

Reclamation Manual

Directives and Standards

Subject: Dam Safety Performance Monitoring for High- and Significant-Hazard Dams

Purpose: To establish roles, responsibilities, and procedures for performance monitoring to provide continuing surveillance of Reclamation dams. Dams are monitored to verify that performance is consistent with expectations.

Authority: Reclamation Project Act of 1902 and Supplemental Acts; Reclamation Safety of Dams Act of 1978 and Reclamation Safety of Dams Act Amendments of 1984; and Departmental Manual Part 753, Dam Safety Program.

Contact: Water Resources Office, D-5500
Dam Safety Office, D-6600

1. **Scope.** This directive applies to all high- and significant-hazard dams that are either owned by Reclamation or included as part of an authorized Reclamation Project. This directive establishes the requirements for dam safety performance monitoring of those structures.
2. **Performance Monitoring.** Performance monitoring of dams is accomplished by conducting visual observations and reviewing and analyzing data collected from instruments which measure critical indicators of structural behavior. Measurements complement visual observations as a continuing surveillance of the threat to life, property, and the environment, and assist in investigating unexpected or abnormal performance. A full measurement program covers system design, installation, documentation of "as-built" conditions, operation, maintenance, and use and evaluation of instruments and measurement systems for dams, appurtenant structures, and foundations. Instrumented monitoring includes measurements of displacement, strain, stress, pressure, loads on structural members, and seepage and drainage along with environmental factors that affect dam behavior such as temperatures, reservoir level, and precipitation. Data are collected and observations are made, processed, and evaluated by qualified personnel. Results are presented in an easily understood format so that personnel not familiar with the dam can quickly comprehend all significant findings.
3. **Roles and Responsibilities.**
 - A. **Regional Directors.** Each Regional Director is responsible for ensuring these Performance Monitoring Directives are implemented at all dams in their region.
 - B. **Director, Policy Office.** The Director, Policy Office is responsible for coordinating with other Directors to develop and improve Reclamation-wide directives and standards that provide for performance monitoring of dams, and for assessing the effectiveness of implementation of those directives and standards.

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- C. **Area Office Managers.** Area Office Managers are responsible for ensuring that all data and visual observations associated with performance monitoring of dams in their area are obtained, recorded, reviewed, and transmitted in accordance with required written schedules. Area Managers are responsible for ensuring that instrument installation and maintenance, including repair, rehabilitation, replacement, and calibration are completed as required.
- D. **Chief, Dam Safety Office.** The Chief, Dam Safety Office is responsible for ensuring that all required data and visual observations are evaluated, and unacceptable structural performance is investigated in a timely manner. The Chief, Dam Safety Office is responsible for ensuring that performance parameters defining acceptable performance are developed and maintained for each dam; that performance monitoring schedules and necessary instructions are developed and maintained for each dam; and that performance monitoring records are permanently maintained and accessible to staff throughout Reclamation.
4. **Performance Monitoring Procedures.**
- A. **Obtaining Performance Monitoring Data From Instruments and Visual Observations.**
- (1) Data and visual observations that accurately indicate the performance of each high- and significant-hazard dam will be collected, recorded, and reviewed.
 - (2) Data and visual observations will be collected by qualified and knowledgeable personnel in accordance with established procedures. Management attention will be directed to ensure that specialized experience and skills necessary for performance monitoring activities are sustained. Performance monitoring specialists will provide necessary training to field personnel during site visits. Data will be collected from properly functioning and calibrated instrumentation and systems that conform to accepted performance monitoring standards and practices. A written schedule that lists requirements for site personnel for visual observations, data collection, review, and transmission will be developed and maintained for each dam. All data, visual observations, and supporting information will be recorded and processed as official records.
 - (3) All monitoring devices and systems will be periodically inspected, maintained, and calibrated in conformance with established procedures. Performance of these activities will be documented and preserved as official records.
 - (4) When performance monitoring devices need to be repaired, rehabilitated, replaced, or reinstalled, or when installation of new devices is determined to be necessary, appropriate action will be taken in a timely manner. System design, installation

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and/or rework of devices, documentation of “as-built” conditions, and data acquisition will be performed in a manner consistent with accepted practices. All essential and significant details concerning repairs or modifications to existing devices, or installation of new devices, will be recorded and maintained as official records.

B. Processing and Reviewing Performance Monitoring Data and Visual Observations.

- (1) All measurements and observations obtained by personnel conducting performance monitoring activities at the site will be compared with previous data and reviewed for unexpected changes or anomalies. Comparisons and reviews will be made as data are collected at the site or as soon as practicable. Any anomalous data will be re-collected to verify the correctness of the initial data. If data or visual observations are verified to be anomalous, the data or visual observation will be immediately reported through established channels to a dam performance monitoring specialist for further investigation. All performance monitoring measurements, visual observations, and supporting information will be maintained as an official performance monitoring record and stored appropriately in a centralized database.
- (2) All performance monitoring records submitted to the centralized database will be reviewed by a qualified and experienced dam performance monitoring specialist. The review will be accomplished in accordance with written requirements stating the time period within which submitted data must be reviewed and findings reported (see paragraph C below). Any data or observations appearing to indicate unusual or unacceptable dam performance will be thoroughly investigated by the dam performance monitoring specialist in collaboration with personnel from the office that submitted the data and appropriate technical specialists. Unacceptable dam performance will be considered a dam safety issue and will be processed in a timely manner in accordance with paragraph D below. Results of all dam performance monitoring specialists’ reviews will be documented and reported to the appropriate Regional Office, Area Office, and dam operating entity; the Dam Safety Office; and submitted into the official performance monitoring database. Reporting includes notification of continued acceptable performance, when that is the finding.
- (3) Dam performance monitoring specialists will periodically visit dams to maintain first-hand knowledge of performance monitoring at the site. Visits are to be initiated by Dam Safety Office personnel or Regional or Area Office staff.

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C. **Performance Monitoring Schedules and Instructions.** Personnel associated with each high- and significant-hazard dam will maintain written documents that will contain the following information:

- Frequencies for collection of data and visual observations at each dam [Schedule for Periodic Monitoring (L-23) or similar].
- Frequencies for transmission of data and visual observations. (Unless otherwise defined, this time period will be 2 weeks for “infrequently read instruments” which are instruments read no more frequently than annually, and 3 working days for all other instruments and visual observations.)
- Special instructions for use, inspection, maintenance, and calibration of instruments and systems.
- Time period within which data and observations received at the central database by dam safety performance monitoring specialists must be reviewed and findings reported. (Unless otherwise defined, this time period will be 2 weeks for “infrequently read instruments” which are instruments read no more frequently than annually, and 3 working days for all other instruments and visual observations.)

(1) Schedules and instructions will be developed in a collaborative effort involving personnel representing the appropriate regional and area office and the Dam Safety Office. A copy of each schedule and instruction will be included in the appropriate Standing Operating Procedures.

D. **Rapid Response to Performance Data or Visual Observations Indicating Unacceptable Performance.**

(1) Data or visual observations collected at the site by personnel assigned to perform monitoring activities or records reviewed by a dam performance monitoring specialist may indicate the existence of a dam safety issue. Dam safety issues are defined in the Reclamation Manual policy *Decisions Related to Dam Safety Issues* (FAC P02). All dam safety issues identified through performance monitoring activities will be promptly resolved in conformance with requirements contained in FAC P02.

(2) Written documentation for each decision made to resolve a dam safety issue identified during performance monitoring is required. In addition to performing those actions necessary to document decisions as required in FAC P02, a copy of all decision documents resolving dam safety issues identified during performance monitoring will be retained in the official performance monitoring database.

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- E. **Performance Monitoring Records.** Official records to document performance at all high- and significant-hazard dams will be permanently maintained and stored in a centralized database. Recordkeeping will conform to all applicable laws and the Reclamation Manual directive *Records and Information Management* (RCD 05-01).
- (1) Performance monitoring records will include:
- Identification and installation details for all monitoring devices including surveyed locations and current “as-built” drawings.
 - Pertinent historical performance monitoring data.
 - Records of calibration and maintenance activities.
 - Description of modifications and repairs to existing monitoring devices.
 - Dam performance monitoring specialists’ review reports.
 - Performance parameter technical memoranda.
 - Written record of previous data from each device for comparison with collected performance monitoring data and visual observations in an easily understood format.
 - Documents describing decisions made to resolve dam safety issues identified through performance monitoring.
 - Data and results from investigations conducted at the dam that are not part of the periodic performance monitoring program (e.g., monitoring during construction or special investigations for specific purposes).
- F. **Assessing the Performance Monitoring Effort.**
- (1) The adequacy of performance monitoring at each high- and significant-hazard dam will be periodically evaluated in a thorough and detailed manner. Review of performance monitoring activities at each dam will be conducted as part of the state-of-the-art review and performance parameter technical memorandum development process that is part of the comprehensive facility review program as described in Reclamation Manual directive *Review/Examination Program for High- and Significant-Hazard Dams* (FAC 01-07).
- (2) General reviews and assessments of performance monitoring activities including compliance to Reclamation Manual requirements in general and requirements of this

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Directive and Standard in particular, will be accomplished on a continuing basis. Requirements associated with reviews and assessments of performance monitoring efforts are stated in the following related Policy and Directives:

- *Annual Reporting for Dam Safety, Security, and Related Operations* (FAC 01-06).
 - *Decisions Related to Dam Safety Issues* (FAC P02).
 - *Reviews/Examination Program for High- and Significant-Hazard Dams* (FAC 01-07).
 - *Records and Information Management* (RCD 05-01).
- (3) Other reviews and assessments of monitoring activities, including site visits by performance monitoring specialists, will be performed to determine the effectiveness of monitoring at each dam and to identify opportunities for improving performance monitoring.