II Semana Internacional sobre la aplicación del Análisis de Riesgos a la Seguridad de Presas

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The consequence of hiding a risk is, in fact, increasing it.

(Ulrich Beck, Expert in the type of information that requires the public opinion in case of danger, crisis or catastrophe).

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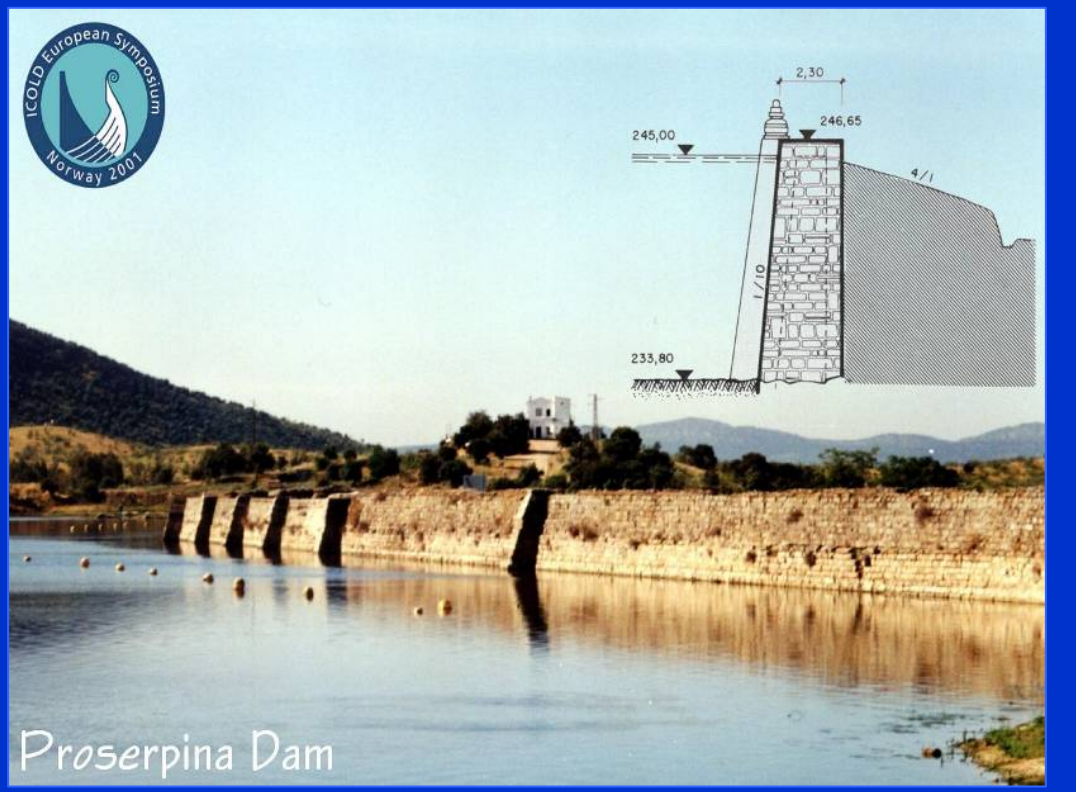
Overview

- ≈ 1.250 Large Dams on operation (ICOLD's Criteria) + 27 Under Construction
- Volume of water stored : 56.400 Mm^3
- 1º Place (Europe) - 4º (World)
- 30% → Ministry of Environment
- Oldest dams:

  Cornalbo (H=24 m) [II Century]

  Proserpina (H=19 m) [II Century]
- Average Life: 43,5 Years



Technical Regulations for Dam and Reservoir Safety (1996)

Holder: Dam Safety responsible

Duties:

- Classification depending on the potential hazards
- First Filling Plan (New Dams)
- Operation Procedures
- Periodic Dam Safety Review
- Emergency Action Plans
- Technical Archive

Bulletin 59 (ICOLD, 1989): *Dam Safety*

Periodic Dam Safety Review. Main Conclusions

Can provide:

- Potential Failure Modes
- Engineering assessment ratings against engineering standards.
- A list of needed investigations, their prioritisation, urgency, schedule, and status (now based on an expert judgment).
- A list of needed potential structural and non-structural measures for increasing safety, fulfill engineering standards, possible prioritisation, urgency, schedule, etc (now based on an expert judgment).

Are dams structures safe enough according with the Technical Regulations for Dam and Reservoir Safety (1996)?

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Conclusions:

- The traditional approach is familiar to dam engineering professionals, but it cannot relate dam safety levels to public safety levels in other fields.

- While the traditional engineering standards approach is designed to protect public safety, dam owners have to address additional considerations:

  - Optimising the priority of risk reduction programs
  - Justifying dam safety capital and operating expenditures

RISK AS PART OF

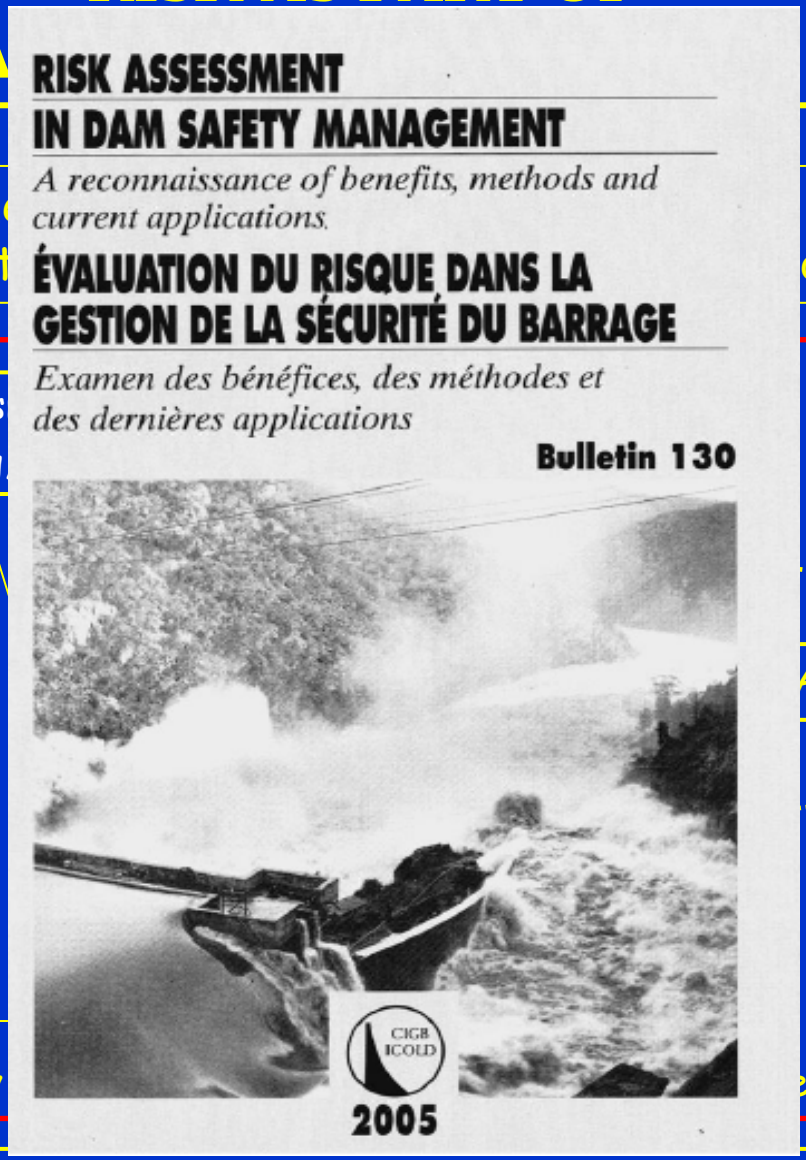
A

Risk Assessm examining &
evaluating the st dam.

Engineering Assess
What can go wrong,

Analisys

Risk = Probability x Consequences



It is a model that describes the physical & functional performance of a system

- Risk Based Prioritization System (RBPS)
- Portfolio Risk Asssesment Dam and priority indexing (PRA, CI)
- Comprehensive Facility Review (CFR)
- Technical Priority Rating; Dam safety priority indexing (TPR, CI)
- Dam security risk (and vulnerability) assessment. (RAM-D, EPRI tool)
- Failure Modes and Events Analysis (FMEA)
- Separable construction upgrade packages (SCUPS)
- As-low-as-reasonably-practicable (ALARP)
- Cost per statistical life saved (CPSLS)
- Failure Index (FI)
- Condition Indexing Method for Embankment Dams (CIMED)
- Decision Trees (DT)
- Influence Diagrams (ID)
- Surrogate Worth Trade off Method (SWT)
- Multi Attribute Utility Theory (MAUT)
- Analytical Hierarchy Process (AHP)

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1st Stage

Screening
Periodically updated

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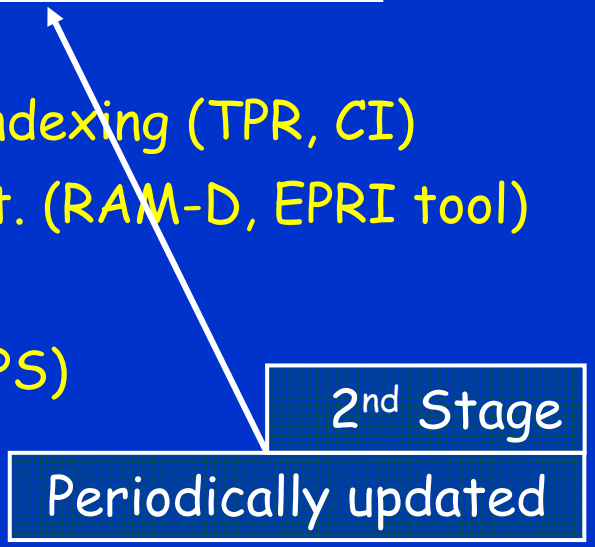

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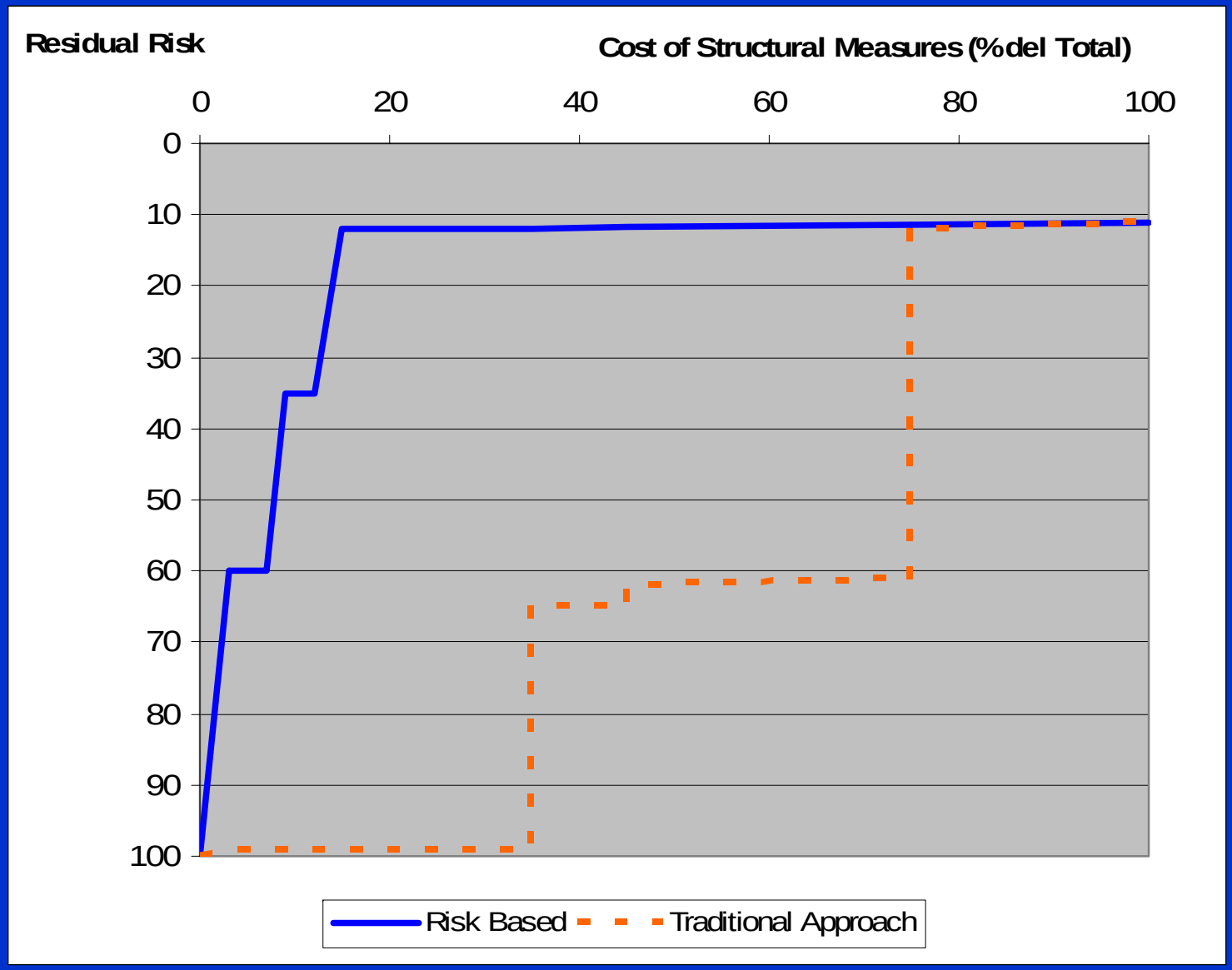
Risk Reduction for the PFRA Approach

Fuente: *FROM PORTFOLIO RISK ASSESSMENT TO PORTFOLIO RISK MANAGEMENT*, Bowles (2006)



Main Conclusions:

- In Spain, for dam engineering profession, Risk Based Dam Safety Management continues being a very discussed matter.
- Limitations must be fully considered and risk assessment approaches should be used only as a supplement and not as a replacement for the traditional approach (*White Paper on Dam Safety, USSD, Committee on Dam Safety*).
- Dam engineering profession must be confident that change will lead to improvements in dam safety and even more importantly in public safety.

Are dams vulnerable?

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Are dams vulnerable?

causing loss of life. The potential for terrorism is not new. In 1941, Federal Bureau of Investigation Director J. Edgar Hoover wrote, "It has long been recognized that among public utilities, water supply facilities offer a particularly vulnerable point of attack to the foreign agent, due to the strategic position they occupy in keeping the wheels of industry turning and in preserving the health and morale of the American populace." Water infrastructure systems also are highly linked with other infrastructures, especially electric power and transportation, as well as the chemical industry which supplies treatment

Attacks to Dams

Date	Parties Involved	Basis of Conflict (see Note 1)	Violent Conflict or in the Context of Violence?	Description	Sources
1940-1945	Multiple parties	Military target	Yes	Hydroelectric dams routinely bombed as strategic targets during World War II.	Gleick 1993
1943	Britain, Germany	Military target	Yes	British Royal Air Force bombed dams on the Mohne, Sorpe, and Eder Rivers, Germany (May 16, 17). Mohne Dam breech killed 1,200, destroyed all downstream dams for 50 km.	Kirschner 1949
1944	Germany, Italy, Britain, United States	Military tool	Yes	German forces used waters from the Isoletta Dam (Liri River) in January and February to successfully destroy British assault forces crossing the Garigliano River (downstream of Liri River). The German Army then dammed the Rapido River, flooding a valley occupied by the American Army.	Corps of Engineers 1953
1993	Yugoslavia	Military target and tool	Yes	Peruca Dam intentionally destroyed during war.	Gleick 1993
1998	United States	Cyber-terrorism	No	A 12-year old computer hacker broke into the SCADA computer system that runs Arizona's Roosevelt Dam, giving him complete control of the dam's massive floodgates. The cities of Mesa, Tempe, and Phoenix, Arizona are downstream of this dam. No damage was done.	Gellman 2002
1998	Democratic Republic of Congo	Military target, Terrorism	Yes	Attacks on Inga Dam during efforts to topple President Kabila. Disruption of electricity supplies from Inga Dam and water supplies to Kinshasa	Chenje 2001, Human Rights Watch 1998

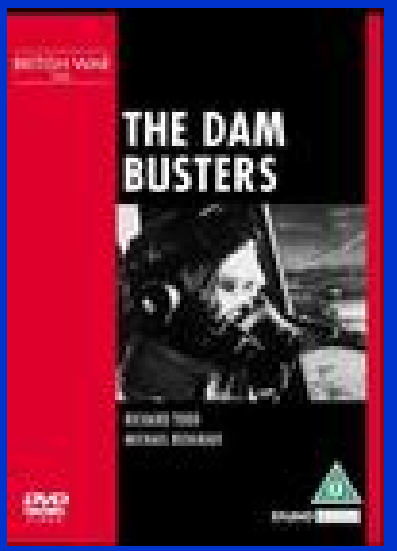
Chastise Operation (1943)

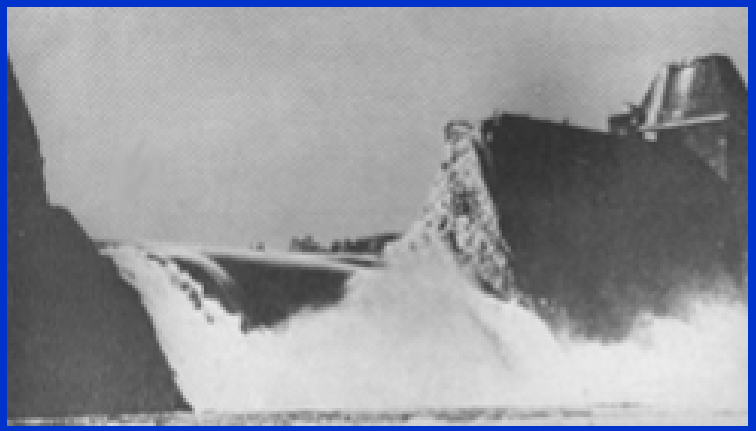
On the night of 16th/17th May 1943, 19 specially modified Lancaster bombers of 617 squadron took of from R.A.F Scampton to carry out Operation Chastise, the attack of the dams in Germany's Ruhr valley.

An attack which would make history and lead to 617 squadron becoming known as

THE DAMBUSTERS

Operation Chastise: The Dambusters' Story





Presa Mohne

Presa Eder

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Peruça Dam (1993)

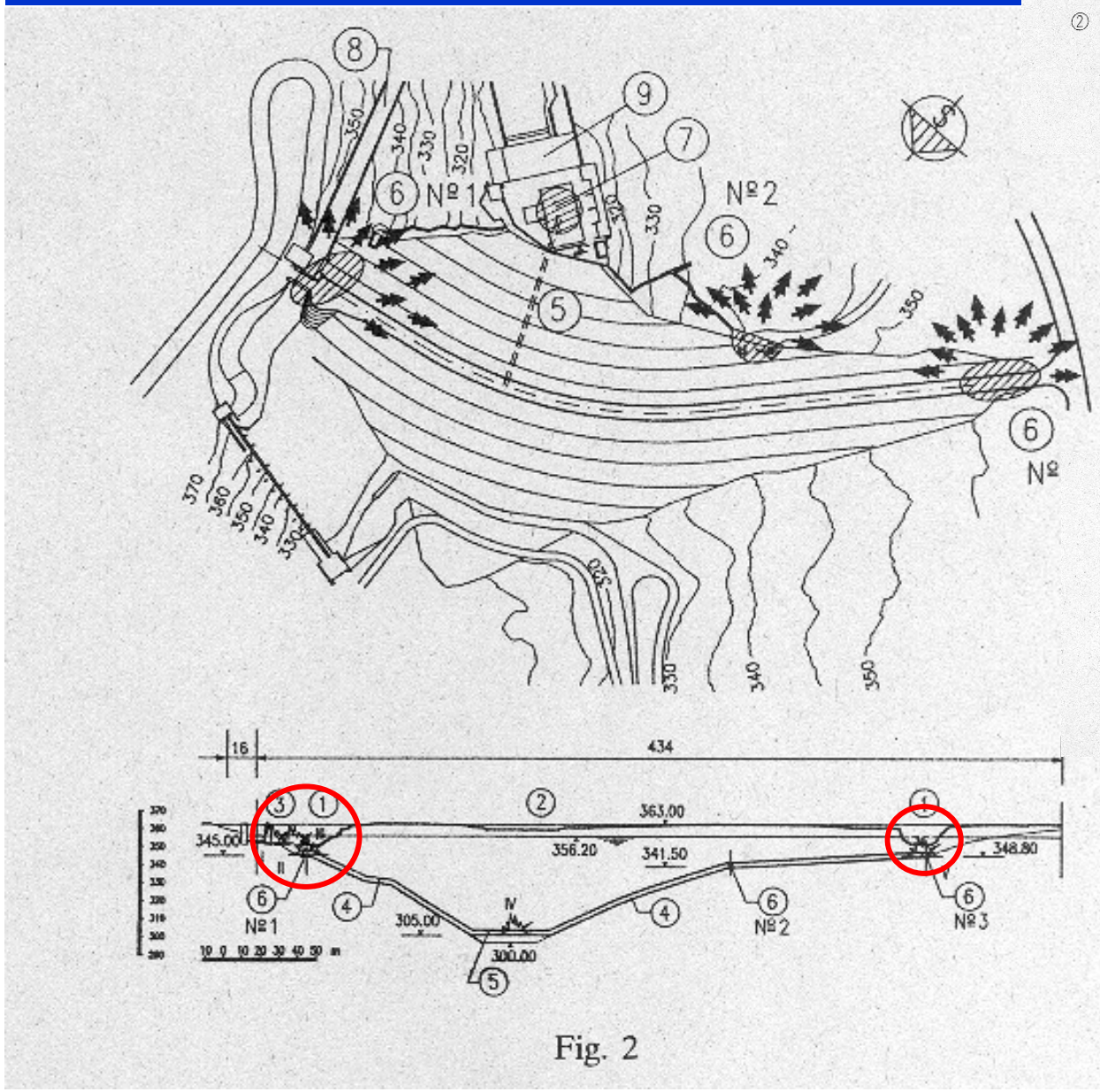
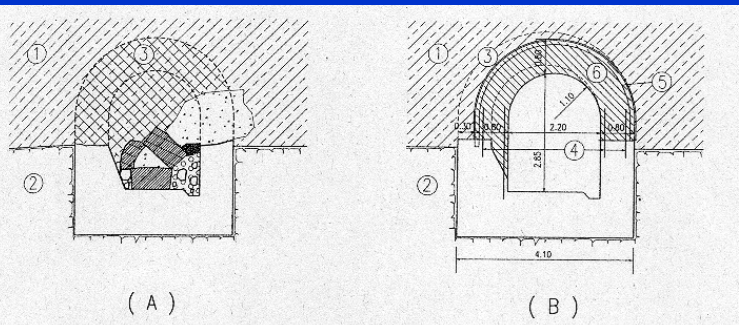
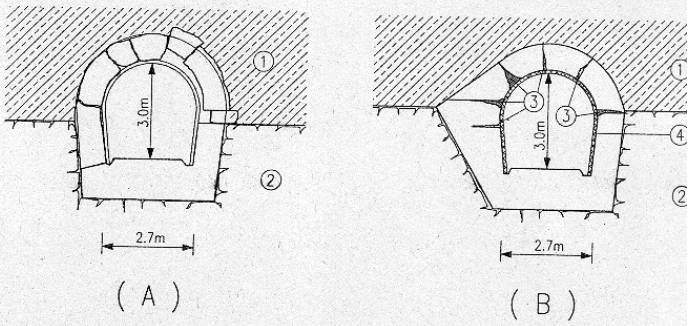


Fig. 2





JESÚS DIGE (EFE)

Guardias civiles cortan el paso a los trabajadores de Itoiz que intentaban bloquear el furgón en el que eran trasladados los detenidos.

El juez envía a la cárcel a los ocho jóvenes radicales detenidos

Los sabotajes dejan en la calle a 306 obreros del embalse de Itoiz

Un total de 306 trabajadores se han quedado en la calle hasta que se reparen los destrozos causados por unos saboteadores en las obras del embalse que se construye en Itoiz (Navarra). Las empresas constructoras acordaron ayer el despido de los obreros hasta que sean reparados los gravísimos daños —probablemente superen los 1.000 millones de pesetas— ocasionados la pasada semana por un sabotaje. Los ocho jóvenes que presuntamente lo efectuaron ingresaron ayer en la prisión de Pamplona por orden del juez que instruye el caso. Desde la Delegación del Gobierno en Navarra se ha señalado a grupos radicales próximos al entorno de ETA como causantes de los desmanes.

Los saboteadores destrozaron el sistema por el que el hormigón era trasladado hasta la presa, lo que imposibilita la continuación de los trabajos durante varios meses. Esta acción ha causado la indignación de los empleados, que se manifestaron ayer por la mañana desde la presa hasta la cercana localidad de Aoiz, ante cuyo Ayuntamiento se concentraron. A la llegada del furgón de la Guardia Civil que trasladó a los presuntos autores del sabotaje, pertenecientes al colectivo Solidarios con Itoiz, un grupo de trabajadores despedidos intentó bloquear el paso del furgón.

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Sabotages on Itoiz Dam during its construction (1996)

Economic losses: 6 M€

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Conclusion: Dams are vulnerable structures; therefore dam security risks must be taken into account and they must be managed, …..

……. properly managed.

Why Dam Security?

- Recognition that ***security*** of dams against terrorist attack/sabotage is nowadays a ***hot critical*** issue in European countries; dams are a vital part of Europe Infrastructures.

- Lack of systematic and rational approaches for the ***security assessment of dams***, either at national and European level.

- Lack of technical and decisional tools to support ***risk mapping*** of dams, with regards to terrorist threats at European level.

List of Technical Committees

Technical committees

Presently, ICOLD has 24 Technical Committees that address current technical issues related to the development and management of water resources. The listing of the ICOLD Committees is given hereafter. A total of 130 Technical Bulletins have been published and are available for purchase. Information on these publications is given on ICOLD Catalog.

List of Committee:

1 Committee on computational aspects of analysis and design of dams
2 Committee on seismic aspects of dam design
3 Committee on hydraulics for dams
4 Committee on concrete for dams
5 Committee on materials for fill dams
6 Committee on dam surveillance
7 Committee on the environment
8 Committee on dam safety
9 Engineering activities in the planning process for water resources projects
10 Committee on sedimentation of reservoirs
11 Committee on dam decommissioning
12 Committee on tailings dams and waste lagoons
13 Committee on operation, maintenance and rehabilitation of dams
14 Committee on the public awareness and education
15 Committee on register of dams and documentation
16 Ad Hoc Constitutional Committee
17 Dams for hydroelectric energy
19 Ad hoc committee on small dams
19 Committee on dams and floods
20 Committee on role of dams in the development and managementof river basins
21 Committee on Cost Savings in Dam Construction
22 Committee on Groundwater Dams
23 Financial and Advisory Committee

Committee on Dam Security (New)
or
Committee on Dam Safety & Security

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Dam Security in U.S.A After September 11

will be funded. In response, Congress has approved $410 million in funds for security at water infrastructure facilities (P.L. 107-117, P.L. 108-7, and P.L. 108-11) and passed a bill requiring drinking water utilities to conduct security vulnerability assessments (P.L. 107-188). Congress also created a Department of Homeland Security with

Department of Homeland Security. In November, Congress approved a major government reorganization to create a Department of Homeland Security, consolidating all or parts of 22 federal agencies (P.L. 107-297). The new department includes coordination to secure the nation's critical infrastructure, including water infrastructure, through partnerships with the public and private sectors. It is responsible for detailed


STOP


NOTICE
AREA
UNDER VIDEO
SURVEILLANCE


KEEP
BACK
1000
FEET

Conclusions:

It is necessary:

1. A ***threat assessment*** procedure for the determination of the likelihood of terrorist attacks, sabotages and intrusions to dams.
2. A procedure for the ***consequence assessment*** in case the threats would succeed in compromising the ability of the dam to accomplish its mission.
3. A procedure for determining the ***effectiveness of the security protection*** system to prevent an attack against the dam or an operational component of it.

Conclusions:

4. The methodology today shown, ***risk based,*** seems to be nowadays the best method to determine dam vulnerability and to identify the needs of ***security upgrades*** or ***risk reduction***: to determine where to place sensors, cameras, lights, or whether is necessary invest in walls, barriers, higher fences, better doors, or improved policies).

Thanks for your attention

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