500 pages	R	IS	30 chapters in volumes 1,2 , Volume 3 includes 26 case histories and 22,600 references.	
LEMPERIER F	2001	Risk analysis: what sort should be applied and to which dams. Hydropower & dams. Issue 4. Pp1280132	R	IS		264
LEMPERIER F, ROYET P & BLANC P	2001	Low cost methods for safety improvements of medium and small dams. Proc European Conf. 'dams in a European context'. Pp443- 450	R	IS	Includes analysis of European dams history and accidents.	
LEMPERIERE F	2001	Cost efficiency of measures to improve dam safety in Asia. The International Journal On Hydropower & Dams, Vol 9, Issue 1	ED	RSP	Of the 45000 large dams of all types, there are 25000 earthfill dams in Asia. This article discusses efficient strategies to improve dam safety, such as clear targets, analysis of risks and hazards, knowledge of costs, efficiency of mitigation measures and implementation methods.	
LEMPERIERE F	2002	Non-structural measures for cost effective risk reduction. The International Journal On Hydropower & Dams, Vol 9, Issue 4	R	RSP	Low cost non-structural measures may reduce or avoid structural expenses and can be implemented in a short time.	
LEWIN J, HINKS J	2001	Spotlight on… Spillway Gates International Water Power & Dam Construction, Dec	AP	RSP	The reliability of spillway gate installations is critical for the safety of dams. This article explains why spillway gate design, maintenance and operation require close attention.	727
Lewin, J, Starkel, L and Baker, VR	1995	Global continental paleohydrology, 1995, Wiley	H	IS		
LLOYD DM, ANDERSON MG, HUSSEIN AN, JAMALUDIN A & WILKINSON	2001	Preventing landslides on roads and railways : a new risk-based approach. Proc ICE. Civil Eng. 144 (Aug) pp129-134	G	IS	Little information on risk aspects. Appeared to have used Chasam to calculate SF of slopes under various rainfall conditions and then link in with sections of road that have high likelihood of failure and consequences of failure	280
LMICG	1998	major Incidents - the Joint approach. 52pp	EP	IS	sets out how Lancashire co-ordinates emergency services & local government response to major incidents.	607
LOCKE M, INDRARTNA, ADIKARI	2000	Erosion and filtration of cohesive soil. Proc Conf 3 rd International conference geofilters. Warsaw June 2000. Publc Wolski & Mlynarek. Pp175-182. Pubsl A.A Balkema		IE	series of lab tests, similar to pinhole. Results confirm Sherard and Dunnigan, 1989	903
LOFSTEDT R E & Frewer L	1998	Risk & modern society. Earthscan Reader. 273pp	R	IS	Social scientists views of risk management. 11 papers	231
LOKE MH		Constrained time-lapse resistivity imaging inversion			from STATS	698
LONG M, LYDON I, CONATY E	2002	River Shannon Hydro-Electric Scheme: Fort Henry. Embankment: Upstream slope failure and Remedial Work. British Dam Society Conference	ED	RSP	A second paper presented on the above failure, including discussion on remedial measures and reservoir operating procedures.	707
LONG M, LYDON I, CONATY F	2002	River Shannon Hydro-Electric Scheme: Failure of upstream slope of Fort Henry Embankment: Analysis. British Dam Society Conference	ED	RSP	Geotechnical analysis of the embankment failure due to rapid drawdown of the impounding reservoir. Failure occurred in 1979.	706
LOWING & LAW FM	1995	Reconciling flood frequency curves with the probable maximum flood. British Hydrological Society 5th national Hydrology Symposium, Edinburgh	H	IS		346
LOWING M J	1995	Linkage of flood frequency curve with maximum flood estimate DOE Research Report FR/D 0023. 26pp	H	IS	adapts Rowbottom et al (1986) to extend flood peak probability curve up to PMF	227
LUBKOWSKI ZA & DUAN X	2001	EN1997 Eurocode 8 : Design of structures for earthquake resistance. Proc ICE. Civil Eng. Nov. Vol. 144 Special issue 2 pp 55-60	G	IS	review and summary of pre-standard, due for conversion to full European standard by 2003	284

Author	Year	Title, Publication reference etc	Subject	Identified as part of	Remarks/ Short description of content	KBR Number
LUEHRING R, BEZANSON S, GRANT R	1999	Averting incipient piping failure of a turn of the century wilderness dam. USCOLD annual conf. Pp419-442	ED	IE	7m high embankment dam built in 1906 with historic seepage problems, had new seepage along outside of outlet works. Describes measures to stabilise	663
LYNGRA A J	2001	Condition assessment of dams - a manual. Proc ICOLD European Conf, Norway. Pp451-457	R	IS	Description of manual initiated by Norwegian Electricity association	
MacDONALD D E and SCOTT C W	2000	Design floods for UK reservoirs – a personal view of current issues. Proceedings of 11th British Dam Society Conference, pp 1-11. Thomas Telford, London.	H	IS	Comparison of FEK and RS	59
MacDONALD D E and SCOTT C W	2000	Revised design storm rainfall estimates obtained from the Flood Estimation Handbook (FEH). Proceedings of 11th British Dam Society Conference, pp 12-13.	H	IS	Comparison of FEH and FSR	60
MacDONALD D E and SCOTT C W	2001	FEH and FSR rainfall estimates: an explanation for the discrepancies identified for very rare events. Dams & reservoirs 11(2) pp28-31	H	IS		340
MACDONALD D E, MOLYNEUX J D	2002	Rehabilitation of the Upper and Lower Bohernabreena Spillways. British Dam Society Conference	AP	RSP	Hydrological and hydraulic analysis of 2 reservoirs in series to design remedial measures so that they can pass the PMF as required by their category 'A' classification.	705
MACDONALD D E, SCOTT C W	2001	FEH vs. FSR Rainfall Estimates: An Explanation for the Discrepancies Identified for Very Rare Events. Dams and Reservoirs, Vol.11, No.2	H	RSP	A brief summary of the procedures used by the Flood Estimation Handbook (FEH) to provide rainfall depth-duration-frequency estimates for the UK. Comparison is made between the FEH and FSR (Flood Studies Report) methodology for a selection of reservoirs for the 10,000 year event.	717
MacDONALD, T C and LANGRIDGE-MONOPOLIS, J	1984	"Breaching characteristics of dam failures". In: Hyd Div, vol. 110 no 5, American Society of Civil Engineers, New York.	DB	IS		61
MAKDISI & SEED	1978	Simplified procedure for estimating dam and embankment earthquake induced deformations. Jour Geotech Eng. Div, ASCE, 104(GT7), 569-867, July	E	IS	Standard method in ANCOLD (1998) and BRE Guide (Charles et al, 1991) for estimating permanent displacement under earthquake shaking	505
MANGURIAN D, FLORES J	2002	Ideas in Action: *Toy Balls, Unconventional Thinking Prevent Collapse of Honduran DaM.* Hrw, Vol 10, No. 5	CD	RSP	The use of toy balls and polypropylene feed sacks to act as a mesh for injected grout below the dam. An innovative solution to an urgent problem.	
MARSHALL D C W	2000	The estimation of flood-response times from digital catchment data. J. CIWEM 14, October, p335-340	H	IS		311
MATTHEWS S L	1994	Subsurface radar as an investigative tool. BRE paper PD139/94. Presented at Conf "Concrete Day 94" 8th June 1994..		IE	Summary of state of the art review on behalf of Concrete Society.	698
MATTHEWS S L	1995	Radar inspection of building structures. BRE paper PD34/95. Presented at conf "use of radar to investigate sites and structures". 14pp Assoc Consulting scientists.		IE	Theoretical background for use of radar in use of structural concrete	697
MAY, B R and HITCH, T J	1989	Improved values of 1-hour M5 rainfalls for the United Kingdom. Met. Mag., 118, 76-81	H	IS		
McCANN M W	1998	Learning from US experience. Int. J Water Power and Dam construction. Dec . Pp30-32	R	IS	describes setting up of NPDP	285
McCANN M W & CASTRO G	1998	A framework for applying and conducting risk-based analysis for dams. USCOLD lecture series (conf). Pp 115-132	R	IS	discusses different levels of risk analysis, in terms of specifying them; defining 5 levels of analysis. No detail on the process of RA itself! Fig 2 is interesting in illustrating probability density function of failure of dam	513
McCANN M W & HATEM G A	1986	Development of a database on dam failures and incidents in the United States. Progress Report No 2 to FEMA. Prepared under FEMA Contract EMW-C-0458. March. Includes as Appendix B a 85 page thesis by Hatem of Dec 1985 with analysis of available data. Purchased through NPDP.	R	IS	First steps towards US database on dam failures and incidents. Comprises 1534 events, of which 538 are failures.	605
McCANN M W, FRANZINIA J B, KAVAZANJIAN E & SHAH H C	1985	Preliminary safety evaluation of existing dams. Report prepared in 2 volumes by John A.Blume earthquake Engineering centre, Dept of Civil Eng., Stanford University under a project supported by US FEMA. Contract EMW-c-0458. . Vol. I ((Report No 69) describes methodology, Volume II (Report No 70)- user manual	R	IS	probably earliest attempt at integrated system	281
McGrath	2000	Churchill Fellow Report on Study of International practice and use of risk assessment in dam management. 57pp				675
MCQUAID J	2002	Risk assessment - its development and relevant considerations for dam safety. British Dam Society Conference	R	RSP	This paper discusses what risk assessment is in relation to dam safety and discusses what questions people should be asking. It also outlines development in risk assessment and discusses issues relevant to dam safety.	712

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MEADOWCROFT I	2001	A short introduction to the R&D programme in risk issues. Paper 3.7	R	IS	describes work under MAFF/ EA research programme	338
MEJIA L H, GILLON M, WALKER J, NEWSON T	2002	Seismic load evaluation criteria by two dam owners in New Zealand. The International Journal On Hydropower & Dams, Vol 9, Issue 4	EQ	RSP	Criteria used to develop seismic loads for the safety evaluation of dams. The paper summarises the principles and approach used and the international standards studied in selecting the criteria.	
Melchers RE	2002	probabilistic risk assessment for structures. Proc ICE. Struct and Buildings. 152. Nov. Pp351-359	S		Paper forms part of Australian structural reliability research.	
MEYER M A & BOOKER	1990	Eliciting and Analysing Expert Judgement: A Practical Guide. Rep NUREG/CR-5424. Nucl. Regul. Comm., Washington DC	R	IS		
Meyer MA, Booker JM	1991	Eliciting and analysing Expert Judgment: a Practical Guide. Volume 5 in series "Knowledge -based Systems". Academic Press Ltd. ISBN 0-12-493230-4 452PP	R	EE	Written by 2 staff at Los Alamos Nat lab, new Mexico for Nuclear Regulator Commission. Aim to provide a guide on expert judgment for lay persons.	
MICHOT D	2001	ELEMO8: spatial and temporal monitoring of sol water flow and draying induced by corn roots using electrical resistivity tomography.			from STATS	699
MIDDLEBROOKS TA	1953	Earth dam practice in the United States. Trans ASCE geotechnical Vol. pp697-727	ED	IS	gives relative frequency of different modes of failure	
MIDDLESEX UNIVERSITY FLOOD HAZARD RESEARCH CENTRE	1990	Flood Loss Assessment Information Report (FLAIR) 378pp	H	IS		62
MIDDLESEX UNIVERSITY FLOOD HAZARD RESEARCH CENTRE	2003	'Benefits of Flood and Coastal Defence: Techniques and Data for 2003'. (Multicoloured Manual)				
MIDDLETON & FRANKS	2001	using risk matrices. Tce. September. Pp34-37	R	IS	Employees of Det Norske Veritas describe technique used in predictive elements of COMAH safety reports.	622
MILLER S P	1987	Embankment overtopping - case histories. Proc Conf Hydraulic Eng. Pp739-744	DB	IS	Limited information on 5 case histories	625
MILNE, P	1996	"The management of reservoir safety". In: Proceedings of 9th Conference of British Dam Society. Thomas Telford, London.	R	IS		332
MINOR H E	1998	Report of the European R&D working group 'Floods'. Conf dam safety Barcelona. Publs Balkema. 1541-1550	H	IS	Reviews actions of Working Group of Floods – 1994-1998. Focus on legislation and present international practise in France, Italy, Spain, Sweden, Switzerland, UK.	63
MLYNAREK J	2000	geodrains and geofilters - retrospectives and future trends. Special Lecture at Proc Conf 3 rd International conference geofilters. Warsaw June 2000. Public Wolski & Mlynarek. Pp27-47. Pubsl A.A Balkema		IE		902
MOCKETT ID & SIMM	2002	Risk levels in coastal and river engineering. A guidance framework for design. Publs Thomas tenfold. 242pp	R	IS	Report funded by DTI and HSE to look at multi-attribute design and setting acceptable risk levels. KBR EA library 120/6.04	
MOFFAT A I B	2002	The Characteristics of UK Puddle Clays - a Review. British Dam Society Conference	ED	RSP	This paper reviews the use of puddle clays as the slender central core in embankment dams. It assesses the performance of puddle clay and recommends further research into its specific characteristics and compatible repair materials.	714
MOFFAT, A I B	1982	"Dam deterioration: a British perspective". In: Proceedings of BNCOLD Symposium, Keele. BNCOLD, London. Paper No 8	ED	IS		64
MOFFAT, A I B	1988	"Embankment dams and concepts of reservoir hazard analysis". In: Proc Conf "Reservoir Renovation 88", Paper 6.4. BNCOLD, London.	R	IS		65
MOFFAT, A I B	1988	"Low probability hazards to UK dams – seismic events and aircraft strikes". Discussion on Developments and legislation in Proc Conf. The Prospect for reservoirs in the 21st Century. Thomas Telford, London.	R	IS		
MONTEIRO GS, COSTA S & CAVILHAS J	2001	Safety studies of the existing Idanha, Cova do Viriato, Capinha and Toulica dams. Methodology of application of RSB (Portugal) Proc ICOLD European symp, Norway. Pp263-269	R	IS	review safety of 4 dams.	225
MOONEY J & WALKER G	2002	The derivation and use of population data for major hazard accident modelling. HSE Contract Research Report 410/2002. 110pp. Prepared by Dept of Geography, Staffordshire University. On HSE website	R	IS	evaluate and derive sources of population data for use in QRA. Solution used postcode as foundation and then combine with further datasets to provide "richer" data set	
MORGAN M G, FLORIG H K, DEKAY M L, FISCHBECK P	2000	Categorising risks for risk ranking. Risk analysis 20(1) 49-58	R	IS	discusses process for risk categorisation & ranking	

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MORRIS M W	2000	CADAM - Concerted Action on dambreak modelling. Final Report Feb. 1988 - Jan 2000. HR Report No SR571. 33pages plus 2 appendices	DB	IS		621
MORRIS M W	2000	CADAM: A European concerted action project on dambreak modelling. Proc BDS Conf bath. Pp 42-52	DB	IS	also conference in Milan may 1999.	
MORRIS M W	2002	The IMPACT Project - Continuing European Research on Dambreak Processes and the Failure of Flood Embankments. British Dam Society Conference	DB	RSP	This paper discusses the work being carried out by the IMPACT Project (Investigation of Extreme Flood Processes and Uncertainty). The 3 study areas are Breach Formation, Flood Routing and Sediment Movement. The objective of the project is to improve understanding of these processes and develop tools and methodologies for more accurate and reliable predication.	
MORRIS M W & GALLAND JC	2002	Dambreak modelling guidelines & best practice. EU Research Contract ENV4-CT97-0555. Available on web on HR siteCADAM: Concerted action on dambreak modelling. 33pp	DB	IS	Complements ICOLD Bulletin 111. Literature review; 14 breach models (Table 2); some lab and filed tests, partly scoping study for further research; does not appear to cover small height dams relevant to UL	620
MORRIS MW, HASSAN M	2002	Breach formation through embankment dams & Flood Defence embankments: A state of the Art Review. Paper presented at IMPACT workshop at HR. May. 21pp Available on web via www.samui.co.uk/impact-project	DB	IS	compares 15 breach prediction models; concludes no reliable breach prediction models. Lists 9 ongoing research projects	596
MYERS, VA	1967	Meteorological estimation of extreme precipitation for spillway design floods. US Weather Bureau Technical Memorandum WBTM Hydro-5, US Dept Commerce, Washington DC	H	IS		390
NADARAJAH S	1994	University of Sheffield PhD dissertation entitled 'Multivariate Extreme Value Methods with Application to reservoir Flood Safety' 162pp	H	IS	MSc forming basis of 4 papers on Joint probability research for DOE. Difficult to abstract the engineering conclusions	
NADARAJAH S & C W ANDERSON	1993	Environmental factors, affecting reservoir safety. In 'Statistics in the Environment' eds. V Barnett & K F Turkman, J Wiley & Sons, Chichester & New York 163-183.	H	IS	one of 4 papers with output from Joint probability research for DOE	
NATHAN rj WEINMANN, HILL	2002	use of a Monte Carlo framework to characterise hydrologic risk. ANCOLD 2002 Conf. Pp53-62	H	IS		354
NATHAN, RJ and WEINMANN, PE	2001	Australian Rainfall and Runoff, Book 6. The Institution of Engineers, Australia, 2001.	H	IS		333
NATIONAL RESEARCH COUNCIL	1985	Safety of Dams - Flood and Earthquake Criteria. Committee on Safety Criteria for Dams. 263pp. Prepared under the auspices of Water Science and Technology Board, Commission on Engineering and Technical Systems, National Research Council, Washington, DC. National Academy Press, Washington DC Viewable under: http://www.nap.edu/openbook/0309035325/html (and www.nap.edu/catalog/288)	R	IS	recognises the need the derivation of floods with very long return periods for the purposes of a risk-based safety assessment procedure. Suggests a pragmatic way to obtain the magnitude of these events is to assign a period to the PMF and to extend the flood frequency curve derived by normal methods up to the PMF by extrapolation on specified graph paper.	66
NAYLOR D J, MARANHA J R, MARANHA DAS NEVES E, VEIGA PINTO A A		A back-analysis of Beliche Dam. Geotechnique, Vol GE47, Issue 02	EQ	RSP	Back-analysis for a dam in southern Portugal. The dam was subject to a 'Class A' prediction which grossly under predicted the actual settlement at end of construction. The analysis described here incorporated an elastic-plastic critical state model applied in terms of critical stress. This simulated the effect of collapse settlement and by doing so reproduced a maximum settlement which was close to that measured.	729
NERC	1975	The flood studies report (five volumes). Natural Environmental Research Council, London.	H	IS	18 supplementary reports issued 1977 to 1988	274
NILKENS B, RETTEMEIER K, FALKENHAGEN & KONGETER	2001	Risk Assessment procedure for German dams. ICOLD 69th annul meeting Dresden. Vol. 1. Pp428-438	R	IS		206
NNCOLD	1997	Conference at Trondheim in Norway on Risk-based dam safety evaluations	R	IS	included state of risk assessment in Australia, Austria, Canada, Netherlands, France, Germany, Norway, Sweden, Switzerland, UK and the US	67
NORSTEDT U, NILSSON A	1997	Internal erosion and aging in some of the Swedish earth and rockfill dams. ICOLD. Florence. Q73, R20. pp307-319	ED	IE	results of questionnaire to dam owners. Plus 2 case histories	662
NPDP	1994	Guidelines for reporting the performance of Dams.	IR	ID	13 chapters on how to report dam incidents plus 21 reporting forms	609
NUREG	1998	Risk informed decision making: technical specifications, NUREG-0800. US NUCLEAR Regulatory Commission.	R	IS		68
OECD/NEA	1990	"How the public perceives technologies". In: "Communicating for Tomorrow". OECD/NEA Workshop, Paris.	R	IS		

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O'Hagan	1997	The ABLE story: Bayesian asset management in the water industry. Chapter 8 in "The practice of Bayesian analysis" Edited by Simon French & Jim Q Smith pp 173-189. Arnold.	S	EE	Involvement by Statistician in formulating capex bids for AMP1, AMP2	628
O'HAGAN	1998	Eliciting expert beliefs in substantial practical applications. The Statistician, 47 Part 1, pp21-35, Discussion 55-68	O	IS	2 case histories, a water company and rock mass permeability for Sellafield	599
O'KEEFFEE J D	2002	The Contribution to Society of Irish Hydro-Electric Dams. British Dam Society Conference	L	RSP	A discussion of the social and political impact of hydropower dams built between 1925 and 1974. The future contribution of these projects is also discussed.	
O'MAHONY B, HAUGH B	2002	Stability Reassessment and Remedial Works at Leixlip Dam. British Dam Society Conference	R	RSP	Concerns were raised regarding the stability of the dam, due to the presence of weak layers of gouge material interspersed with limestone layers in its rock foundation. The paper provides a brief summary of previous studies undertaken and describes the latest assessment. It also describes the remedial work carried out and its success using rock anchors to stabilise the dam.	
OREDA	1997	Offshore Reliability data handbook. Published by OREDA participants; distributed by Det Norske Veritas. 535pp 3rd Edition	IR	ID	Publication of reliability data on offshore platforms, based on pooling of data by 10 oil companies, including Agip, BP, ELF, Shell, Total and 5 other Norwegian companies. Part I of Book is 35 pages describes the project; Part II the reliability data	631
OSBORN TJ, HULME M	2002	Evidence for trends in heavy rainfall events over the UK. Phil Trans R Soc Lond. A 360. pp1313-1325	H	IS		361
OSBORN, T J, HULME M, JONES P D & BASNETT T A	2000	Observed Trends in the daily intensity of United Kingdom precipitation. Int. Journ. Climatology, 20, 347-364	H	IS	daily rainfall has increased in winter and reduce in summer, over period 1961-2000	656
OWEN MW	1980	Design of seawalls allowing for wave overtopping. Report No EX 924. Hydraulics research, Wallingford	O	IS	Unable to get copy from HR, as they say superseded by Besley (1999). See also Van Der Meer et al. 1998	69
PARKS C D, WALTHALL S	2002	The successful grouting of Heaphy embankment, Angelzarke reservoir. British Dam Society Conference	ED	RSP	This paper presents the process undertaken to control leakage from a dam constructed in 1870. The proposed method was concrete grouting in the zone of leakage. The first attempt was unsuccessful, but succeeded at the second attempt. The paper describes the lessons learnt during the project.	
PARR, N M and CULLEN, N	1988	"Risk management and reservoir maintenance". In: Journal of the Institution of Water and Environmental Management, vol. 2, no 6, December, pp 587-593. Disc pp612-624	R	IS	Summary of interim state of Cullen (1990)	70
PASMAN, H J DUXBURY, H A and BJORDAL, E N	1992	"Major hazards in the process industries, achievements and challenges in loss" prevention. In: Journal of Hazardous Materials, vol. 30, p1.	R	IS		282
PATTEL A, KNOOP B	1999	A risk based approach for optimising dam monitoring. ANCOLD Bulletin 111, pp59-67		IE	Hydro Tasmania review of its entire dam surveillance programme; where the outcome was that monitoring efforts were closely linked to identified risks (some dams increased, others reduced)	
PAYNE KM, CORWIN RF	1999	Self potential methods to investigate the water seepage flow through Earthfill embankment dams. Proc Symp on appln of geophysics to engineering and environmental problems. Pp41-48		IE		697
PECK R B	1969	Advantages and limitations of the observational method in applied soil mechanics. 9th Rankin lecture. Geotechnique 19(2) 171-187	G	IS		
PECK R B	1980	Where has all the judgement gone. The fifth Laurits Bjerrum lecture. Can, geotech. J 17, 584-590	G	IS	the ;lecture aims to reduce the probability of failure of dams by fostering the application of engineering judgement in design and application	
PENMAN A.D.M.	1994	Reservoir Safety and the Environment. Proceedings of the eighth conference of the British Dam Society held at the University of Exeter, 14-17 September 1994. 'Examples of Problems involving Clay Cores affecting Dam Safety'. Pages 42-51. Published by Thomas Telford Services Ltd.	ED			563
PENMAN A D M	2002	Tailings dam incidents and new methods. British Dam Society Conference	R	RSP	This paper identified that tailings dams have failed at an average rate of 1.7 per year over the last 30 years. It provides case studies of some of these failures and investigates reasons for failure despite increasing geotechnical knowledge of dam construction.	
PERRY A H & HOWELLS K A	1982	Are large falls of rain in Wales becoming more frequent? Weather, 37, 240-243	H	IS		

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PICKUP, G	1989	Palaeflood hydrology and estimation of the magnitude, frequency and areal extent of extreme floods – an Australian perspective. Civil Engineering Transactions of I. E. Aust., CE31: 19-29.	H	IS		228
PILARCZYK KW, BRETELER MK	2000	Geotextiles in revetment structures - A Dutch approach. Proc Conf 3 rd International conference geofilters. Warsaw June 2000. Publs Wolski & Mlynarek. Pp339-348 Pubsl A.A Balkema				906
POHL R	2000	Failure frequency of gates and valves at dams and weirs. Hydropower & dams. Issue 6. Pp77-82	AP	IS	author is research engineer at Dresden Univ.	543
Posskit FF	1974	Assessment of Selected Dams in Northern Ireland BNCOLD Newcastle Paper 5.4 (6 pages)				923
Powledge, G.R., Ralston, D.C., Miller, P., Chen, Y.H., Clopper, P.E. and Temple, D.M.,	1989	Mechanics of Overflow Erosion of Embankments. II: Hydraulic and Design Considerations, Journal of Hydraulic Engineering, ASCE, Vol. 115, No. 8, August 1989. Pp 1056-1075	ED	IS	Focussed at design of reinforcement to allow overtopping	71
Powledge, G.R., Ralston, D.C., Miller, P., Chen, Y.H., Clopper, P.E. and Temple, D.M.,	1989	Mechanics of Overflow Erosion of Embankments. I: Research Activities, Journal of Hydraulic Engineering, ASCE, Vol. 115, No. 8, August 1989. Pp 1040- 1055	ED	IS	Focussed at reinforcement to allow overtopping	544
PRICE, R K	1985	"Flood routing". In: Developments in hydraulic engineering (Ed Novack, P). Elsevier, pp 129-173	H	IS		72
PROVINCIALE WATERSTAAT GRONEIGEN (PWG)	1979	Pollution control and use of norms in Gronigen – criteria for risk related to dangerous goods	R	IS		
PRUDHOMME C & REED D W	1999	Mapping extreme rainfall in a mountainous region using geostatistical techniques: a case study in Scotland. Int. Journ. Climatology, 19, 1337-1356	H	IS		317
PRUDHOMME, C REED, D.W	1998	Relationships between extreme daily precipitation and topography in a mountainous region: a case study in Scotland. International journal of Climatology Vol. 18 Pages 1439 - 1453	H	IS		318
PRUDHOMME, C REED, D.W	1999	Mapping extreme rainfall in a mountainous region using geostatistical techniques: a case study in Scotland. International journal of Climatology, Vol. 19. Page 1337-1356	H	IS		335
PURNELL	2002	Civil Engineering, May 2002, Volume 150, Special Issue One. 'Flood Risk - A Government Perspective'. Pages10-14.	H			579
QUIGLEY, L. WALLS & R. HODGE	2000	'Eliciting Prior Distributions for Potential System Faults from Correlated Experts'. Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 1. Pages 325-329. Published by A.A. Balkema.	EE			571
RABOUW RF, THOMPSON KM, COOKE RM	2001	The aviation risk to groundlings with spatial variability.8pp. ESRel. On Delft website ssor.twi.tudelft.ntl/~risk/br/research.html	R		MSC at Deflft?	667
RALSTON	1987	Mechanics of embankment erosion during overflow. Proc Conf Hydraulic Eng. Pp733-738	DB	IS		624
RAMSBOTTOM D & HATWOOD	2001	Integrated river flood management. DEFRA conf II.4.1-12	H	IS		73
READER, R A, KENNARD, M F and HAY, J	1997	Valves, pipework and associated equipment in dams – guide to condition assessment. CIRIA Report 170, London. 160pp. A5 size	AP	IS	Only considers iron and steel pipework, and does not cover older dams with other types of pipework. Includes as Figure 7.1 how suggested action required relates to combination of likelihood of failure and hazard	343
REED & ANDERSON	1992	A statistical perspective on reservoir flood standards. BDS Conf. In Water Resources and Reservoir Engineering, eds. N M Parr, J A Charles & S Walker, Thos. Telford, London, 229-239.	H	IS	one of 4 papers with output from Joint probability research for DOE - describes DOE research on joint probability of rainfall, snowmelt, antecedent conditions and wind	341
REED D W	1992	Triggers to severe floods: extreme rainfall and antecedent wetness. BDS Conf. Pp 219-229	H	IS		
REED D W	1994	On the Gradex method of estimating extreme floods. Dams % reservoirs. June. 4(2) pp17-19	H	IS	Summarises method and reviews rainfall frequency analysis; concludes cannot be recommended for use for extreme floods	

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Reed D W, I J DWYER, S NADARAJAH, J TAWN & C W ANDERSON	1994	Maximum reservoir water levels. In 'Reservoir Safety and Environment' Thomas Telford, London, 200-213.	H	IS	one of 4 papers with output from Joint probability research for DOE	
REED DW & FIELD EK	1992	Reservoir Flood Estimation: another look. IoH Report 114. May 87pp	H	IS	Reviews reservoir flood estimation, including comparison of 15 reservoired catchments	313
REED, D.W DORTE, J ROBSON, A.J FAULKNER, D.S STEWART, E.J	1999	Regional frequency analysis: a new vocabulary. Hydrological Extremes: Understanding, Predicting, Mitigating (Proceedings of IUGG 99 Symposium HIS, Birmingham, July 1999) IAHS Publ. No. 255. Pages 237 - 243.	H	IS		309
REED, D.W FAULKNER, D.S STEWART, E.J	1999	The FORGEX method of rainfall growth estimation. II: Description. Hydrology and Earth System Sciences, 3(2), Pages 197 - 203	H	IS		315
REED, D.W DORTE, J	2000	Improving the accuracy of estimates: a new method for statistical flood frequency estimation in the UK. Kassel reports of Hydraulic Engineering no. 9/2000 Pages G-33 to G-43	H	IS		306
REED, D.W.		Plans for the flood estimation handbook. Pages 8.3.1 to 8.3.8	H	IS		302
REED, D.W. HOUGHTONCARR, H RICHARDSON, D.B		Introducing the flood estimation handbook. Pages 2.1.1 to 2.1.8	H	IS		259
RETTEMEIR K & KONGETER J	1998	Dam safety management: Overview of the state of the art in Germany compared to other European countries. Dam Safety, Vol. 1, Proc. Int. Symp. On New Trends and Guidelines on Dam Safety, Barcelona, 17-19 June 1998, Balkema, pp55-59.	L	IS	Reviews legislative requirements, technical requirements including design floods and maintenance requirements. Provides design floods for Finland, France, Italy, Norway, Austria, Portugal, Sweden, Switzerland, Spain and the UK	
RETTEMEIR K, NILKENS B, FALKENHAGEN B & KONGETER J	2001	New developments in dam safety - Feasibility evaluation on risk assessment. Proc ICOLD European Cong, Norway. Pp303-308	R	IS	describes risk assessment process in Germany, including F-N curve	257
RIGBY P, WALTHALL S, GARDINER K D	2002	A methodology for seismic investigation and analysis of dams in the UK. British Dam Society Conference	EQ	RSP	Soil parameters derived from existing data only, have been found to give pessimistic results when used in seismic analyses. The paper discusses the design of ground investigations needed to obtain realistic parameters and the development of a methodology to determine the level of investigation required for dams in different seismic categories.	
Riley RC	1986	A procedure for evaluating permissible limits of overtopping of vegetated earthen embankments. Annual meeting, association of State dam safety officials, Austin, Texas. October	DB			
RIMINGTON J.D. & V.M. TRBOJEVIC	2000	Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 1. 'Determination of ALARP in Conditions of Uncertainty". Pages 201-205. Published by A.A. Balkema.	R			568
RISSLER P	2001	Dimension of the design flood as part of a reservoir safety concept. Hydropower & dams. Issue 4 pp 98105	R	IS	relates design flood to FN curve	301
ROBERDS WJ	1990	Methods for developing defensible subjective probability assessments. Transportation Research Record. National Research Council, Washington 1288. pp183-190	R	IE		632
ROBSON, A REED, D JONES, T		Trends in UK floods. Pages I.1.1 to I.1.12	H	IS		316
ROBSON, A.J JONES, T.K REED, D.W BAYLISS, A.C	1998	A Study of national trend and variation in UK floods. International Journal of Climatology, Vol. 18, Pages 165 - 182	H	IS		304

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ROBSON,A HOUGHTONCARR, H FAULKNER,D JAKOB, D MARSHALL,D.C.W REED,D.W		The flood estimation handbook methods. Pages 2.2.1 to 2.2.8	H	IS		74
ROYAL SOCIETY STUDY GROUP	1992	Risk: Analysis, Perception and Management. Royal Society, London.	R	IS		271
ROYET P, & CHAUVET R	2000	Preparation of a specific emergency plan for Bimont dam and information to the public. ICOLD Q76 R37. Vol. Pp547-568	R	IS	good example of how emergency plan received by the public	
RYAN C P	2002	Rehabilitation of Owen Falls Dam. Dams and Reservoirs, Vol.12, No.2	CD	RSP	Repair of the 30m high mass concrete dam due to cracking and seepage. It was discovered that evidence of Alkaki Aggregate Reaction (AAR) was taking place. The report details repair work was carried out to enhance the safety and stability of the dam.	
SACHS	1978	Wind Forces in Engineering. 2nd Edition. Pergamon press	O	IS	deals only with wind on structures, rather than wind generated waves, but Chapter 2 gives some useful data on wind data	75
SALMON GM, CATTANACH JD, HARTFORD DND	1996	Measuring and managing the safety at Wahleach dam. Proc Canadian dam safety conference. Pp 150-164	R	IS		669
SALMON GM, CHIN WQ, PLESA V	1997	Estimating the magnitude and probability of extreme floods. Conf Hydropower 97. Pubs Balkema. Pp531- 538	H	IS		359
Samad MA, Bare DW, taggart WC, Pflaum JM	1987	Statistical analysis of dam failures. Hydraulic engineering. Pp582-587	R	ID		594
SANDILANDS, N M and NOBLE, M	1998	"A programme of risk assessments for flood gates on hydro electric reservoirs". In: The prospect for reservoirs in the 21st century. Thomas Telford. Pp27-38	R	IS		76
SANDILANDS, N M, and FINDLAY, J W	2000	Development of a risk based approach to dam safety management. ICOLD Beijing Q76, R10, pp133-148	R	IS		77
SANDILANDS, N M, NOBLE, M and FINDLAY, J W	1998	Risk assessment strategies for dam based hydro schemes. In: The Prospect for reservoirs in the 21st century. Thomas Telford. Pp13-26	R	IS		
SARKARIA, G S	1973	"Safety appraisal of old dams: an updated perspective". In: Inspection, Maintenance and Rehabilitation of Old Dams, pp 405-417. American Society of Civil Engineers.	L	IS		336
SAYERS P, CROSSMAN M, MEADOWCROFT I & MOODY A	2001	Integrating reliable flood modelling with probabilistic analysis in practice. DEFRA Conf 07.4.1-12	H	IS	Case history is marine flood defences	
SAYERS, J.W. HALL & I.C. MEADOWCRFOT	2002	Civil Engineering, May 2002, Volume 150, Special Issue One. 'Towards Risk-Based Flood Hazard Management in the UK'. Pages 36-41.	H			582
SCHOFIELD	1993	A framework for offshore risk criteria. Safety & Reliability vol 13 No 2pp5-18	R	IS	One of background references given in Ball & Floyd	682
SCOTT C W, BOMMER J	2002	Seismic hazard in the UK - another look. British Dam Society Conference	EQ	RSP	This paper reviews the literature on seismicity of the UK and discusses options for assessing the seismic hazard to critical structures such as dams. The paper finds that UK dams are intrinsically seismically robust structures, however appurtenant structures are significantly more venerable than dam structure.	703
SCOTT C W, MOLYNEUX J D	2001	Britain's concrete dams - The final 50 years. Proc. of ICE, Civil Engineering, Nov, Vol.144, Issue 4	CD	RSP	The paper describes the development of concrete dams from 1942 to the completion of Maentwrog in 1991. The paper questions whether this dam could be the UK's last concrete dam owing to social and environmental concerns surrounding dam construction. It also looks at how the expertise of UK dam designers has been exported worldwide. There is a brief review of the WCD report.	
SCS	1985	Erath dams and reservoirs. US Dept Agriculture Tech release No 60	DB			
SEED H B & IDRISS	1982	Ground motions and soil liquefaction during earthquakes. Earthquake Engineering Research Institute. Volume 5 of series of monographs on Earthquake Criteria, Structural design and string motion records	E	IS		506
SHALABY AL	1995	Sensitivity to probable maximum flood. Jour Irrigation and drainage Eng. Sept/Oct. 327-337	H	IS		345

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SHEPARD M A	2002	Ladybower Reservoir Draw-Off Valve Replacement. Dams and Reservoirs, Vol.12, No.1	AP	RSP	Replacement of two 50 year old operating and guard valves. This paper discusses how the valves were replaced without drawing down the reservoir. It discusses underwater techniques utilised, problems encountered and innovative solutions developed to undertake this work.	
SHERARD JL	1986	Hydraulic Fracturing in embankment dams. ASCE. 112(10) 905-927		IE		912
SHERMAN, LK	1932	Streamflow from rainfall by unit-graph method. Engineering News-Record, 108, pp501-505.	H	IS		78
SIMON JONES	1966	International Conference and Workshop on Process Safety Management and Inherently Safer Processes October 8-11, 1966, Orlando Airport Mariott Hotel, Orlando, Florida.' The Role of the Institution of Chemical Engineers in Promoting Process Safety'. Pages 464-467. Published by American Institute of Chemical Engineers.	R			560
SIMS C	2002	Bohernabreena Reservoirs Spillway Improvements/ Dams and Reservoirs, Vol.12, No.2	AP	RSP	Hydrological and hydraulic analysis of 2 reservoirs in series to design remedial measures so that they can pass the PMF as required by their category 'A' classification.	721
SINGH, V P	1997	Dam-break modelling technology. Kluwer Academic Publishing, Dordrecht.	DB	IS		79
SKEMPTON AW & BROGAN JM	1994	Experiments on piping in sandy gravels. Geotechnique 44(3) pp 449-460				920
SKEMPTON, A W	1989	Historical development of British embankment dams to 1960. Keynote address to Proc Conf on clay barriers for embankment dams. Thomas Telford, London. Pp 15-52	ED	IS		80
SKINNER H	2000	The use of historical data in assessing the risks posed by embankment dams. Dams & Reservoirs, vol. 10, no 1, April, pp 9-12	R	IS	Use of BRE Database quantify risk of problems and frequency of incidents and remedial works	293
SKIPP B O & WOO G	1993	A question of judgement: expert or engineering? Proc Conf Risk and reliability in ground engineering. London. Publ Thomas Telford. Paper 2. Pp 29-39	R	IS	two types of judgement compared in table I. Paper generated by the Seismic Hazard Working party of Nuclear Electric plc	81
SLOVIC et al	1980	"Facts and fears: understanding perceived risk". In: Societal risk assessment: how safe is safe enough. Plenum.	R	IS		246
SMITH		Reliability, maintainability and Risk	R	IS	Section 9.4.3 includes probability of aircraft crash rate	350
SMITH CD	1998	The PMF does have a frequency. Canadian WRJ 2391) 1.7	H	IS		
SMITH M	2003	Influence of uncertainty in the stability analysis of a dam foundation. Proc Conf dam maintenance and rehabilitation. Madrid 2002. Pp 131-136 Pubs Swets & Zeitlinger			Use a 23m high 1000m long earthfill structure founded on glacial deposits to illustrate how use of analysis of uncertainties in stability analysis allowed a better comprehension of the factors affecting the stability of the slope.	696
SNELL	1997	Cost-benefit analysis for engineers and planners. Thomas Telford. 306pp	R	IS		221
SOCIETY FOR RISK ANALYSIS	1998	Annual Plenary session : assessing and managing risks in a democratic society. Risk analysis 2000; Vol 20(3) 301-316	R	IS	perspectives on how environmental risk management decisions is/ should be informed by democratic process	224
Socitey of Risk analysis	2000	Foresight and precaution. Proc of ESREL 2000 and SARA Europe annual conference. In 2 volumes/ Vol 2 is 112 paper (850pages)				583
SPENCER, P WALSH, P		The flood estimation handbook: Users' perspectives from North West England. Pages 2.4.1 to 2.4.14	H	IS		82
SRD	1985	A feasibility study into probabilistic risk assessment for reservoirs. Water Research Centre External Report no ER 188E, Swindon.	R	IS		
STATELER JN	2003	using performance parameters to define dam safety monitoring programs: 10 years of experience in the US bureau of reclamation. Proc Conf dam maintenance and rehabilitation. Madird 2002. Pp 131-136 Pubs Swets & Zeitlinger		IE	the process results in (1) identifying the most likely failure modes, (2) how the monitoring efforts relate to failure modes and (3) what constitutes unexpected performance that requires prompt investigation	695
Stedinger J.R. and Cohn T.A.	1986	Flood frequency analysis with historical and Palaeoflood information. Water Resources Research, 22, 785-793	H	IS		308
STEWART JEREMY	2002	Where to keep your dam documents? British Dam Society Conference	L	RSP	Safe storage, quick and easy access of important documentation. Development of a system by Severn Trent Water and COGNICA.	
STEWART, E.J REED, D.W FAULKNER, D.S REYNARD, N.S	1999	The FORGEX method of rainfall growth estimation. I: Review of requirement. Hydrology and Earth System Sciences, 3(2), Pages 187 - 195	H	IS		

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STOJMIROVIC G, SOUTHCOTT P	2001	A consequence assessment methodology for dam breaks. Proc European Conf Geraingar, Norway. Pp349-356	R	IS	Application of ANCOLD dam failure consequence methodology to 54 dams in Tasmania.	-
SUTHERLAND J, HUMM D, & CHRIMES m	2001	Historic Concrete - background to appraisal. Pubs Thomas Telford. 437pp	O	IS	19 chapters on various uses of concrete - useful overview, but width of publication means insufficient space for lot of detail	328
SWAIN RE, BOWLES D and OSTENAA D	1998	A framework for characterisation of extreme floods for dam safety risk assessment. Proceedings of the 1998 USCOLD Annual Lecture, Buffalo, New York, August 1998 http://www.engineering.usu.edu/uwrl/www/faculty/DSB/framework.html	H	IS	In the context of dam risk assessment, considers what return period events can be reliably derived by different methods.	357
SWAISGOOD JR	1995	Estimating deformation of embankment dams caused by earthquakes. Paper to be presented at the Assoc. of State dam safety officials western regional conference, may. 16pp	E	IS		508
SWAISGOOD JR	1998	Seismically induced deformation of embankment dams. Proc 6th US Nat Conf on earthquake Engineering. Seattle, Washington June. 12pp	E	IS		517
SWANNELL N G	1994	Simplified seismic safety evaluation of embankment dams. Dams & Reservoirs October 4(3). Pp17-19	EQ	IS	Includes relationship between displacement and acceleration in probabilistic terms given by Ambrasyes and Menu (1972) - gives methodology considered to satisfy BRE Guide (Charles et al, 1991)	
TARRANT F R & ROWLAND	2000	Prediction of downstream damage following dam failure: no quick solution. Proc BDS Conf bath. Pp36-53 & Discussion volume pp17-34	DB	IS		292
TARRANT FR, HOPKINS LA, BARTLETT JM	1994	Inundation mapping for dam failures - lessons from UK experience. Proc Conf BDS. Pulc Thomas Telford. Pp282-291	DB		Summarise results of dam break on 35 UU dams using DAMBRK	
TARRENT FIONA, ACKERS JOHN, GRAHAM-SMITH NIGEL	2002	Reservoir risk assessments in the north of Scotland. British Dam Society Conference	R	RSP	This paper describes the experiences of Binnie Black & Veatch (BBV) in carrying out reservoir risk assessments for the North of Scotland Water Authority (NOSWA) using the guidance given I the CIRIA Report C542 "Risk Management for UK Reservoirs".	713
TATALOVICH	1998	Comparison of failure models from risk assessment and historical data for Bureau of Reclamation dam. DSO-98-01. 12 pages and 24 thick appendices. Available on BOR website	R	IS	BOR report comparing analysis with historical - differences of up to 2 orders of magnitude in both directions. Project was limited to about 4 man months, so output mainly recommend for future work	
TEDD P AND HART JM	1985	BRE Note No N 3/85. Investigation into the use of infrared thermography to detect leakage from old embankment dams. 12pp		IE	feasibility study of use, including trial on 4 Pennine dams. Conclude inappropriate where varied vegetation, or obscured by trees and cannot be used on sunny days because surface temperatures governed by solar gain from sun. Surface temperatures also depend on solar history (e.g. duration exposed to sun); solar absorbance and thermal mass of object	694
TEDD P AND HART JM	1988	The use of infrared thermography and temperature measurement to detect leakage from embankment dams. Int Sym on detection of subsurface flow phenomena by selfpotential/ geoelectrical and thermometrical methods. Karlsruhe		IE		691
TEDD P, CHARLES J A & HOLTON I R	1997	Settlement of old embankment dams : a guide to measurement and interpretation. Dams & Reservoirs. March. Pp18-23	ED	IS	Summary of two unpublished Research reports for DETR (listed in Guide to Reservoirs Act)	83
TEDD P, CHARLES J A, ROBERTSHAW A C	2002	Settlement of old embankment dams and reservoir drawdown. British Dam Society Conference	ED	RSP	This paper reports on monitoring carried out over the last 15 years on crest settlement of embankment dams. This has been used to assess long-term performance and safety of embankment dams. Five dams were studied in the Yorkshire Pennines.	708
TEDD P, SKINNER H D and CHARLES J A	2000	Developments in the British national dams database. Proceedings of 11th British Dam Society Conference, pp 181-189. Thomas Telford, London	L	IS	Analyses of UK dams, distribution of risk category, remedial works as function of type and flood category	84
TEDD, J.A. CHARLES & I.R. HOLTON	1994	'Remedial Works to Clay Cores of UK Embankment Dams'. Pages 52-61. Reservoir Safety and the Environment. Proceedings of the eighth conference of the British Dam Society held at the University of Exeter, 14-17 September 1994. Published by Thomas Telford Services Ltd.	ED			562
TEDD, P, HOLTON, I R and CHARLES, J A	1992	"The BRE dams database". In: Water Resources and Reservoir Engineering: Proceedings of the 7th British Dam Society Conference, PP 403-10, Thomas Telford, London	L	IS		85

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Tedd, P., Charloes, J. A., Holton, I. R. & Robertshaw, A. C.	1997	The effect of reservoir drawdown and long term consolidation on the deformation of old embankment dams. Geotechnique, Vol.47, No. 1, 33-48				910
Thomas HR, He Y	1995	Analysis of coupled heat, moisture and air transfer in a deformable unsaturated soil. Geotechnique 45(4), 677-689			development of new theoretical formulation for the analysis of coupled heat, moisture and air transfer. Part of studies for burial of nuclear waste in underground adits, surrounded by bentonite clay backfill	913
THOMPSON G& P.B. CLARK	1994	Reservoir Safety and the Environment. Proceedings of the eighth conference of the British Dam Society held at the University of Exeter, 14-17 September 1994. 'Rapid Hazard Ranking for Large Dams'. Pages 306-315. Published by Thomas Telford Services Ltd.	R			565
THOMPSON KM, RABOUW RF & COOKE RM	2001	The risk of groundling fatalities from unintentional airplane crashes. Risk Analysis 21(6) 1025-1038	R	IS	Reviews risk of ground fatalities from crashing aeroplanes in light of events of 11th Sept 2001; concludes average annual risk is 1.2 in a 100 million	531
THOMPSON, G and CLARK, P B	1993	"Rapid hazard ranking for large dams". In: Reservoir Safety and the Environment Proceedings of the 8th British Dam Society Conference, pp 306-15. Thomas Telford, London.	R	IS		
TJERK W. VAN DER SCHAAF	1996	International Conference and Workshop on Process Safety Management and Inherently Safer Processes October 8-11, 1966, Orlando Airport Mariott Hotel, Orlando, Florida. ' A Risk Management Tool Based on Incident Analysis'. Pages 242-251. Published by American Institute of Chemical Engineers.	IR			558
TOWNSHEND P D, LUND K A	2002	Flood control using the automatic TOPS spillway gates: A case study of the Avis Dam, Namibia. British Dam Society Conference	AP	RSP	The city council required that the maximum discharge for the 1 in 100 year flood from the Avis Dam be limited to almost half the inflow peak to reduce flooding in the city. The paper presents a case study of the problem, solution, design, model study, fabrication and commissioning of the TOPS Spillway gates for this dam.	
TRIESTE D J	1991	The Bureau of Reclamations new downstream hazard classifications guidelines. Proc 6th BDS Conf, Nottingham. Sept 1990. Paper 21. Pp141-144	R	IS	Includes 5 useful figures of flood danger level as function of velocity and depth to houses, mobile homes, vehicles, adults and children	634
TWORT A C	1977	The repair of Lluest Wen dam. Journal of Institution of Water Engineers and Scientists, vol. 31, no 4, July, pp 269-279.	ED	IS	Description of incident	
US ARMY CORPS ENGINEERS	1984	Shore protection manual. In two volumes (Chapter 1 to 5 in Vol. 1, Chapter 6 to 8 & Appendices in Vole 2). 4th Edition, 2nd printing in 1984	W	IS		203
US ARMY CORPS ENGINEERS	1999	Condition rating procedures for earth and rockfill embankment dams. Tech Report REMR-OM-25. Sept. 96pp Authors Anderson G, Chouinard L E & Foltz S	R	IS	Draft circulated for comment Sept 1998, with title Condition Assessment methodology for embankment dams.	
US DEPT OF AGRIC	1986	Soil mechanics Note No 1. Eng Guide for determining the gradation of sand and gravel filters. Jan 15.18pp				918
USCOLD	1975	Lessons from dam Incidents, USA. Publs ASCE/USCOLD.387pp (A5 size)	R	IS	Combination of responses from 1965 and 1973 questionnaires, on failures and accidents	524
VAN DER MEER JW, TONJES P & DE WAAL JP	1998	A code for dike height design and examination. Coastlines, structures and breakwaters. Proc Int. Conf at ICE. Publ Thomas Telford. Pp 5-19	W	IS	Gives equations for wave run-up and wave overtopping of flood dikes, including confidence limits	86
VAN NNORTWIJK JM, VROUWENVELDE R ACWM, CALLE, SLIJKHUIS	1999	Probability of dike failure due to uplifting and piping. 10th European safety and reliability conference (ESREL 99), pp1165-1170. Pubs Balkema. Also on Delft website ssor.twi.tudelft.ntl/~risk/br/research.html	R			664
VAUGHAN	1994	Assumptions, prediction and reality in geotechnical engineering. 34th Rankine lecture. Geotechnique 44 (4) pp 571-610				908
Vaughan & Soarses	1982	Design of filters for clay cores of dams. ASCE 108 (GT1) Jan pp17-31. Disc ASCE Sept 1983 , 109(GT9) pp 1191-1201		IE	permeability rather than grain size, developed following Balderhead	919
VAUGHAN P R, KOVACEVIC N, RIDLEY A M	2002	The influence of climate and climate change on the stability of abutment and reservoir slopes. British Dam Society Conference	ED	RSP	A discussion of how climatic conditions can affect slope stability.	
VAUGHAN P R, KOVACEVIC N, RIDLEY A M	2002	The influence of climate and climate change on the stability of embankment dam slopes. British Dam Society Conference	ED	RSP	The influence of climate change on the stability of embankment slopes is likely to be small.	
VAUGHAN PR	1971	The use of hydraulic fracture tests to detect crack formation in embankment dam cores. Unpublished Internal report. 18pp plus 29 figures				689
VAUGHAN PR	2000	Filter design for dam cores of clay, a retrospect. Conf Filters and Drainage in Geotechnical and Environmental Engineering. Publ Balkema. Pp 189-196	ED	IE	Discussion and review of rules for deign of filters	683

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VAUGHAN PR	2000	Internal erosion of dams - assessment of risks.. Conf Filters and Drainage in Geotechnical and Environmental Engineering. Publ Balkema. Pp 349-356	ED	IE	Overview of risks	684
VAUGHAN, P R, KLUTH, D J, LEONARD, M W and PRADOURA, H H M	1970	"Cracking and erosion of the rolled clay core of Balderhead dam and the remedial works adopted for its repair". In: Transactions of 10th International Congress on Large Dams, vol. 1, pp 73-93, ICOLD.	ED	IS	Description of incident	87
Vaughan, P. R., Chalmers, R. W., & Mackay, M.	2000	Ladybower Dam: Analysis and prediction of settlement due to long term operation. *Dams 2000, Proc. 11th Biennial Conference, British Dams Society,* Bath. 360-376.				915
VICK S G	2000	Engineering application of dam safety risk analysis. Transactions of 20th International Congress on Large Dams, Beijing, September, vol. 1, pp 325-335.	R	IS	deals with probabilistic risk assessment - illustrates how quantitative risk analysis can demonstrate that the greatest risks derive from events far smaller than PMF and MCE, simply because they occur much more frequently	88
VICK, S G	1997	Risk analysis practice in different countries. International Workshop on Risk-based Dam Safety Evaluations. NNCOLD, Oslo.	R	IS		242
VICK, S G	1999	Appendix A to BOR Risk analysis. Considerations for estimate structural response probabilities in dam safety risk analysis. 16pp plus figures				674
VISEU T, MARTINS R	1998	Safety risks of small dams. Proc Conf Dam Safety Barcelona. Pp 283-288	R	IS	Reviews minimum size of dam/ reservoir to come under national legislation, and contrasts with potential damage caused by failure of such dams	633
VOGEL A.	2000	Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 2. 'The Influence of the Dam Type to the Hazards of Dam Failures Caused by Human Factors': Pages 1369-1372. Published by A.A. Balkema.	R			577
VOSE D	2000	Risk analysis. Publs John Wiley & sons Ltd.	R	IS	Useful summary of QRA. Vose is independent consultant specialising in Monto Carlo analysis	291
VRIJLING J K & P.H.A.J.M. VAN GELDER	2000	Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 1. 'An Analysis of the Valuation of a Human Life'. Pages 197-199. Published by A.A. Balkema.	R			567
WAHL T L	1998	Prediction of embankment dam breach parameters: A literature Review and needs assessment. US BOR Dam safety Research Report DSO-98-004. 55pages. Available on web at http://www.usbr.gov/wrrl/twahl/	EP	IS	Table 1 lists 18 dam failure papers. Appendix A includes data on 108 dam failures. Comments include p 34 Froehlich best for breach width; ; p35 most methods under predict the failure time, although MacDonald & Langridge over predicts; p40 - Froehlich (1995) is one of the better available methods for peak Q; p42 Walder & O'conenr provide a valuable tool for reconnaissance level estimates (ref 89 in RMUKR)	627
Wahl T L	2001	The uncertainty of embankment dam breach parameter predictions based on dam failure case studies. Paper prepared for USDA/FEMA workshop on issues, resolutions and research needs related to dam failure analysis. June. Available on web at http://www.usbr.gov/wrrl/twahl/	EP	IS	Tests various rapid methods against dataset of 108 real failures, to establish average difference between method and real failure. Concludes "the Froehlich method can be considered the best estimate of peak Q, and Walder and O'Conner provide an upper bound"	626
WALDER, J.S. and O'CONNOR, J.E.	1997	"Methods for Predicting Peak Discharge from Floods Caused by Failure of Natural and Earthen Dams". Water Resources Research, vol. 33, no 10, pp 2337-2348, Oct 97.	DB	IS	paper by 2 members of US geological survey; propose breach discharge governed by rate of down cutting K, which generally varies between 10 and 100m/hour	636
WALLEND, MEIGHEN, BEESLEY, XUREB	2002	A new method for estimating probable maximum precipitation in tropical Australia ANCOLD 2002 Conf. pp75-86	H	IS		356
WAN CF, FELL R, FOSTER MA	2002	Experimental investigation of the rate of piping erosion of soils in embankment dams. ANCOLD 2002 conference pp249-258	ED	IE	reports slot erosion test and hole erosion test to study erosion rate of a soil.	640
WELSH, S	1993	"Assessment and management of risks to the environment". Trans IchemE, Part 3-14, February.	R	IS		
WEN Y K & CHU SL	1973	Tornado risks and design wind speed. Am Soc Civ Eng. Jour Struct Div 99(ST12) pp 2409-2421	O	IS	quoted in ESDU (1990) as basis for statement that tornado dominate extreme wind speed for return period > 500 years	504
Wetmore JN & Fread DL	1984	The NWS simplified dam break flood forecasting method for desk-top and hand-held microcomputers. Printed and distributed by the FEMA US. 122pp	DB			

Author	Year	Title, Publication reference etc	Subject	Identified as part of	Remarks/ Short description of content	KBR Number
Wetmore JN & Fread DL	1991	The NWS simplified dam break flood forecasting method. Revised by Fread DL, Lewis JM & Wiele SM.. Available on internet at oh/hrl/rvrmech/documentation/smpdbk (rvrmech = river mechanics home page). 9pp plus 32 pages of progam manual and example program	DB	IS		587
WHITMAN RV	1984	Evaluating calculated Risk in geotechnical Engineering. Jour. Of geotechnical Engineering. ASCE 110(2) Feb	R	IS		
WICKHAM DB	1992	Collapse of an earth embankment dam. Dams and reservoirs. October 2(3) 18-19	ED	IS	Rapid failure by internal erosion along 5 year old outlet pipe at 110 year old Warmwithens dam	92
WIELAND M	2002	Why Do We Need Strong Motion Instruments in Large Dams? Bulletin, Vol.13, No.2 Canadian Dam Association	EQ	RSP	Discussion on the need for Strong Motion Instruments (SMI) in large dams to monitor seismic safety.	723
WIELAND M	2002	Taking up the call…improving seismic dam safety. International Water Power & Dam Construction, March	EQ	RSP	The use of seismic analysis to assist in ensuring dam safety will not be questioned by opponents of new dams.	726
WILLEMS A, BEDFORD T, VERSTEGEN & JANSSENN	2000	Expert quantification of uncertainties in a risk analysis for an infrastructure. Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 2. pp1087-1092	EE	IE		585
WOLSKI W, MLYNAREK J	2000	Filters and drainage in geotechnical and environmental engineering. Proc Conf 3 rd International conference geofilters. Warsaw June 2000. 400pp Pubcl A.A Balkema			Special lectures by Indrartina, Mlynarek	699
Wong HN, Ho KSS, Chan YC	1997	Assessment of consequences of landslides. Int. Workshop Landslide Risk Assessment. Feb. Honolulu pp111-149. Ed Cruden & Fell. Balkema	R	IE	Describes generalised consequence model developed in HK to assess landslide consequence, and construction of an example F-N curve	630
WOOLF D	2002	Numerical simulation of hydraulic structures. Dams and Reservoirs, Vol.12, No.1	AP	RSP	This paper is a report on analysis carried out at Langsett Reservoir following the increase in the design flood after the launch of the FEH in March 2000. A computational fluid dynamics model (CFD) was created to investigate options to increase the spillway capacity.	
WRIGHT C E	1994	UK reservoir failures and safety legislation. Dams and Reservoirs, vol. 4, no 3, October, pp 20-21	L	IS	summary of catastrophic dam failures in UK, plus deregulation proposals regarding siltation and supervision of reservoirs less than 100,000m3	
WRIGHT, J.B. DAVIES, E. COURTNEY & H. REID	2000	CIRAS: Collecting and Analysing Human Factors Data from the UK Rail Industry': Proceedings of Esrel, 2000, SARS and SRA-Europe Annual Conference, Edinburgh, Scotland, United Kingdom, 15-17 May 2000. Foresight and Precaution. Volume 2. Pages 941-947'. Published by A.A. Balkema.	R			578
YARDE AJ, BANYARD LS & ALLSOP NWH	1996	Reservoir dams: wave conditions, wave overtopping and slab protection. HR Wallingford Report No SR 459.	W	IS		
ZDRAVKOVIC L, POTTS D M, HIGHT D W, ZDRAVKOVIC L	2002	The effect of strength anisotropy on the behaviour of embankments on soft ground. Geotechnique, Vol GE52, Issue 06	G	RSP	This article discusses the construction of embankments on soft clay deposits & attempts to demonstrate the effect of soil strength anisotropy on the behaviour of soft clay embankments through finite element analysis using an anisotropic soil model.	730

ANNEX 2 : QUESTIONNAIRES A AND B: NUMBER RETURNED AND NUMBER OF INCIDENTS/YR IN UK

Introduction

This section describes the dissemination and results which are in common to the two questionnaires. It should be read in conjunction with the Report on each task, which covers issues specific to each questionnaire.

Recipients were selected to provide a reasonable cross section of those with a professional involvement in dams in the UK.

For selection of the 10% of Supervising Engineers selection was limited to those who had given permission for their name and address to be available on the internet, and recipients were selected to represent employees of owners and consultants who were either not represented by the other recipients (owners of > 15 dams and those with Panel AR engineers); or who worked in regional offices.

The owners of one or two dams were selected to comprise a range of types of owner, namely:-

- Private owners/ charities – 5 number
- Fishing clubs – 2 number
- Local authority/ other public body – 4 number
- Commercial company e.g. farmers – 4 number

The questionnaires were devised as predominantly closed questions, where the recipient had a choice of a number of predefined answers. This was to facilitate statistical analysis of the results. However, in addition a number of open questions were also provided through the questionnaire to allow the recipient to add additional information.

Completeness of reporting

The recipients and number of responses by recipient type is summarised in Table Annex 2.1. It can be seen that overall 43% completed Questionnaire A, 35% completed Questionnaire B whilst only 16% supplied examples of internal erosion for Incident Levels 2 and 3.

An important issue is to what extent the dam owners who responded to the questionnaires are representative of the whole population of UK dam owners. For this reason the questionnaire was sent to the following, on the expectation that the percentage response would be interpolated between these two groups,

- All owners of more than 15 dams (20 number)
- A selected sample of 15 owners who own only 1 or 2 dams.

The response from the owners of dams is summarised in Annex Table 2.2; it can be seen that the % completeness from owners of 1 or 2 dams was very low with only one out of 15 sent questionnaires responding. One owner's site manger wrote to apologise for not completing the questionnaires but said "The questionnaire is extremely long and involved and I just do not have the time available to devote to it." The important issue is whether this is representative of owners of only one or two dams, or whether the group was somehow unrepresentative. It is considered likely that this is representative

of small owners who generally do not have the time or in some cases do not have the technical knowledge to answer the questionnaires.

The response from owners of a modest number of dams (say 3 to 15) is likely to be closer to those of owners of only one or two dams, in that they too are unlikely to have professional engineering staff to manage the safety and operation of the dams. Thus although on one hand the 11 responses from the larger dam owners represent 48% of UK dams, it is likely that owners of less than 15 dams would be much less responsive to any voluntary incident reporting system, or system for early detection of internal erosion (i.e. only 5% of the sample of owners of 1 or 2 dams responded to the questionnaires). This poor response is supported by the response from Supervising Engineers employed by dam owners (selected to the owners of less than 15 dams); where the % replying to Questionnaire A was 18% and to Questionnaire B was 9%.

If it was assumed that only 10% of owners of between 3 and 14 dams would have responded to the questionnaire, and that there are 500 owners of only one or two dams then it is estimated that only 79 out of 1040 dams would have been represented by responses (i.e. 7% of dams in portfolios smaller than 15 dams). This is illustrated in Table Annex 2.2.

This is a serious issue, as it implies that any voluntary system of incident reporting or implementation of systems for early detection of internal erosion is unlikely to be effective at reaching owners of a limited number of dams.

Table Annex 2.1 : Summary of recipients and responses to Questionnaire A and B

Response		Dam owners			Panel AR			Supervising Eng, employed by		Research	Subtotal; other than dam	Overall
Questionnaire Series		>15 dams 101-120	1, 2 dams 141-174	Subtotal	Employee 201-233	Retired 241-257	Other 241-292	Dam owner 301-312	Consultant 321-345	Inst 401, 402	owners	
Number of questionnaires sent out		20	15	35	32	17	7	11	13	2	82	117
Questionnaire A												
returned Note 1		11	2	13	12	12	3	4	5	1	37	50
% response (of those sent out)		55%	13%	37%	38%	71%	43%	36%	38%	50%	45%	43%
Questionnaire B												
Part 1 - Views on surveillance												
returned		11	1	12	11	9	3	2	3	0	28	40
% response (of those sent out)		55%	7%	34%	34%	53%	43%	18%	23%	0%	34%	34%
Part 2 – data on incidents												
Number providing incidents		5	0	5	7	3	2	1	1	0	14	19
% response (of those sent out)		25%	0%	14%	22%	18%	29%	9%	8%	0%	17%	16%
Number of internal erosion incidents	level 1	0	0	0	0	0	0	0	0	0	0	0
(Note 3)	level 2	5	0	5	7	2	3	1	0	0	13	18
	level 3	2	0	2	7	5	1	0	1	0	14	16
	total	**7**	**0**	**7**	**14**	**7**	**4**	**1**	**1**	**0**	**27**	**34**

Notes

1. Other comprises independent, dam owner and those whose name and address is not available on the Defra web site (communication was through Defra)
2. For dam owners this is number of responses by owner i.e. where one owner sent in three responses, from three different regions
3. There was one Level 3 incident reported by owners which were duplicated by panel AR engineer (reported as level 2).

Table Annex 2.2 : Proportion of dam owners who would take part in voluntary questionnaire and other dam safety activities

		For owners of					Overall total	
		> 15 dams		1, 2 dams		3 to 14 dams		
	Number of	owners	dams	owners	dams	dams	owners	dams
Total		20	1560	Not available				
	% of UK dams		60%					
Sample (Recipients of questionnaire)		20	1560	15	20	None	35	1580
Those that responded to Questionnaire A		11	1240	1	1	Not app.	12	1241
	% of recipients	55%	79%	7%	5%		34%	79%
	% of UK dams		48%		0.04%			48%
Extrapolation of sample to whole population of UK dams								
Assumed number of UK dams in group			1560		500	540		2600
Percentage of dams where recipient would respond	% of recipients		79%		5%	10%		51%
Number that dams that would be represented by response to questionnaire	Number of dams		1240		25	54		1319

Number of incidents per year

The number of each level of incident per year is important to both tasks, to Task A because of assessing the completeness of reporting, and Task B because of providing data on internal erosion incidents.

Internal erosion incidents were reported as follows

a) Q2- 40 respondents stated they were involved with a total of 93 Level 1 to 3 events over the last 10 years
b) Q7- 19 respondents gave examples of 38 specific examples of Level 1 to 3 incidents in any period (on average two examples from each respondent, although the number per individual varied between 1 and a maximum of four incidents).

Issues in assessing this data are

a) are some of the incidents duplicated (or triplicated) between dam owners, Panel AR Engineers, and Supervising Engineers?
b) how complete is the data i.e. how many incidents of each level were unreported?
c) these events represent internal erosion only; how many other Level 2 and 3 incidents occur due to causes other than internal erosion.

A manual check has been made of the incidents given in response to Q7 and the following responses identified as duplicates

Incident level	Date of incident	Dam height	Reported by Respondent No		
			Owner	Panel AR	Supervising panel
3	1997	3	104	256[1]	Not reported

1. Panel Engineer reported as a Level 2 incident, but year of construction, year of incident, Flood category and height otherwise identical, so deemed to be same incident

The number of each level of incident is summarised in Table Annex 2.3. In response to Q7 onwards a total of 15 specific Level 2 internal erosion incidents were reported as occurring in the period 1993 to 2002 (an average of 1.5 per year), whilst the response to Q2 suggests that the number of Level 2 internal erosion incidents was between 2.4 per year and 4.2 per year on average, the value depending on the overlap of reporting between panel engineers and dam owners (say 3.3 average). Corrections are also required to this for

a) only a proportion of Panel AR engineers and dam owners reporting (34% by number of respondents, 48% of UK dams)
b) inclusion of other types of threat/failure mode.

For the purposes of this research contract it will be assumed that on average there are 4 Level 2 incidents a year (of which say 3 are internal erosion).

The table shows what had been inferred as the number of each level of incident per year and thus the annul probability of an event, including the assumptions made. For comparison the values from the Integrated System project are also included. The main differences, relative to the Integrated system values, are that there are more Level 2 incidents, but less Level 3.

Table Annex 2.3 : Assessment of possible number of incidents per year

	from BRE database				This report										
	Definition of incident	Historic AP of incident		Implied average number of incidents per year	Definition of incident	Number of each level of incident of internal erosion reported by Questionnaire B							Provisional number of incidents if all levels of incident were to be reported		Inferred annual probability
Level	Description	($\times 10^{-5}$/annum)			Description	Number in last 10 years (Q2)				Specific examples given , in any period (Q7 onwards) (value in brackets is 1992 or before)			**Adopted/ per year**	Remarks	($\times 10^{-5}$/annum)
		Pre-1975	1975 - 2000	1975-2000		Owners of > 15 dams	Panel AR Engineers	Supervising Engineers	Total	Owners of > 15 dams	Panel AR Engineers	Period 1993 - 2002; After correction for duplication			Note 2
1	Failure: Uncontrolled release of water resulting in death or damage downstream.	15	<2	0	Failure (uncontrolled sudden release of a large quantity of water)	0	1	0	1	0	0	0	**0**		
2	Serious incident (Large settlement or leakage) involving emergency action or drawdown of the reservoir.	100	50	1	Emergency drawdown	17	24	1	42	5	13 (3)	15	**3**	Approach in Note 1 would give 8/year; specific instances give 3/year if corrected on same basis as Note 1; adopt lower value	167
3	Incident or change in previously observed behaviour to cause major investigations and remedial works.	1000	1000	20	Inspecting Engineer called to site, or unplanned works arising out of incident	27	19	4	50	2	14 (3)	13	**10**	Note 1	556
4	Symptoms causing sufficient concern to involve an inspecting engineer and an increase in surveillance and monitoring of instrumentation.	2000	2000	40	Works arising out of periodic safety review	119	166	1	286	Not requested			**60**	Note 1	3,333
5	Design limitation: Inadequate flood capacity, scour capacity, emergency drawdown capacity, slope stability based on reassessment.			Not incl	Upgrading works not covered by higher incident class	79	55	5	139	Not requested			**28**	Note 1	1,556
6	Not used			Not incl	Magnitude of external load exceeds 1% annual probability (100 year return period)	Not requested				Not requested			**104**	1% of UK dams/ year x 4 threats	
7	Not used				Any operational failure coved by reliability database	Not requested				Not requested					
	Total			61	Total					6	27	**27**	**205**		

Notes

1 Value based on responses to Question 2, but corrected by increasing by the proportion of responses received (1/0.34), and reduced by factor of 1.5 to allow for overlap between owners of more than 15 dams and Panel Engineers

2 On basis that there are 1800 embankment dams in UK under the Reservoirs Act

ANNEX 3: PACKAGE SENT OUT AS QUESTIONNAIRE

Contents

Covering Letter

XU0248/130/32/AJB

15th April 2003

Dear Sir/ Madam

DEFRA Research Contract
Questionnaire XXX

We are writing to you on behalf of DEFRA, to ask if you would be prepared to assist in research work to improve the safety of dams in England, Scotland and Wales. Your participation and assistance would be by way of completing the following attached questionnaires

A:	Incident database for UK dams and investigation of near miss incidents
B:	Detection and progression of internal erosion in embankment dams

A Guidance Note is included, which sets out the reason for the survey and the background to the questions. The questionnaires are being sent to a sample of dam owners, all Panel AR Engineers, 10% of Supervising Engineers and BRE/Newcastle University.

Your participation in the survey is entirely voluntary and strictly confidential; individual responses will not be identifiable in the survey results. In addition, any data provided will be treated in the strictest confidence.

Questionnaire A should not take more than 30 minutes to complete, whilst Questionnaire B should not take more than 30 minutes per incident (we have requested data on up to 5 incidents, giving 2.5 hours maximum for this questionnaire). If you have any queries please do not hesitate to contact me.

We request that the completed survey be returned by 2nd May; if returned after this date we cannot guarantee your views will be included in the analysis of the results of the survey. If you are not the individual responsible for the safety of dams owned by your organisation then please forward this letter and attachments onto that person.

Finally, as part of the research being undertaken for DEFRA we are planning to study about six case histories of the detection and progression of internal erosion in more detail. If you have data on such a case history and are prepared to make this information available on a strictly confidential basis, such that the dam and organisation(s) involved are not identified please contact the undersigned.

Yours sincerely

Alan Brown
Project Manager
Telephone: +44 1372 86 3585
Fax: +44 1372 86 3355
Email: *Alan.J.Brown@Halliburton.com*

Encl:
Guidance Notes to Questionnaires
2 Questionnaires and Template for extended text response to open questions
Paper on use of incident database by Brown & Tedd

Guidance Note

Introduction

These questionnaires form part of a research contract being carried out by KBR for Defra; the terms of reference for this research being given in Appendices A and B. This element of the project commenced in September 2002 and is due for completion by August 2004.

This note sets out the reasons for the survey and provides some notes to assist in completing the survey form.

If you are able to complete the survey, the data obtained will assist in identifying, and thus taking account of, the views of dam owners and the dam engineering profession.

Reason for Questionnaire to dam professionals

It is considered that some of the issues in the terms of reference for KBR can best be addressed by obtaining the views of dam engineering professionals on some of the issues involved. Specifically the purpose of each questionnaire is

	Subject	Purpose of Questionnaire
A	Incident database for UK dams, and near miss investigation	Your views on a) format, content and other issues relating to setting up such a database (see notes in Section 3 below) b) how near- miss incidents should be investigated and reported, to provide feedback to dam owners and thus improve the safety of UK dams (see notes in Section 4 below)
B	Detection and progression of internal erosion of embankment dams	Your experience of serious incidents, to allow us to review the practicality and options for methods of the early detection of progressive internal erosion. (In the long term such data could also be collected through a database as described under Questionnaire A. However, this data is required now to allow Task B of the research project to be completed)

Background information on databases

There are now a number of different types of database being developed in industries other than dams to collect data on historical performance of assets for the benefit of those industries. It is important that we benefit from experiences in other industries, a review of such databases being in progress as part of the research. In broad terms these databases may be grouped as follows

	Possible purpose of database	Example of such a database
1	Inventory of installations	BRE database for UK dams
2	Historical record of performance	The BRE database, although set up primarily to record physical characteristics, also includes some data on incidents. A paper by Brown and Tedd to be published in Hydropower and Dams in 2003 and included with this questionnaire provides analysis of this data [1]
3	Identify "what happened, why and what has been done to prevent re-occurrence for each incident", and disseminate to scheme participants to reduce likelihood of a re-occurrence	The Civil Aviation Authority "Mandatory Occurrence Reporting Scheme" is such a scheme *www.caa.co.uk*
4	Reliability data of each element of an installation, including annual failure rate for valves etc	a) Publication of reliability data on equipment on offshore platforms, through the OREDA scheme, based on pooling of data by 10 oil companies, including Agip, BP, ELF, Shell, Total and 5 other Norwegian companies. (Offshore Reliability data handbook. Published by OREDA participants; distributed by Det Norske Veritas. 535pp 3rd Edition, 1997) b) UKWIR is currently funding research into a similar database for sewerage works and water mains, to follow the Ofwat Common Framework approach. c) The Environment Agency is managing research into collecting data on reliability of components such as gates, culverts and flaps, to contribute to improvements in the efficiency and effectiveness of flood defences (R&D project W5-029)

[1] It is emphasised that it is not necessary to read this paper to complete the survey, such that this paper may be disregarded if the recipient so wishes.

The terms of reference for Task A are given in Appendix A to this note, and envisage that a database for UK dams is likely to cover Items 1 to 3. The purpose of the questionnaire is to obtain the views of dam owners and others on both the purpose of any UK database, and the preferred:

- Format/ content
- Arrangements for access to data, including periodic reporting
- Management of such a database, including funding

Background Information on investigation of Near Miss Incidents

Serious (near miss) incidents are investigated in different ways in different industries. It is anticipated that any such system for dams would be similar to that in Civil Aviation Authority; the objective being "to ensure that knowledge of these occurrences is disseminated so that other persons and organisations may learn from them". To this end the statement by the Chairmen of the CAA (CAP 382, June 1996) includes the following principles

- The name of person submitting the report and persons concerned are confidential, unless in either case the person concerned authorises disclosure
- It is not the "policy (of the CAA) to institute proceedings in respect of unpremeditated or inadvertent breaches of the law, …except in cases involving dereliction of duty amounting to gross negligence"

Confidentiality

All data provided in this questionnaire will be treated in the strictest confidence. Individual questionnaires are numbered to allow checking of responses received, sending of one reminder and grouting of respondents by role of respondent. The results of the questionnaires will be combined to permit statistical analysis of the results. The published results of this study will not allow any dam or respondent to be identifiable, although the type of recipient will be identifiable by the questionnaire number (e.g. Dam owners 100 series, Panel AR Engineers 200 series).

Results

It is anticipated that the main findings of the research will be given in a research report published by Defra, probably on their website. In addition results from this study will be presented at two meetings of the British Dam Society in autumn 2003, one for each research task. All participants in this survey will be informed of the time and place of the presentation.

Completing the Questionnaire

The questions in the questionnaire are predominantly of a "closed" nature to enable statistical analysis of the results to be easily undertaken. As such the majority of questions only allow one of a series of predefined answers to be given (click on the bottom right corner of the answer box).

If none of the predefined responses apply the box may be left empty, although in this situation we would appreciate insertion in the comments box as to what other response would be given. Where the data field is a number, and the question is inapplicable we suggest you enter 999 to denote this.

However, in addition to the closed questions, there are periodic "open" questions where comments or another response may be given. If there is insufficient space in the box to provide comments, please use the separate form provided (Word table) and include this when returning the completed questionnaire to KBR.

The team understands the unique nature of every dam and every event. As such, in addition to the closed questions, the study organisers would appreciate any other information relating to any events that the participants are able to provide. This additional information will enable the study to delve beyond the results of a series of closed questions.

Definition of Levels of Incident

The Questionnaire has been structured to be self explanatory as far as possible. The only issue on which additional guidance is felt to be necessary is the preliminary definition of different levels of incident on which the questionnaire to industry has been based. This is given in Table 1.

Table 1 : Preliminary definition of Levels of Incident

Incident level	Description	Remarks
1	Failure (uncontrolled sudden large release of retained water)	a) May not be whole reservoir e.g. sudden failure of a spillway or other gate would qualify b) Large is in relation to the downstream channel and is taken to be greater than the lesser of the mean annual flood or bank full flow
2	Serious incident involving emergency drawdown or emergency works	Emergency is defined as where the dam is likely to fail in a short period if no action were taken
3	Any of the following a) Incident leading to unplanned site visit by Inspecting Engineer, b) Precautionary drawdown c) Incident leading to unplanned physical works	a) May lead to changes in surveillance regime b) It may be difficult to consistently differentiate precautionary drawdown from emergency drawdown c) Unplanned means not part of a periodic safety review
4	Physical works arising out of periodic safety review	
5	Any of the following a) Incident leading to additional (unplanned) visit to site by Supervising Engineer, but no further action (except possibly changes to surveillance regime and/or phone consultation with last Inspecting Engineer) b) Investigation arising out of periodic safety review	
6	Magnitude of load from external threat exceeds 1% probability (1 in 100 year return period), but no effect on dam (i.e. Not one of incident levels 1 to 5)	External threat is any external influence on the dam, such as floods, seismic, wind, failure of upstream dam

NB

1. *This system is based on the existing system of four levels of incident used in the BRE database, but extended in the light of experience with that database.*
2. Where an incident occurs initially at a lower level followed by a higher level, only the higher level will be recorded, provided the escalation is within a short period of the initial incident

Questionnaire B : Selection of five embankment dams

We have given you space to provide detailed data on five instances of internal erosion at embankment dams. We request that you complete the questionnaire on up to five incidents as follows

a) all Level 1 and 2 incidents (subject to a maximum of five)
b) if less than five in 'a', make up to five with Level 3 incidents

We recognise that completing the questionnaire for five incidents would require some time, and if this is not possible we would prefer that

i) one incident is completed as fully as possible, rather than two or more being only partially completed
ii) priority is given to completing Questions 7 to 38 over the later questions (e.g. complete one fully and one for only questions 7 to 38?)

The study organisers will be using this data to make some overall assessment of what features makes a dam susceptible to internal erosion, and how the rate of deterioration may vary with these characteristics. If you therefore wish to submit more than five instances please submit a second questionnaire; if you wish to comment on whether your instances are biased in some way please add these comments to the space for general comments at the end of the sheet.

Questionnaire B : Background to other questions

Question 15

An important element of increasing our understanding of internal erosion is to define models of behaviour; including definitions of different mechanisms of deterioration by internal erosion. Question 17 of Questionnaire B asks that you assign, if possible, a mechanism to each incident. The following definitions of different mechanisms are used, based on Charles (2002, BDS Conference)

Internal erosion	The removal of solid material, usually in suspension, from within an embankment or its foundation by the flow of water
Piping	a) A process that starts at the exit point of seepage and in which a continuous passage or pipe is developed in the soil by backward erosion. When the pipe approaches the source of water there is a sudden breakthrough. b) The hydraulic gradient at the point where the water flows out of the ground is critical, but is difficult to predict as it depends on localised weaknesses in the fill. Cohesionless soils, particularly fine sands and silts are most susceptible. c) Usually commences on the surface of the embankment slope
Suffusion	Mass erosion in soils which are internally unstable. Fines are transported by seepage flow between the larger sizes of the embankment fill or the foundation soils and the process may lead to either an accumulation of fines in some part of the fill, or fines being taken entirely out of the embankment
Concentrated leaks	In cohesive soils which are capable of sustaining an open crack, concentrated leaks may occur with erosion of soil particles along the sides of a crack. The crack may be caused by a) Hydraulic fracture b) Along other preferential flow paths (e.g. non-homogeneous core, interface between layers) c) Hydraulic separation between fill and structure d) Collapse settlement on saturation (possibly leading to wet seams) Erosion may either be along the interface of, or into an open crack or joint in, the wall of a conduit or other structure, or abutment
Dispersive clays	Clay soils which disperse or deflocculate in the presence of relatively pure water

Questions 36, 37

Laboratory tests reported in Atkinson, Charles & Mhach (1990, QJEG, 23, pp103-108) showed that of puddle clays from four UK dams tested using a new "Cylinder Dispersion test" one was dispersive in reservoir water. Further information on dispersive clays is given in the ICOLD Bulletin (No 77, 1990). The purpose of these questions is obtain any further results of dispersion (or erodibility) testing that has been carried out on clays in UK dams.

Returning the completed Questionnaire

The questionnaire has been provided to you either by email, or as a package containing a floppy disk and a printed version of the questionnaire. The electronic form of the questionnaire is a Microsoft Excel (v97 or greater) spreadsheet. Where possible, the team requests that respondents insert their information directly into the spreadsheet and then email the resulting file to: *Mary.Pambos@Halliburton.com*.

If email submission of the results is not possible, fill out a paper copy and then post the results to Mary Pambos, KBR, Hill Park Court, Springfield Drive, Leatherhead, Surrey, KT22 7NL (01372-863272) *(or if you prefer complete the questionnaire on the floppy and post this back to us; however, in this case please also post a paper printout of the completed questionnaire in case the floppy is damaged in the post*). For completion in manuscript please use only the predefined options for responses to closed questions, and put any additional information in the open questions

The questionnaires may be returned separately, for example if information is not immediately to hand to complete Questionnaire B.

If you have any queries relating to the nature of the Questionnaire, please contact Alan Brown at *Alan.J.Brown@Halliburton.com* or 01372-863585.

Appendix A :Terms of reference for Research Task A for KBR

The research contract for KBR has the following objectives, as defined in the Defra Specification:-

- *to propose a system of incident reporting which will be instrumental in helping to identify and quantify trends in the behaviour of dams subject to the 1975 Act safety regime. Authoritative and comprehensive information on this issue will help determine future research priorities….*

Furthermore the Defra specification states that in consideration of the above objective seven particular areas should be addressed, these being assigned task sub-numbers as follows (numbering amended from the sequence of bullet points given in the Specification to follow the likely sequence of development)

Task No	Description
A1	*The information the report should contain and the form it should take to optimise statistical analysis and thus effectiveness of the data accumulated*
A2	*What gives rise to an incident report and from whom the report should be made*
A3	*How a voluntary reporting system could be designed to be acceptable to the range of reservoir undertakers, for example by overcoming the need some undertakers may have to keep information on dam incidents confidential. The contractor is expected to investigate how this has been achieved in other industries (e.g. civil aviation)*
A4	*How 'near miss' incidents might be investigated and recorded (taking account of HSE's review of practices in other industries – Regulating higher hazards: exploring the issues, HSE 2000)*
A5	*Which body should establish and maintain the incident reporting system*
A6	*The funding implications of establishing and maintaining such a system and how these might be accommodated.*
A7	*The relation, if any, with other existing databases held by other industries or government bodies.*

Appendix B :Terms of reference for Research Task B for KBR

Clause 8 of the Specification states that the specific objective is to

- *provide a cost-effective approach to the early detection of progressive internal erosion in embankment dams;*

whilst the introduction to Clause 11 states that it is

- *to devise an effective solution to the problem of monitoring internal erosion and leakage which undertakers could be expected to adopt without incurring disproportionate expense.…..…*

and describes three stages, as follows

Stage 1 *- The development of a strategy for the early detection of internal erosion in embankment dams.*

- *The starting point will be to assess overall feasibility and the respective roles of surveillance and real time remote monitoring of instrumentation and warning systems.*
- *Techniques for remote monitoring of instrumentation located in or on the dam to detect internal erosion will be identified and evaluated.*
- *The contractor will produce an outline strategy within a year and present it for peer review at a meeting of a professional body (e.g. British Dams Society).*

Stage 2 *– In the light of feedback at the review meeting, the strategy will be refined. Appropriate instrumentation and monitoring systems, which can provide immediate warning of changes to normal leakage levels, will be developed and tested on appropriate dams. Further development of the strategy may then be required.*

Stage 3 *– Technical guidance will be prepared and a meeting of a professional body held to ensure wide dissemination of the strategy and the instrumentation developments.*

Questionnaire A

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
	HISTORICAL PERFORMANCE OF DAMS **Reason for/ value of database** *NB It may be easier to complete Questions 1 and 4 after you have completed the rest of the questionnaire)*		
1	It is proposed to set up a database to collect data on incidents to dams. Please indicate whether you agree that development of a database that contained each of the following would be of value (and thus you would support it)		
a	to identify trends for the safety of UK dams	Strongly agree/ Agree/ Disagree/ Strongly Disagree	
b	as a management tool for monitoring and improving the way dams are managed, by providing feedback on incidents	Strongly agree/ Agree/ Disagree/ Strongly Disagree	
c	to identify and prioritise future research	Strongly agree/ Agree/ Disagree/ Strongly Disagree	
d	to provide output you could use for your own purposes?	Strongly agree/ Agree/ Disagree/ Strongly Disagree	
2	Please indicate whether you agree that development of a database that contained each of the following would be of value (and thus you would support it)		
a	Annual probability of dam safety incident (which would have several levels of incident, ranging from level 2 (emergency drawdown) to level 5 (concern leading to visit by Supervising Engineer, but no further action)	Strongly agree/ Agree/ Disagree/ Strongly Disagree	
b	Lessons learnt service, where for every "notifiable" incident, the reason for the incident occurring and steps taken to prevent re-occurrence are circulated to all participants in the database ((the dam and owner being anonymous).	Strongly agree/ Agree/ Disagree/ Strongly Disagree	
c	For 'b' enter the number for the lowest level of incident for which this service would be of value	1/2/3/4/5	
d	Historical costs resulting from a dam safety incident (e.g. a level 2 incident results in average cost of £0.5M, with range of £0.01M to £5M)	Strongly agree/ Agree/ Disagree/ Strongly Disagree	
e	Duration of time for which normal dam operation was disrupted following a dam safety incident, and level of disruption/ loss of yield	Strongly agree/ Agree/ Disagree/ Strongly Disagree	
f	Reliability of equipment at the dam e.g. failure rate for spillway gates, valves, actuators, pipelines, riprap wave protection	Strongly agree/ Agree/ Disagree/ Strongly Disagree	
g	Is there any other form of output that you consider a national dam database should contain	Open (text)	
h	Would you like to comment on any of the above issues?	Open (text)	
3	If you represent a dam owner, how many dams does your organisation manage? 1 to 5 6 to 10 11 to 20 21 to 40 41+	Number	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
4	For the types of output in Q2, how much would your organisation be prepared to pay, as an annual fee per reservoir, to obtain access to this output and an annual report? (to get fee per annum per dam, divide total fee by number of dams your organisation owns) *Note 1. Even if you would not be the decision maker for your organisation on this, it would be helpful if you would indicate your estimate of the likely position your organisation would take. 2. If you are not a dam owner just enter the total £amount/ annum.*		
a	Annual Probability of dam safety incidents	£/annum/dam	
b	Feedback service on incident notification	£/annum/dam	
c	Cost resulting from dam safety incidents	£/annum/dam	
d	Disruption to dam operation following an incident	£/annum/dam	
e	Equipment reliability	£/annum/dam	
e	Other (give fee / annum/ dam for each set of data)	Text, so can be several £/annum/dam	
	Entry of data		
5	For reporting of dam safety incidents to the database who should be able to file a report, in addition to the dam owner		
a	Supervising Engineer for that dam	Yes/ No	
b	Inspecting Engineer involved in that incident	Yes/ No	
c	The general public	Yes/ No	
d	Should the reporting system allow the report to be anonymous, if the reporter does not want to be identified?	Yes/ No/ Only known to database manager and not entered on database (confidential)	
6a	What would be a reasonable length of time required to complete the incident report form for a Level 3 incident (unplanned visit by Inspecting Engineer, or unplanned works) on average? a) less than 15 minutes b) 15 to 30 minutes c) 30 minutes to 1 hour d) 1 to 2 hours e) more than 2 hours	a/b/c/d/e	
	For the following levels of incident, what would be a reasonable proportion of time to complete an incident report form, as a proportion of the time you consider reasonable for completing the form for a Level 3 incident (Question 6a)?		
6b	Level 4 incident	%	
6c	Level 5 incident	%	
6d	Level 6 incident	%	
7	To be of value for statistical analysis, the incident needs to be coded into issues such as threat causing incident, mechanism of deterioration, mode of failure, location etc. Would you prefer that the originator of the incident report does this (using a published guide), or should the managers of the database do this based on a free format text report and coming back to the reporter if necessary? (the latter may result in a higher annual fee to users of the database)	Originator/ Database operator	
8	If entry of data into the database was voluntary, what % of the following incidents would you report		
a	Level 2 incident (reservoir lowered to reduce probability of failure)	%	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
b	Level 3 incident - Inspecting Engineer called to site and/or unplanned works carried out to the dam	%	
c	Level 4 incident - Works arising out of periodic safety review	%	
d	Level 5 Incident - Supervising Engineer called to site, but no further action (with the exception of changes to surveillance regime)	%	
e	Level 6 Incident - magnitude of load from external threat exceeds 1% probability (1 in 100 year return period)	%	
f	Do have you any comments on the definitions of levels of incidents	Open (text)	
	Note : For those who are not dam owners, please skip questions 9 and 10 and go straight to Q11		
	Data to be held		
9	To be of value for statistical analysis the database needs to contain data on the physical characteristics of the dam, such as type of core, geology, location and type of appurtenant works. Would you prepared to provide this information: a) in advance b) at the time of the incident c) not prepared to provide information	a/b/c	
10	Would you be prepared to provide copies of the following to the database		
a	Original construction and historical incidents (e.g. drawings, design reports)	Yes/No/ Sometimes	
b	Any reports following an incident e.g. reports by external panel engineers, internal reports	Yes/No/ Sometimes	
c	Details of works carried out to prevent an occurrence of the problem	Yes/No/ Sometimes	
d	If you have replied "sometimes " to any of the above, would you be prepared to expand/ explain your response?	Open (text)	
	Access to data in database		
11	Access to any such database will be a key issue. It is envisaged that in principle, there could be several filters on access e.g. a) Which dams can be seen (by owner, or by Supervising Engineer) b) What type of data can be seen (e.g. physical characteristics, but not incidents) c) Whether the data is anonymous, or the identity of each dam is known Should the following have access to the whole database (with identities of dams withheld)		
a	The public (albeit with limited viewing rights)? An example of this is the US database on incidents (www.npdp.stanford.edu)	Yes/No	
b	Inspecting Engineers	Yes/No	
c	Supervising Engineers	Yes/No	
d	Dam owners (i.e. not only their dams)	Yes/No	
e	Enforcement authority	Yes/No	
12	What data should the following be able to view on a dam where they are appointed? a) Dam characteristics only b) As 'a' plus incidents c) As 'b' plus Reliability data		
a	Supervising Engineer	a/b/c	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
b	Inspecting Engineer for that dam, for the period of appointment	a/b/c	
13	Should the dam owner be able to decide who knows the identity of their dams?	Yes/No	
14	Are there any comments on the above?	Open (text)	
	Reporting		
15	Bearing in mind the need to balance frequent reporting (feedback) to users of the database as a way of maximising the percentage of incidents reported, and the cost of more frequent reporting:		
a	How often should summary reports on trends etc be distributed? a) Quarterly b) Six-monthly c) Annually d) Other	a/b/c/d	
b	How often should lessons learnt reports be distributed (assuming one report per incident, for the level of incident as Q2c) a) Monthly b) Quarterly c) Six-monthly d) Annually e) Other	a/b/c/d/e	
16	How should the report be distributed to users of the database		
	a) On the Internet, available to public	Yes/No	
	b) On the Internet, only accessible to those with a password	Yes/No	
	c) Posted to those users with largest number of dams - enter the threshold for the minimum number of dams to qualify an owner to receive the periodic reports	Number	
	Management of database		
17	There are various options for management of the database. Which of the following would you prefer to manage the database? a) The enforcement authority b) An independent commercial body, on behalf of the regulator (Defra) c) A research body, on behalf of Defra	a/b/c	
18	Would you please explain the reason for your preference	Open (text)	
19	If the database were managed by the enforcement authority, would this affect your willingness to provide data?	Would not provide/ Would provide less sensitive information/No effect	
	Funding of database		
20	Funding for such a database will be a difficult issue. Which of the following would you prefer? a) Annual charge on dam owners? b) Annual charge on Panel Engineers? c) Charge on Panel appointments and re-appointments (five yearly) d) Users of the data e) Some combination of the above (please spell out which in Q24) f) Other (please expand in Q24)	a/b/c/d/e/f	
21	If there were a charge on owners, which would you prefer		
a	a) A two tier system for a charge on dam owners, with dams which do not generate a commercial revenue subject to a lower (or nil) rate	Yes/No	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
b	b) Vary with risk class e.g. Category A to D for floods?	Yes/No	
c	c) Vary with height of dam	Yes/No	
d	d) Vary with reservoir capacity	Yes/No	
e	e) Single fee for all dams	Yes/No	
22	What would be a reasonable average amount per dam per year, if funded through a charge on dam owners? a) less than £20 b) £20 to 40 c) £40 to £80 d) £80 to £160 e) more than £160 (give amount/ year)	a/b/c/d	
23	Do you have any other comments on how a database should be funded?	Open (text)	
24	Do you have any other comments on the contents and format of an incident database for dams, and how it should be managed	Open (text)	
INVESTIGATION OF NEAR MISS INCIDENTS			
	The context of these questions are explained in the Guidance Note, and Q2b, 4b		
25	Should a body other than a dam owner be involved in the investigation of serious (level 2) Incidents?	Yes/No	
26	Who should such a report go to?		
	a) Defra	Yes/No	
	b) Enforcement authority	Yes/No	
	c) Dam owner	Yes/No	
	d) Incident database manager	Yes/No	
	e) Other (state who)	Open (text)	
27	What is the lowest level of incident that should be subject to external investigation? I.e. level 2 or 3?	2/3	
28	Who should investigate a serious incident? a) Panel AR Engineer appointed by the owner b) Panel AR Engineer appointed by the Enforcement authority? c) Panel AR Engineer appointed by Defra d) Other	a/b/c/d	
29	If you have put other, please comment further	Open (text)	
30	Who should have access to the incident report a) Publicly available on web b) Copy to all stakeholders (including downstream communities) c) Copy to incident database manager, dam owner and enforcement authority only? d) Copy to dam owner and enforcement authority only? e) Other	a/b/c/d/e	
31	Please add any further comments (if preferred attach as Word file, noting here how many sheets are attached)	Open (text)	

Please check that you have completed all questions, including Questions 1 and 4 (and if blank this is deliberate, with any comments added in Open (text) entries)

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Questionnaire B

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
	Your experience		
1	Please enter the number of dams in UK that you have been involved with in a professional capacity over the course of your career.	<10; 12-20; 21-50; 51-100; >101	
2	In the last 10 years, have you been involved with (or have an intimate knowledge of) any occurrences of internal erosion within a dam? If yes, indicate the number of each level of incident (see Guidance Notes for definitions of Level of incident)		
a	Level 1 (Failure)	Number	
b	Level 2 (Emergency drawdown/ works)	Number	
c	Level 3 (Unplanned visit/ precautionary drawdown)	Number	
d	Level 4 (Works from periodic safety review)	Number (round to nearest 10)	
e	Level 5 (unplanned visit by Supervising Engineer/ Investigation)	Number (round to nearest 10)	
	Your opinion of the effectiveness of surveillance, generally		
	To be able to have a reasonable reliability of detecting internal erosion in time to forestall a Level 2 incident, in your personal opinion:		
3	What frequency of visual inspection is required (use fractions of a day if necessary)	Days	
4	For staff who carry out the visual inspections		
a	What minimum level of education attainment should they have achieved	GCSE/ A levels/ HNC/ Degree	
b	What is the minimum proportion of time that they should spend on dam safety related work	Hours/ week (average over year)	
c	What is the minimum number of years experience of work on dams they should have had (express as equivalent full time years so 50% of time for 10 years is 5 year equivalent)	Years	
d	Are there any other features that should be used to define the experience and skills of staff carrying out routine surveillance visits?	Open (text)	
5	What training should the staff carrying out the visual inspections have?		
a	Type of training	None/ Verbal by Supervisor/ Written by Supervisor/ In-house course/ External course	
b	Number of hours CPD on dam safety issues per year?	Hours/ year	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
6	Which of the following instrumentation do you consider is of value in detecting and monitoring progression of internal erosion		
a	Standpipe piezometer	High/ medium/ low/ none	
b	Other piezometer	High/ medium/ low/ none	
c	Settlement monitoring	High/ medium/ low/ none	
d	Seepage quantity	High/ medium/ low/ none	
e	Seepage turbidity	High/ medium/ low/ none	
f	Visual inspection	High/ medium/ low/ none	
g	Other (give details in 6h)	High/ medium/ low/ none	
h	If you answered 6g, please provide details of your 'other' instrumentation.		
	Your experience of specific events For up to 5 events of Internal Erosion, selected following the criteria in Section 8 of the Guidance Note, can you please provide information on the following parameters. *(Space is provided at the bottom for further details, should you wish to expand on your responses)*		**Event 1**
7	What was the seriousness of the incident (use the definitions provided in the Guidance Note)	Level 1/2/3	
8	Year of the event?	Number	
9	Flood Category of the dam (using the Floods and Reservoir Safety Guidelines)	A, B, C, D	
10	Year of construction of the dam (approx if not known exactly)	Number	
11	Height of the dam (m)	Number	
12	Dam Crest Length (m)	Number	
	Information on incident		
13	What was the reservoir level at the time the incident was detected, expressed as height above (+) or below (-) the spillway overflow	Metres	
14	What was the initiating event? i.e. was there a trigger?	None noted/ Gradual deterioration/ Rise in reservoir level/ Previous drawdown of reservoir/ Other	
15	Where at the damsite did the problem occur? (Choose the most appropriate response)	Embankment/ Foundation/ Embankment- foundation interface/ Embankment-abutment interface/ Along conduit/ Into conduit/ Along spillway wall/ Other	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
16	What as the mechanism of deterioration? (please make your best estimate; definitions of terms are given in Section 10 of the Guidance Note)	Concentrated leak/ Suffusion/ Piping/ Dispersive clays/ Other/ Don't know	
17	At what elevation was the intake to the erosion path? (expressed as height above (+) or below (-) the spillway overflow). Provide your best estimate if not known precisely	Metres	
18	Do you have any further comments on the incident, including expanding any response where "other" was given	Open (text)	
	Event Detection		
19	Who detected the incident?	Public/ Staff on routine visit/ Staff passing dam on incidental visit/ Supervising Engineer/ Inspecting Engineer	
20	What was the level of training of the detecting personnel in looking for unusual behaviour and thus when specialist advice should be sought	None/ On the job/ verbal instructions by Supervisor/ written instructions by Supervisor/ In-house course/ External course	
21	Would improved training of staff undertaking routine visits have affected the reliability of detection?	Yes /No /Unsure	
22	To what extent did each of the following indicate internal erosion was occurring at the time the incident was detected?		
a	Seepage: Quantity	Strong/ Medium/ Low/ No indication	
b	Seepage: Turbidity or other characteristic	Strong/ Medium/ Low/ No indication	
c	Settlement	Strong/ Medium/ Low/ No indication/ No Instruments	
d	Piezometer readings	Strong/ Medium/ Low/ No indication/ No Instruments	
	Rate of deterioration		
23	What was the time between the incident being detected and *(give your best estimate)*		
	a) the first physical action taken on site which would reduce the risk of failure?	Hours	
	b) the maximum flow rate from the leak (or other symptom of internal erosion)	Hours	
	c) the incident was controlled (e.g. reservoir drawn down and leak had stopped)	Hours	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
24	Assuming that there was some form of leakage flow, what was the magnitude of this flow - please make your best estimate *(leave blank if no seepage flow, but please comment in Q27)*		
a	when the event was detected	litre/ sec	
b	at its maximum	litre/sec	
c	when the incident was controlled?	litre/sec	
25	What was the elapsed time between the last surveillance visit of the dam and the event being detected?	Days	
26	What was the total volume of fill eroded from the dam (please make your best estimate)	<0.5m^3, 0.5 - 2 m3, 2.1-10m3, > 10m^3;	
27	Assuming that no action was taken following detection, can you please estimate		
a	when the dam would have failed? This is the time between detection and failure.	Days	
b	the leakage rate when the situation would have become uncontrollable?	litre/sec	
28	Do you have any further comments on the rate of deterioration. *Useful data would include the magnitude of flow versus time prior to intervention; whether the flow naturally self healed (even if only partially) and if so the time after detection and change in flow*	Open (text)	

Characteristics of the dam at the location of the Internal erosion incident

(leave blank if not applicable)

29	What is the type of embankment?	Puddle clay/ Homogenous/ Rolled clay/ Concrete core wall/ Upstream membrane/ Other/ Unknown	
30	What is the dam foundation? Please select one of the predefined options	Gravel/ Sand/ Silt/ Clay PI> 22/ Clay PI<22 / Weathered rock/ Rock + gouge filled discontinuities/ Sound rock/ Other	
31	For the fill forming the watertight element:-		
a	What is the geological origin?	Alluvial/ Glacial/ Lacustrine/ Marine/ Weathered rock/ Other	
b	What is its Liquid Limit?	Number	
c	What is its Plasticity Index?	Number	
32	For the fill material immediately <u>downstream</u> of the impervious element:-		
a	What would you describe its form of construction?	Random/ Zoned/ Selected/ Homogenous	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
b	What is its geological origin?	Alluvial/ Glacial/ Lacustrine/ Marine/ Weathered rock/ Other	
c	Does it satisfy modern filter criteria against the core?	Yes/ No/ Marginal/ Homogenous dam/ Don't know	
d	What is the D15 of its particle size distribution (i.e. particle size for which 15% is finer)?	Number (mm)	
33	For the fill material immediately upstream of the impervious element:-		
a	What would you describe its form of construction?	Random/ Zoned/ Selected/ Homogenous	
b	What is its geological origin?	Alluvial/ Glacial/ Lacustrine/ Marine/ Weathered rock/ Other	
c	Does it act as a crack filler, in that fines could be washed into a crack in the core and seal it?	Yes/ No/ Marginal/ Don't know	
d	What is the soil type?	Gravel/ Sand/ Silt/ Clay PI >22/ Clay PI of 22 or less/ Weathered (soft) rockfill/ Sound rockfill	
34	For the impervious element at original ground level		
a	What is its width?	Metres	
b	What is the head across it?	Metres	
35	If the incident involved a conduit (pipe or culvert) through the embankment fill		
a	what is the external diameter of this conduit? <0.25 metres 0.25 to 0.5 metres 0.51 to 1 metre 1.01 to 2 metres Greater than 2 metres	Metres	
b	What was the type of construction of pipe or culvert	Masonry culvert/ Brick culvert/ Concrete culvert/ Pipe encased in concrete/ Pipe laid within fill/ Other	
c	What is the spacing of movement joints (or any other feature through which fill cold be eroded)	Metres	
d	Was there any special treatment of the interface between the fill and conduit? E.g. None, shaped concrete, cut-off collars, filter wraparound?	Open (text)	
36	Geometry of (steepest) abutment	>80 degrees, 60 to 79 degrees, 45 to 59 degrees, 30 to 44 degrees, < 30 degrees	
37	What are the characteristics of the reservoir water?		

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
a	pH	Number	
b	Total dissolved solids	mg /litre	
c	Conductivity	microS/cm^{-1}	
d	Any other data that might be relevant?	Open (text)	
38	Have any of the embankment or foundation soils been subjected to any form of dispersion or erodibility testing (e.g. pinhole test, crumb test, double hydrometer) and if so which test(s), what were the results, and on which element/ from which geological formation?	Open (text)	
39	Are there any unusual features? E.g. narrow crest, steep downstream slope; filters retrofitted to downstream face	Open (text)	
	Surveillance Before the Event		
40	What was the frequency of visits to the dam before the incident?	Daily/ 3 times per week/ 2 times per week/ Weekly/ Fortnightly/ Monthly/ Less frequently than monthly	
41	How many of the following instruments does the dam have (in functioning order; approximate numbers acceptable)		
a	Standpipe piezometers	Number	
b	Other forms of piezometer	Number	
c	Settlement monitoring points	Number	
d	V notch or other quantification of seepage	Number	
42	What was the elapsed time between readings of these instruments prior to the incident?		
a	Standpipe piezometers	Weeks	
b	Other forms of piezometer	Weeks	
c	Settlement monitoring points	Weeks	
d	V notch or other quantification of seepage	Weeks	
43	What was the process used to assess surveillance data before the event? e.g. reviewed by trained personnel to look for unusual readings and new trends?		
a	Technician taking readings given formal trigger values, which if the readings then exceeded he would immediately seek further advice	No review/ No review but operator would flag unusual reading/ Yes - trigger values defined	
b	Formal review by others	Line supervisor/ Supervising Engineer/ External consultant	
44	What was the frequency between		
a	Reviews by an engineer	Weeks	
b	Reviews by the Supervising Engineer	Weeks	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
c	Written report on readings (including Supervising Engineer's annul statement)	Weeks	
d	Written reports by External consultant	Weeks	
	Prior warning/ Previous manifestations		
45	Is it likely that internal erosion was occurring prior to the incident?	Yes/ No/ Maybe	
46	Did any of the following indicators give prior warning of the incident?		
a	Seepage: Quantity	Strong/ Medium/ Low/ No indication	
b	Seepage: Turbidity or other characteristic	Strong/ Medium/ Low/ No indication	
c	Settlement	Strong/ Medium/ Low/ No indication/ No Instruments	
d	Piezometer readings	Strong/ Medium/ Low/ No indication/ No Instruments	
47	For each incident which parameter was the most useful as an indicator of internal erosion	Suspended fines/ Quantity of seepage/ Piezometer readings/ Embankment crest deformation/ Other deformation	
48	Please expand the above, or provide any further comments on what prior warning there was (in retrospect) *e.g. quantify the settlement rate, seepage flows*	Open (text)	
	Surveillance After the Event		
49	Was the frequency of any of the following changed as a result of the incident (give relative increase i.e. 2 = twice as often; if no change enter 1; consider frequency one year after completion of physical works)		
a	Surveillance visit	Ratio	
b	Frequency of reading piezometers	Ratio	
c	Frequency of reading seepage measurement devices	Ratio	
d	Frequency of reading settlement measurement devices	Ratio	
	Action taken to control		
50	What action was taken immediately on detection, and in your opinion how effective was it?		
a	Lower reservoir	Effective/ Minor/ No effect / Not undertaken	
b	Filter downstream	Effective/ Minor/ No effect / Not undertaken	

	Question	Options for Response	Cell for entry of response (if electronic using data validation "pick list")
c	Dump material into reservoir	Effective/ Minor/ No effect / Not undertaken	
d	Other	Open (text)	
51	What physical works were then carried out to deal with the incident?	Diaphragm wall/ Sheetpiling/ Grouting/ Reline conduit/ Filter/ Other	
52	Were the physical works effective?	Yes/ Partially but supplementary measures taken/ Partially but no further action/ No	
53	If supplementary physical measures were taken, what were they?	Diaphragm wall/ Sheetpiling/ Grouting/ Reline pipe/ Filter/ Other/ Not applicable	
54	Was site investigation carried out to assist in understanding the cause? If so, please give the number of exploratory holes (of any type) *(leave blank if no site investigation done)*	Number	
55	Please provide any further information e.g. key findings of any investigations/ reports into the cause	Open (text)	
	Drawdown Capacity		
56	What was the drawdown capacity prior to the incident (over the upper third of the reservoir)?	m/day	
57	Has the drawdown capacity been modified since the event (or is it planned to be)? If so, please indicate the drawdown capability after these modifications (leave blank if no change)	m/day	
	Other Comments		
58	Please add any other comments you may have, either in the text box or as an attached Word document	Open (text)	

Please check that you have completed all questions (and if blank this is deliberate, with any comments added in Open (text) entries)

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Proforma for open responses
Questionnaire A

Question	
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2h	
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26e	
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Questionnaire B

4d	
18	
28	
35d	
37d	
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50d	
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58	