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INSPECTION OF WATER-CONTROL STRUCTURES ASSOCIATED WITH NUCLEAR POWER PLANTS

A. INTRODUCTION

Paragraphs (a)(4) and (b)(4) of §50.34, "Contents of Applications: Technical Information," of 10 CFR Part 50, "Licensing of Production and Utilization Facilities," require each applicant for a construction permit or operating license to provide an analysis and evaluation of the design and performance of structures, systems, and components of the facility for the purpose of assessing the risk to public health and safety resulting from operation of the facility. General Design Criterion 45, "Inspection of Cooling Water System," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 requires that the cooling water system be designed to permit appropriate periodic inspection of important components to ensure the integrity and capability of the system. Paragraph (c)(3) of §50.36, "Technical Specifications," of 10 CFR Part 50 defines surveillance requirements as those relating to test, calibration, or inspection to ensure that the necessary quality of systems and components is maintained, that facility operation will be within safe limits, and that the limiting conditions of operation will be met.

This guide describes a basis acceptable to the NRC staff for developing an appropriate inservice inspection and surveillance program for dams, slopes, canals, and other water-control structures associated with emergency cooling water systems of nuclear power plants. Guidelines for the design and construction of these structures will be presented in separate guides.

B. DISCUSSION

The National Dam Safety Act (Public Law 92-367) requires, in part, that the Secretary of the Army, acting through the Chief of Engineers, carry out a national program of inspection of dams* for the purpose of protecting human life and property. To determine whether a dam (including the waters impounded by the dam) constitutes a danger to human life or property, the Secretary is required to take into consideration the possibility that the dam might be endangered by overtopping, seepage, settlement, erosion, sediment, cracking, earth movement, earthquakes, failure of bulkheads, flashboards, gates on conduits, or other conditions that exist or that might occur in any area in the vicinity of the dam. As soon as practicable after inspection of a dam, the Secretary is to notify the Governor of the State in which such dam is located of the results of such investigation. The Secretary is required to notify the Governor immediately of any hazardous conditions found during an inspection and to advise the Governor, on request, of timely remedial measures necessary to mitigate or obviate any hazardous conditions.

This legislation was developed as an expression of public and congressional concern over the safety of dams in the United States. On August 28, 1974, the Corps of Engineers published "Proposed Guidelines for Safety Inspection of Dams" in the *Federal Register* (39 FR 31334). These guidelines propose procedures for inspection and evaluation of dams to determine if they constitute hazards to human life and property. The proposed inspection procedures are similar to the procedures discussed in this guide.

* Section 2 of the Act specifically excludes from the inspection program (1) dams under the jurisdiction of the Bureau of Reclamation, the Tennessee Valley Authority, or the International Boundary and Water Commission, (2) dams that have been constructed pursuant to licenses issued under the authority of the Federal Power Act, (3) dams that have been inspected within the 12-month period immediately prior to the enactment of this Act by a State agency and that the Governor of such State requests be excluded from inspection, and (4) dams that the Secretary of the Army determines do not pose any threat to human life or property. The Secretary may inspect dams that have been licensed under the Federal Power Act on request of the Federal Power Commission and dams under the jurisdiction of the International Boundary and Water Commission on request of such Commission.

Dams, slopes, canals, and other water-control structures and associated facilities are used to impound, retain, and divert water sources for the emergency cooling operations of nuclear power plants. Failure to perform their functions could endanger the plant and cause an undesirable release of radioactive material to the environment, thus affecting the public health and safety. The design and construction of these facilities, therefore, require a high degree of professional engineering performance. The foundation of the dam should be stable under all conditions and should be capable of carrying the weight of the structure. The dam should impound its reservoir water without undue strain and should be safe under the application of external forces such as those resulting from earthquakes. The reservoir area should be water retentive and free of the possibilities of dangerous slides. Dams and associated facilities should be maintained in good working condition throughout their lives. Operation and surveillance through the years should be conducted in such a manner that any change in their structural, hydraulic, and foundation conditions can be detected promptly and corrections made.

Statistics of dam failures, based on the sum of operation years of a regional group of dams (Ref. 1), show a frequency of one failure every 1500 to 1800 dam years. Causes of latent danger inherent in such works arise from site conditions, hydrologic and hydraulic features, types and qualities of the structures, operation and maintenance, and influence of the environment. Of these causes, the majority lie within the boundaries of modern technology and can be avoided. Most failures have resulted from gradually worsening defects (due to design, construction, operation, or lack of maintenance) that were either undiscovered or misjudged. The Nashville Masonry Dam in Tennessee failed because of the saturation of concealed clay seams (Ref. 1); the South Fork Dam in Pennsylvania failed because of the overgrown vegetation at the spillway (Ref. 1); and the Waco Dam slide in Texas that occurred during construction is attributed to the low residual strength, high pore pressure buildup (Ref. 2), and highly anisotropic behavior of the shale (Ref. 3).

Dams and associated facilities have not always performed as expected, as exemplified by excessively high pressure buildup discovered in the foundation soil at West Branch Dam in Ohio (Ref. 4) and unusually high uplift pressure noted at Hoover Dam (Ref. 5). Construction defects have been found, such as soft materials left in the abutments of a gravity dam, inadequate provisions for heat dissipation of mass concrete structures, or impervious fill misplaced in the shell of a zoned earthfill dam (Ref. 6). Foundations may need further treatment after a period of operation, e.g., the foundation at Hoover Dam, which was treated by providing additional drainage and grouting to reduce uplift pressure and seepage. To detect such behavioral deviations, regular surveillance is essential.

Some dams may become weaker with advancing years, and expert professional care is then needed. Examples of this phenomenon are concrete dams that were weakened by a chemical reaction between the alkalies of the cement and the silica of the aggregate (Ref. 6) and dams that experienced progressive failure in earthfill embankments (Ref. 7). The weakening of a dam or its foundation may become apparent only after many years of safe operation. Painstaking monitoring and analysis of performance data are necessary to ensure detection of adverse conditions, including peripheral phenomena such as subsidence and landslide (Refs. 7 and 8). Each structure, as well as each site, has its own characteristics and its own susceptibilities to problems, and the surveillance program should be tailored to account for these.

Thorough physical examination is an essential part of the surveillance program. The optimal frequency of inspections depends on the size, age, and condition of the facilities; the character of the foundation; the regional geological setting; and the proximity of the facilities to populated areas.

The search for superficial signs of distress such as longitudinal and transverse cracks is only one phase of the examination. Possible internal disorders may be probed by various portable instruments (Refs. 9 and 10) such as soniscopes, hydrophones, television, and bore-hole cameras. It is important that these observations be correlated closely with measurements from embedded devices.

Particularly vulnerable areas that should be monitored are those where embankments have been placed against or are covered by structures. There may be a high susceptibility to internal erosion at the planes of contact. Dams have failed because of piping along abutments and underneath superimposed structures such as fish ladders and spillways (Ref. 12).

Attention should also be focused on the slopes of the reservoir behind the dam where unstable terrain may be a problem (Ref. 7). The early stages of slope failure may be manifested in various ways: buckling of concrete and asphaltic linings, leaning of trees and poles, and cracking and bulging of walls (Ref. 11). Thorough surveillance of suspected unstable areas is essential when disturbance could jeopardize the safety of the dam (Ref. 12). These areas require careful and frequent inspection, sometimes supplemented by periodic measurement of precise level and triangulation nets, reading of slope indicators or tiltmeters, and study of aerial photographs.

Before filling a reservoir, records of piezometric levels, ground elevations, and background seismic activity at the site should be compiled so that comparison can be made with the effects of water loading. As soon as filling begins, the inspection and maintenance program for structures and operating equipment should be initiated. This includes regular patrol of the dam and its abutments and observations of seepage flows, piezometric levels, and structural and foundation movements. These readings should be plotted and correlated with concurrent reservoir water levels. An increase in seepage flow and turbidity is a common symptom of piping as a result of impounded water penetrating and flushing out foundation openings (Ref. 1).

Although the most critical time in the life of a reservoir may be during its first filling when the design is checked against actual performance, several years may pass before the foundation and structures have fully adjusted to the loads. Thereafter, deformation will continue in response to cyclical load variations. Attention should be focused on inspection and data collection during relatively rapid changes in reservoir water surface elevations. Year-to-year conditions at high and low seasonal levels should be compared. Data should also be collected on changes occurring since project construction that may influence the safety and function of the facilities. It is important that abnormalities affecting facility safety be met with quick corrective action.

The service water channels should be examined for any conditions such as channel bank erosion, aggradation, or degradation that may impose constraints on the function of the cooling system and present a potential hazard to the safety of the plant. Submerged dams and emergency canals (e.g., artificially dredged canals at the river bed or the bottom of the reservoir) should be examined for any conditions, e.g., blockage caused by sedimentation, debris, or instability of slopes, that may impair the function of the canals under extreme low-flow conditions.

Operation of a dam tends to become routine in the course of time and, without enforced requirements to the contrary, emergency equipment may be put aside, even forgotten, and may be defective when an emergency arises. At Kaddam Dam in India, the failure of the power supply for the electric drive of the spillway gates (Ref. 1) occurred for this very reason.

Inspection personnel should be selected carefully. The inspector and the analyst should be practical, dedicated diagnosticians who examine thoroughly every clue during their scrutiny of the behavior of these structures. A person who becomes uninterested, complacent, or overwhelmed when surrounded by voluminous collected data should not be assigned to this demanding duty. On the other hand, an analyst concerned with quantity rather than quality of data or fascinated with overly sophisticated techniques may overlook obviously adverse trends apparent by scanning data or by simple charting. The key to striking a proper balance is the selection of a person who knows what to look for and is perseverant in his search, discerning in his interpretation, and communicative of his findings.

A list of references used in developing this regulatory guide is included. An additional list that may be useful to the licensee in developing an inspection program is also included. However, the listing of these references does not constitute a blanket endorsement of their contents by the NRC staff.

C. REGULATORY POSITION

This guide applies only to water-control structures (e.g., dams, reservoirs, conveyance facilities) specifically built for use in conjunction with a nuclear power plant and whose failure could have radiological consequences adversely affecting the public health and safety. In addition, the structure was built, wholly or in part, for the purpose of controlling or conveying water for either emergency cooling operation or flood protection of a nuclear power plant. Such a structure may be located on or off the site. The NRC staff may consider the recommendations of this guide fulfilled by the applicant or licensee if the structure is regulated by another agency with which the NRC has executed an interagency agreement relating to the inspection of such water-control structures and which enforces a comparable inspection program, e.g., a hydroelectric pumped-storage project built as part of a nuclear power plant could be under the jurisdiction of the Federal Power Commission.

Inservice inspection should be performed at periodic intervals to check the condition of the water-control structures and evaluate their structural safety and operational adequacy. A detailed, systematic inspection program should consist of, but not necessarily be limited to, the following:

1. Engineering Data Compilation

Engineering data related to the design, construction, and operation of the water-control structures should be collected and, to the extent practicable, included in the initial inspection report.* These data should include the following items, where available and appropriate:

* Most engineering data are information presented in PSAR and FSAR reports. To aid the inspectors, this information should be either incorporated into the report or referenced in detail as to its SAR location.

a. General Project Data

(1) Regional vicinity map showing the project location and the upstream and downstream drainage areas.

(2) As-built drawings of important project features, including details such as instrumentation, internal drainage, transition zones, or relief wells.

b. Hydrologic and Hydraulic Data

(1) Drainage area and basin characteristics.

(2) Storage and surcharge capacities, including dead storage.

(3) Elevation of the maximum design pool and freeboard height.

(4) Spillway characteristics (location, type, width, and crest length and elevation).

(5) Location and description of flashboards, fuse plugs, and emergency spillways.

c. Foundation data and geological features, including boring logs, geological maps, profiles and cross sections, and reports of foundation treatment.

d. Properties of embankment and foundation materials, including results of laboratory tests, field tests, construction control tests, and assumed design material properties.

e. Concrete properties, including the source and type of aggregate, cement used, mix design data, and test results during construction.

f. Electrical and mechanical equipment type; rating of normal and emergency power supplies, hoists, cranes, valves, and valve operators; and control and alarm systems that could affect the safe operation of the water-control structure.

g. Pertinent construction records, including construction problems, alterations, modifications, and maintenance repairs.

h. Water-control plan, including regulation plan under normal conditions and during flood events or other emergency conditions.

i. Earthquake history, including a summary of significant earthquakes in the vicinity.

j. Principal design assumptions and analyses, including hydrologic and hydraulic analyses, stability and stress analyses, and seepage and settlement analyses.

2. Onsite Inspection Program

The onsite inspection program of water-control structures should be established and conducted in a systematic manner to minimize the possibility of overlooking any significant features. A detailed checklist should be developed and followed for the project structures to document the observations of each significant structural and hydraulic feature, including electrical and mechanical control equipment. Particular attention should be given to detecting evidence of leakage, erosion, seepage, slope instability, undue settlement, displacement, tilting, cracking, deterioration, and improper functioning of drains and relief wells; to verifying the adequacy and quality of maintenance and operating procedures; and to observing significant postconstruction changes.

The inspection should include appropriate features and items, including but not limited to the following:

a. Concrete Structures in General

(1) *Concrete Surfaces.* The condition of the concrete surfaces should be examined to evaluate the deterioration and continuing serviceability of the concrete. Descriptions of concrete conditions should conform with the appendix to the American Concrete Institute publication, ACI 201, "Guide for Making a Condition Survey of Concrete in Service" (Ref. 15).

(2) *Structural Cracking.* Concrete structures should be examined for structural cracking resulting from overstress due to applied loads, shrinkage and temperature effects, or differential movements.

(3) *Movement—Horizontal and Vertical Alignment.* Concrete structures should be examined for evidence of any abnormal settlements, heaving, deflections, or lateral movements.

(4) *Junctions.* The conditions at the junctions of the structure with abutments or embankments should be determined.

(5) *Drains—Foundation, Joint, Face.* All drains should be examined for the purpose of ensuring that they are capable of performing their design function.

(6) *Water Passages.* All water passages and other concrete surfaces subject to running water should be examined for erosion, cavitation, obstructions, leakage, or significant structural cracks.

(7) *Seepage or Leakage.* The faces, abutments, and toes of the concrete structures should be examined for evidence of seepage or abnormal leakage, and records of flow of downstream springs should be reviewed for unusual variation with reservoir pool level. The sources of seepage should be determined, if possible.

(8) *Monolithic Joints—Construction Joints.* All monolithic and construction joints should be examined to determine the condition of the joint and filler material, any movement of joints, or any indication of distress or leakage.

(9) *Foundation.* The foundation should be visually examined to the extent possible for damage or possible undermining of the downstream toe.

(10) *Abutments.* The abutments should be examined for signs of instability or excessive weathering.

b. Embankment Structures

(1) *Settlement.* The embankments and downstream toe areas should be examined for any evidence of unusual localized or overall settlement, depressions, or sink holes.

(2) *Slope Stability.* Embankment slopes should be examined for irregularities in alignment and variances from originally constructed slopes, unusual changes from original crest alignment and elevation, evidence of movement at or beyond the toe, and surface cracks that indicate movement.

(3) *Seepage.* The downstream face of abutments, embankment slopes and toes, embankment-structure contacts, and the downstream valley areas should be examined for evidence of existing or past seepage. The sources of seepage should be investigated to determine cause and potential severity affecting dam safety under all operating conditions. The presence on slopes of animal burrows and vegetative growth that might cause detrimental seepage should be examined.

(4) *Drainage Systems.* All drainage systems should be examined to determine whether the systems can freely pass discharge and ensure that the discharge water is not carrying embankment or foundation material. Systems used to monitor drainage should be examined to ensure that they are operational and functioning properly.

(5) *Slope Protection.* The slope protection should be examined for erosion-formed gullies and waveformed notches and benches that have reduced the embankment cross section or exposed less-wave-resistant materials. The adequacy of slope protection against waves, currents, and surface runoff that may occur at the site should be evaluated. The condition of vegetative or any other protective covers should be evaluated, where pertinent.

c. Spillway Structures and Outlet Works

The spillway examination should cover the structures and features, including bulkheads and flashboards, of all service and auxiliary spillways for any condition that may impose operational constraints on the functioning of the spillway. The outlet works examination should include all structures and features designed to release reservoir water below the spillway crest through or around the dam.

(1) *Control Gates and Operating Machinery.* The structural members, connections, hoists, cables, and operating machinery and the adequacy of normal and emergency equipment should be examined and tested to determine the structural integrity and verify the operational adequacy of the equipment. Where cranes are intended to be used for handling gates and bulkheads, the capacity and operating condition of the cranes and lifting beams should be ascertained. Operability of control systems and protective and alarm devices such as limit switches, sump high-water alarms, and drainage should be ascertained.

(2) *Unlined Saddle Spillways.* If unlined saddle spillways are used, they should be examined for evidence of erosion and any conditions that may impose constraints on the functioning of the spillway.

(3) *Approach and Outlet Channels.* The approach and outlet channels should be examined for any conditions that may impose constraints on the functioning of the spillway and the outlet works.

(4) *Stilling Basin (Energy Dissipators).* Stilling basins, including baffles, flip buckets, or other energy dissipators, should be examined for any conditions that may impose constraints on the ability of the stilling basin to prevent downstream scour or erosion that may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined.

(5) *Intake Structure.* The structure and all features should be examined for any conditions that may impose operational constraints on the outlet works. Entrances to the intake structure should be examined for conditions such as silt or debris accumulation that may reduce the discharge capabilities of the outlet works.

(6) *Conduits, Sluices, Water Passages, etc.* The interior surfaces of conduits should be examined for erosion, corrosion, cavitation, cracks, joint separation, and leakage at cracks or joints.

(7) *Drawdown Facilities.* Facilities provided for drawdown of the reservoir to avert impending failure of the dam or to facilitate repairs in the event of stability or foundation problems should be examined for any conditions that may impose constraints on their functioning as planned.

d. Reservoirs

The following features of the reservoir should be examined for any conditions that may impose operational constraints on the cooling system or that may be hazardous to the safety of the dam:

(1) *Shore Line* The landforms around the reservoir should continually be examined for indications of major active or inactive landslide areas and for their susceptibility at any later date to massive landslides of sufficient magnitude to significantly reduce reservoir capacity or create waves that might overtop the dam.

(2) *Sedimentation.* The reservoir and drainage area should be examined for excessive sedimentation or recent developments in the drainage basin that could cause a sudden increase in sediment load, thereby reducing the reservoir capacity with attendant increase in maximum outflow and maximum pool elevation.

(3) *Potential Upstream Hazard Areas.* The reservoir area should be examined for changes with a potential for hazardous backwater flooding.

(4) *Watershed Runoff Potential.* The drainage basin should be examined for any extensive recent alterations to the surface of the drainage basin such as changed agricultural practices, timber clearing, railroad or highway construction, or real estate developments that might adversely affect the runoff characteristics. Upstream projects that could have an impact on the safety of the dam should be identified.

e. Cooling Water Channels and Canals and Intake and Discharge Structures

(1) *Channels and Canals.* The water conveyance channels and canals should be examined for channel bank erosion, bed aggradation or degradation and siltation, undesirable vegetation, or any unusual or inadequate operational behavior.

(2) *Intake and Discharge Structures.* The structures and all features should be examined for any conditions that may impose operational constraints on the cooling facilities such as silt or debris accumulation at the water intake or discharge.

f. Safety and Performance Instrumentation

Instruments that have been installed to measure behavior of the structures should be examined and tested for proper functioning. The available records and readings of installed instruments should be reviewed to detect any unusual performance of the instruments or evidence of unusual performance or distress of the structure. The adequacy of the installed instrumentation to measure the performance and safety of the dam should be determined.

(1) *Headwater and Tailwater Gages.* The existing records of the headwater and tailwater gage measurements should be examined to determine the relationship between these and other instrumentation measurements such as stream flow, uplift pressures, alignment, and drainage system discharge with the upper- and lower-water surface elevations.

(2) *Horizontal and Vertical Alignment Instrumentation (Concrete Structures).* The existing records of alignment and elevation surveys and measurements from inclinometers, inverted plumb bobs, gage points across cracks and joints, or other devices should be examined to determine any change from the original position of the structures.

(3) *Horizontal and Vertical Movement, Consolidation, and Pore-Water Pressure Instrumentation (Embankment Structures).* The existing records of measurements from settlement plates or gages, surface reference marks, slope indicators, and other devices should be examined to determine the movement history of the embankment. Existing piezometer measurements should be examined for the purpose of determining if the pore-water pressures in the embankment and foundation would, under given conditions, impair the safety of the dam.

(4) *Uplift Instrumentation.* The existing records of uplift measurements should be examined for the purpose of determining if the uplift pressures for the maximum pool would impair the safety of the dam.

(5) *Drainage System Instrumentation.* The existing records of measurements of the drainage system flow should be examined to confirm the normal relationship between pool elevations and discharge quantities or to detect any changes that have occurred in this relationship.

(6) *Seismic Instrumentation.* The existing records of seismic instrumentation should be examined to determine the seismic activity in the area and the response of the structures to recent earthquakes.

g. Operation and Maintenance Features

(1) *Reservoir Regulation Plan.* The actual practices in regulating the reservoir and discharges under normal and emergency conditions should be examined to determine if they comply with the designed reservoir regulation plan.

(2) *Maintenance.* The maintenance of the operating facilities and features that pertain to the safety of the dam should be examined to determine the adequacy and quality of the maintenance procedures followed in maintaining the dam and facilities in safe operating condition.

h. Postconstruction Changes

Data should be collected on changes that have occurred since project construction that might influence the safety of the project.

3. Technical Evaluation

Based on the findings of the engineering data review and the onsite inspection, an evaluation of the existing conditions of the water-control structures should be made. The evaluation should include the assessment of the hydraulic and hydrologic capacities and the structural stability.

a. Hydraulic and Hydrologic Design Capacities

These should be evaluated in accordance with applicable portions of Regulatory Guides 1.59, "Design Basis Floods for Nuclear Power Plants;" 1.102, "Flood Protection for Nuclear Power Plants;" and 1.27, "Ultimate Heat Sink for Nuclear Power Plants." All constraints on water control such as blocked entrances, restrictions on operation of spillway and outlet works, inadequate energy dissipators, restrictive channel conditions, significant reduction in reservoir capacity by sedimentation and other factors should be considered in the evaluation.

b. Stability Assessments

These should use in situ properties of the structures, as well as foundation and pertinent geologic information, to determine the existence of changes to or continuation of conditions that are hazardous, or that with time might develop into safety hazards, and to formulate recommendations pertaining to the need for additional investigations, analyses, or remedial measures. References 13 and 14 provide generally acceptable methods for the analyses of structural stability.

4. Frequency of Inspections

The inspection intervals suggested below are for general guidance in developing projected inspection schedules. These intervals in no way preclude more frequent inspections if deemed necessary or less frequent inspections (not to exceed each 5 years) for those structures where conditions or structural integrity warrant such relaxation.

a. Initial Inspection. The first general onsite inspection should be carried out immediately after topping out for new earth and rockfill dams and prior to impoundment of reservoir water for new concrete structures. For existing facilities that are now in operation, onsite inspection should be carried out as soon as practicable if no inspection comparable to that described in this guide has been performed.

b. Subsequent Inspections. The second inspection of earth and rockfill dams should be performed at a reasonable stage of reservoir filling but in no case later than at the attainment of normal operating pool level. The second inspection of concrete structures should be performed when the reservoir water attains the normal operating pool level but in no case later than 1 year after initial impoundment has begun. Subsequent inspections should be made at 1-year intervals for the next 4 years, at 2-year intervals for the following 4 years, and then may be extended to each 5 years if the results of the previous inspections warrant this extension.

c. Special Inspections. Special inspections should be performed immediately after the dam has passed unusually large floods and after the occurrence of significant earthquakes, hurricanes, tornadoes, intense local rainfalls, or other unusual events.

5. Inspection Report

A technical report should be prepared to present the results of each general inspection. These documents should be kept at the project site for reference purposes, should be available for inspection by regulatory authorities, and should be retired only on termination of the project. Any abnormal hazardous conditions observed during the inspection should be reported immediately to the NRC staff in accordance with the Commission's regulations, as summarized in Regulatory Guide 1.16, "Reporting of Operating Information —Appendix A Technical Specifications."

The content of the report should consist of the following:

a. Initial Report. In addition to a general description of water-control structures, major elements of the report should include:

(1) Results of the visual inspection of each project feature, including photographs, where appropriate.

(2) Results of the instrumentation observations.

(3) Evaluation of operational adequacy of the reservoir regulation plan and maintenance of the dam and operating facilities, including the warning system.

(4) Technical assessment of the causes of distress or abnormal conditions and evaluation of the behavior, movement, deformation, or loading of the structure.

(5) Conclusions and recommendations for additional investigations, remedial measures, or future inspections, where appropriate.

b. Subsequent Reports. These reports should include information, as described in paragraphs 5.a(1) through 5.a(5) above, relative to changes or continuation of abnormality in conditions noted since the previous inspection.

6. Inspection Personnel

The inspection should be conducted under the direction of registered professional engineers experienced in the investigation, design, construction, and operation of these facilities. The field inspection team should include engineers, engineering geologists, or other specialists able to recognize signs of possible distress (e.g., structural joint movement, piezometric fluctuations, seepage variations, settlement and horizontal misalignments, slope movement, cracking of concrete, erosion, and corrosion of equipment and conduits) and able to recommend appropriate mitigating measures.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this regulatory guide.

This guide reflects current NRC staff practice. Therefore, except in those cases in which the applicant or licensee proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein is being and will continue to be used in evaluating inservice inspection programs of water-control structures until this guide is revised as a result of suggestions from the public or additional staff review.

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