

## **RECOMMENDATIONS TO ECE GOVERNMENTS ON DAM SAFETY WITH PARTICULAR EMPHASIS ON SMALL DAMS**

***prepared at the Seminar on Dam Safety, held in Rovaniemi (Finland) in 1988,  
and endorsed by the Senior Advisers to ECE Governments on Environmental and  
Water Problems at their second session in March 1989***

Incidents affecting dams have occurred in recent years with severe impacts on man and the environment. This has drawn attention to the necessity for taking a formal approach to the control of safety matters relating to dams. For small dams, the situation has been exacerbated by a steady increase in the number made from tailing wastes or other waste materials. Small dams—often in remote locations and managed by many diverse sectoral entities—have not always been considered as posing a risk and have sometimes been mismanaged in this respect. Additionally, in some countries of the region, the aging of dams could lead to material deterioration and a potential decrease in their operational reliability unless maintenance, repair, upgrading or, if necessary, their abandonment is kept under close review.

When dam failures result in the loss of life or property or impairment of the environment, socio-economic interests are indeed affected, sometimes with costly consequences. For this reason concentrated efforts will have to be made in order to increase the safety of dams, including small dams, so as to minimize the risk of possible damage to human life and the environment.

*It is therefore recommended that for*

### **Dam safety policy**

1. National dam safety policies should be formulated which provide for appropriate and efficient measures to control the safety of all dams. These policies should be compatible with other national policies regarding water management and waste management. They should apply to all levels of administration and should cover all aspects of dam safety management.

### **Legislation**

2. A priority in national dam-safety policy, where appropriate, should be the enactment of legislation and regulations governing the planning, design, siting, construction, operation, maintenance and, when necessary, the abandonment of dams. Such legislation should let advantage be taken of any evolution in technology, risk-assessment and safety measures and ongoing development of standards and regulations. Legislation should be

comprehensive and cover all types of dams and their administration. Adequate provision should be made for compliance enforcement.

3. So as to facilitate their application, consideration should be given to compiling and consolidating into a specific dam-safety code all relevant provisions contained in laws and regulations. Such a code should include the way in which relevant procedures ought to be established and should define the responsibility of those involved.

4. Guidelines should be prepared at the appropriate administrative level for the selection and development of dam sites, coordinated with general land-use planning and water- and waste-management planning. Procedures for planning and implementation of dams should allow for an analysis of risks to be made along with an environmental impact assessment<sup>2</sup> and their results should be considered in the decision-making. The design for dams holding waste lagoons or waste-storage ponds should provide for minimizing the risk of pollution and for rehabilitating the site after use.

### **Planning, design and construction**

5. The design and dimensioning of dams should be carried out only by qualified engineers. Design methods and criteria should conform with the current state-of-the-art technology including that related to dam safety, thus facilitating safety surveillance and possible future repair or rehabilitation work. All ancillary structures should be designed with safety features compatible with that of the main dam. Specific problems expected as a result of severe weather conditions, such as very low winter temperatures, should be defined in formulating design criteria and safety standards for dams.

<sup>2</sup> To this end, the Senior Advisers on Environmental and Water Problems have endorsed recommendations to ECE Governments on environmental impact assessment at their first session (ECE/ENVWA/3).

6. There should be a statutory authority ensuring compliance with established procedures. Implementation of dam construction should not be allowed to proceed without approval by the competent authority. At the end of the design phase, a design report should be prepared giving detailed information on the basic design, criteria, materials, and possible construction methods, including those related to dam safety.

7. Minimum requirements should be drawn up by competent authorities specifying the content and form of the design and construction documents. The construction of dams should be entrusted only to companies with appropriate experience and competent performance regarding works of a similar nature.

8. At all stages of design and construction work, an analysis should be made of potential risks likely to be caused by the construction activities. Contingency measures should thus be prepared.

9. A detailed programme of testing and quality-control should be developed in accordance with relevant requirements set by the competent authorities. This should be carried out during the building phase of the dam by a team that is independent of the construction team. Records of this programme together with information relevant to dam safety should be kept by the dam owner with other completion documents, and so furnish at least part of the information needed by the competent authority in order to approve the start of normal operation of the dam.

#### **Operation and surveillance**

10. For safety reasons, procedures for operation, inspection and surveillance should be drawn up for every dam. These can be used in conjunction with a system of permits for operating dams. The frequency and content of dam inspections should take into account all matters related to the safety of the structure. A competent authority at the appropriate administrative level should be entrusted with responsibility for ensuring that such procedures are implemented. The competent authority should be notified promptly of any changes in procedures related to dam safety.

11. Procedures should provide for visual inspections at appropriate intervals, regular review of instrumentation and monitoring of specific parameters for dam safety during critical situations. The procedures should apply to the dam and all ancillary structures.

12. Maintenance procedures for old dams should avert unacceptable deterioration of their structures.

13. Specific programmes should be carried out so as to establish the safety of old dams, particularly if no records exist regarding their construction. If necessary, renovation programmes should be implemented in order to upgrade their safety.

14. Records should be required to be kept of all rel-

evant factors during the life of a dam, including such information as water levels in the reservoir, inflow, discharge, seepage, displacement, and all other factors concerning dam safety.

15. Programmes should be developed for the training of personnel engaged in all aspects of dam operation, with particular emphasis on visual examination of dam behaviour.

16. Manuals on dam operation covering normal and critical situations should be prepared for every dam.

17. A detailed inventory of existing dams should be kept at the appropriate administrative levels covering all categories of dams. If it appears necessary, hazards to life, property and the environment should be identified for each dam and properly recorded.

18. Potential changes in land use or other developments including environmental changes downstream of the dam should be assessed in relation to the operation of the dam.

#### **Financial arrangements**

19. As dams form part of the basic infrastructure in each country, consideration should be given to the setting up of financing arrangements aimed at assisting the owners of small dams in their maintenance work. This may include tax relief and low-interest loans. Further arrangements should be made when appropriate for fund-raising from dam owners.

#### **Dam safety management**

20. Procedures should be established whereby in case of an extreme release of water, whatever the cause, the rescue authority, civil defence authority and other relevant institutions can be involved in the rescue work according to contingency planning, in order to minimize adverse effects on life, property and the environment.

21. When more than one dam exists in a river basin, one authority should be responsible for coordinating all operational procedures.

22. Research should be encouraged into all matters related to dams and in particular their safety.

#### **Cooperation among riparian countries**

23. Cooperation among riparian countries should be enhanced on questions of dam safety, standards, regulations and liability. Where possible, similar procedures, standards and regulations should be agreed upon and formalized.