



OHIO RIVER BASIN TRIBUTARY SOUTH BRANCH PIGEON CREEK, WASHINGTON COUNTY

PENNSYLVANIA

COKEBURG WATER SUPPLY DAM

NDI ID NO. PA-1094 DER ID NO. 63-30

BOROUGH OF COKEBURG

PHASE 1 INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



Prepared By

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FOR DEPARTMENT OF THE ARMY BALTIMORE DISTRICT CORPS OF ENGINEERS BALTIMORE, MARYLAND 21203 تنسقوناه

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APRIL, 1981

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in detemining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I REPORT NATIONAL DAM INSPECTION REPORT

NAME OF DAM STATE LOCATED COUNTY LOCATED STREAM

DATE OF INSPECTION COORDINATES

Cokeburg Water Supply Dam Pennsylvania Washington Tributary to the South Branch of Pigeon Creek November 5, 1980 Lat: 40° 5.9' Long: 80° 4.2'

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ASSESSMENT

The assessment of Cokeburg Water Supply Dam is based upon visual observations made at the time of inspection, review of available data, hydraulic and hydrologic computations and past operational performance of the structure. The inspection and review of data of the Cokeburg Water Supply Dam revealed that further investigations of the magnitude of a Phase II are required. The inspection did not reveal any problems which require immediate emergency action. The dam appears to be in poor condition and poorly maintained. The structure is classified as unsafe, non-emergency.

The stability of the structure is questionable due to the existence of coke ovens in the downstream slope of the embankment and failure of the discharge culvert outlet. Considerable erosion and/or settlement has occurred near the outlet of the spillway discharge culvert. The interior walls of the culvert, at the outlet are caving in and debris partially blocks the outlet. Portions of the reservoir slopes may contain coal refuse, which could lead to potential landslides affecting the storage and volume of the reservoir. During periods of heavy precipitation a potential landslide could occur, increasing the possibility for overtopping of the structure.

The Cokeburg Water Supply Dam is a high hazard-small size dam. The Spillway Design Flood (SDF) for a dam of this size and classification is in the range of 1/2 PMF to the PMF. The PMF has been selected as the spillway design flood based on the downstream potential for loss of life and property damage. The spillway and reservoir are capable of controlling less than 30% of the PMF without overtopping the embankment low spot. Results of the dam breach analysis indicate that downstream damages would be significantly increased due to dam failure. The spillway is termed seriously inadequate. The dam is classified as an unsafe, non-emergency structure.

COKEBURG WATER SUPPLY DAM PA 1094

The following recommendations and remedial measures should be instituted immediately.

1. A detailed stability and seepage analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction and should be conducted in conjunction with a detailed nydraulic and hydrologic analysis of the structure to increase the spillway capacity and to document the stability of the structure.

2. The fence which surrounds the inlet for the spillway should be removed. The location and type of fence is such that it may reduce the spillway capacity by collecting debris. The fence apparently serves as a security measure against injury to unauthorized personnel who may frequent the site. Other security measures should be implemented, and a trash rack provided, which does not hamper the capability of the spillway to discharge excess inflow to the reservoir.

3. The discharge culvert outlet for the spillway is caving in and debris partially blocks the outlet. The debris should be removed from the outlet, and the area immediately beyond the outlet and the walls of the culvert should be repaired.

4. The owner should make an evaluation to determine the extent of subsurface mining beneath the dam and its possible effects relative to subsidence.

5. The vegetation on the slopes of the structure should be removed under the direction of a professional engineer knowledgeable in dam design and construction to insure that removal of the vegetation does not adversely affect the stability of the structure.

6. It should be ascertained whether the 6" diameter water line which serves as the feed line for the water supply system is capable of serving as a drainline for the reservoir. If it is determined that the line is capable of serving as a drainline, some means of positive upstream closure of the line should be provided. If the line is determined unsuitable as a drainline, an upstream closure should be provided, or the line should be abandoned, and plugged; and some alternate method devised to drain the reservoir.

7. An investigation should be conducted to determine the type of material which forms the slopes immediately adjacent to the reservoir. The investigation should include the potential for the material to slide into the reservoir, thus reducing the storage potential of the reservoir and the potential for overtopping.

8. A safety inspection program should be implemented with inspections at regular intervals by a qualified personnel.

COKEBURG WATER SUPPLY DAM PA 1094

9. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

10. A regularly scheduled maintenance program should be prepared and implemented to insure the continued safe operation of the facility.



Date

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APPROVED BY:

APR81 Date

L. ROBERT KIMBALL & ASSOCIATES CONSULTING ENGINEERS AND ARCHITECTS

R. Jeffrey Kimball, P.E.

AMES W. PECK Colonel, Corps of Engineers District Engineer



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Charles Constant

PHASE I NATIONAL DAM INSPECTION PROGRAM

COKEBURG WATER SUPPLY DAM NDI. I.D. NO. PA 1094 DER I.D. NO. 63-30

SECTION 1 PROJECT INFORMATION

1.1 General.

a. <u>Authority</u>. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. <u>Purpose</u>. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. The Cokeburg Water Supply Dam is an earthfill dam, 400 feet long and 27 feet high. The crest width is 20 feet. The upstream slope is 1/2H:1V to 1H:1V and grass covered. The downstream slope of the dam is 1H:1V and grass covered. Small trees and brush exist on the upstream and downstream slopes of the structure.

Several abandoned coke ovens are visible on the downstream slope of the structure adjacent to the left abutment contact and above the outlet conduit for the spillway.

The spillway for the Cokeburg Water Supply Dam is located at the left abutment of the structure. The spillway consists of a rectangular concrete drop intake structure. A chainlink fence exists around the inlet to the intake structure. Inflow to the structure is discharged through a rectangular masonry culvert. The outlet for the culvert is located at the downstream toe of the dam.

b. Location. The dam is located on a tributary of the South Branch of Pigeon Creek, within the Cokeburg Borough limits, Nashington County, Pennsylvania. The Cokeburg Water Supply Dam can be located on the Ellsworth, U.S.G.S. 7.5 minute quadrangle.

c. <u>Size Classification</u>. The Cokeburg Water Supply Dam is a small size dam (27 feet high, 61 acre-feet).

d. <u>Hazard Classification</u>. The Cokeburg Water Supply Dam is a high hazard dam. Downstream conditions indicate that the loss of more than a few lives and property damage is probable should the structure fail. A small business establishment is located approximately 1,000 feet downstream of the dam.

e. <u>Ownership</u>. The dam is owned by the Borough of Cokeburg. Correspondence should be addressed to:

Mr. Lee Karpoff, Council President Box 398 Cokeburg, Pennsylvania 412/945-6425

f. Purpose of Dam. The dam is used for water supply.

g. Design and Construction History. The original owner of the Cokeburg Water Supply Dam was the Eethlehem Mines Corporation. The impoundment was originally started about 1902 and was used in conjunction with the mining of the Pittsburgh coal seam. Sometime around 1953 the reservoir was purchased from Bethlehem Mines Corporation by the Cokeburg Borough for use as a water supply reservoir. The impondment is currently used to supply water for Cokeburg, Pennsylvania.

The dam was constructed on top of a bank of abandoned coke ovens. Information in the DER files suggests that the coke ovens were abandoned prior to construction of the dam in 1902. Past inspection reports note seepage through the embankment.

A 1919 inspection report indicates that the dam was originally built with both the upstream and downstream slopes equal to 1.5H:1V. A sketch drawn on that inspection report indicates that coke ovens existed along the downstream toe of the dam and along either downstream abutment. A railroad siding existed along the crest of the dam. Apparently, the railroad siding was utilized for loading the coke ovens as part of the coking process. Other information in the inspection report indicates that two brick core walls, each 9 inches thick with a puddle core between the walls, existed at the time of inspection. It was also noted that a portion of the walls exposed on the crest had fallen down.

It was reported by members of the council, who accompanied the inspection team, that the spillway crest had been raised 10 or 12 years ago to increase the capacity of the reservoir. No information was available regarding who had completed the work or the design associated with the work.

h. <u>Normal Operating Procedures</u>. Normal inflow to the reservoir is discharged through the spillway at the left abutment. The reservoir pool is maintained at the spillway crest elevation, 1072.0. A 6 inch diameter waterline exists near the right abutment of the dam and supplies the normal flow of water to the Borough of Cokeburg. Two manholes exist at the downstream toe of the dam near the right abutment. One of the manholes provides access to the 6 inch waterline.

1.3 Pertinent Data.

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а.	Drainage Area.).53 sc	quare mile
b.	Discharge at Dam Site (cfs).		
	Maximum known flood at dam site		Unknown
	Drainline capacity at normal pool		None
	Spillway capacity at top of dam		750
с.	Elevation (U.S.G.S. Datum) (feet) Field	survey	based on
spillway	crest elevation, 1072.0, from U.S.G.S. 7.5 t	ninute	quadrangle.
	Top of dam - low point		1075.0
	Top of dam - design height		Unknown
	Maximum nool - design surcharze		Unknown
	Normal pool		1072.0
	Spillway creet		1072.0
	Upstream invert - 6" waterline		Unknown
	Downstream invert - 6" waterline (approximat	- a)	1045_0
	Maximum tailuatar	/	None
	Toe of dam		1047.9
			104/•)
d.	Reservoir (feet).		
	Length of maximum pool (PMF)		1500
	Length of normal pool		1200
e.	Storage (acre-feet).		
	Normal pool		37
	Top of dam		61
	Top or dam		01
f.	Reservoir Surface (acres).		
	Top of dam		9
	Normal pool		7
	Spillway crest		7
g.	Dam.		
	Туре	Earth	fill over
	->r	andone	d coke oven
		1	bank
	Length		400 feet
	Height		27 feet
	Top width		20 reet
	Side slopes - upstream 0.	5H:1V	to 1H:1V
	- downstream		1H:1V

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Sec. Sec. F.

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Zoning Impervious core Cutoff Grout curtain

None None Brick (deteriorated) None

h. Reservoir Drain.

Type

Length Closure Access

Regulating facilities

i. Spillway.

Type

Length (total crest) Crest elevation Upstream channel Downstream channel 6" diameter water supply line Unknown Valve at toe Manhole at Iownstream toe Valve in manhole

> Rectangular drop inlet 45 feet 1072.0 Lake Masonry culvert

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SECTION 2 ENGINEERING DATA

1.1 <u>Design</u>. Limited information relative to the design of the cokeburg Water Supply Dam was available in the DER files. Comments made as part of various inspection reports indicate that the dam was constructed by the Bethlehem Mines Corporation to be utilized in the mining of the Pittsburgh coal seam. The Commonwealth of Pennsylvania, Department of Environmental Resources, correspondence file was reviewed for the purposes of this report. Several members of the Cokeburg Borough Council accompanied the inspection team but did not provide any additional information relative to the design of the structure.

2.2 <u>Construction</u>. No information exists relative to the construction of the dam. Remarks contained in various inspection reports indicate that the dam was constructed on top of an abandoned bank of coke ovens.

2.3 Operation. No operating records are maintained.

2.4 Evaluation.

a. <u>Availability</u>. Limited available data was provided by the PennDER, Bureau of Dams and Waterway Management, and through interviews with the owner. Several members of the Cokeburg Borough Council were interviewed to obtain data on the operation and maintenance of the dam.

b. <u>Adequacy</u>. Detailed analysis cannot be made because of the lack of detailed design information. This Phase I Report is based on available data, visual inspection and hydrologic and hydraulic analysis. Sufficient information exists to complete a Phase I Report.

SECTION 3 VISUAL INSPECTION

3.1 Findings.

a. <u>General</u>. The onsite inspection of the Cokeburg Water Supply Dam was conducted by personnel of L. Robert Kimball and Associates on November 5, 1980. The inspection consisted of:

- Visual inspection of the retaining structure, abutments and toe.
- 2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
- 3. Observations affecting the runoff potential of the drainage basin.
- 4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appeared to be in poor condition and poorly maintained. From a brief survey conducted during the inspection, it was noted that a low area exists on the embankment crest near the left abutment. The crest width of the dam was measured to be 20 feet. The upstream slope above the water level was measured to be 0.5H:1V to 1H:1V and grass covered. It was also observed that small trees and brush exist on the upstream slope of the dam. The downstream slope of the dam was measured to be 1H:1V and covered with grasses and brush. Large trees were also observed on the downstream slope of the structure. Access to the dam is along an earthen road downstream of the left abutment. The access road continues along the crest of the structure. No major erosion was observed on the crest of the dam. Several coke ovens were observed on the downstream slope near the left abutment and above the outlet culvert for the spillway. It was reported by the owners that coke ovens are present under the entire embankment length. The brick wall, assumed to be used as a cutoff, was partially exposed on the upstream slope. A large part of this wall has failed and fallen into the reservoir. No seepage was observed on the downstream slope or along the toe during the inspection.

c. <u>Appurtenant Structures</u>. The spillway for the reservoir is located near the left abutment through the embankment section. The spillway is a concrete rectangular drop inlet structure, and flows are carried by a masonry culvert through the embankment. The outlet for the culvert is at the downstream toe near the left abutment. A chain link fence exists at the inlet for safety reasons. The inspection team entered the inlet and culvert to inspect the condition of the structure. Seepage was observed exiting from the left interior wall of the culvert. Several concentrated seepage points were observed, and the seepage was estimated at 2 to 3 gallons per minute. The floor of the culvert consists of concrete. The culvert is constructed of rubble masonry with mortar. It was observed that the culvert is in a deteriorating condition, and the sidewalls at the outlet are caving in. The outlet is partially blocked due to the caving sidewalls. Considerable erosion was observed along the downstream slope of the dam in the area of the culvert outlet. Past erosion has exposed a considerable portion of the outlet culvert.

Two rectangular concrete block structures (manholes) were observed at the toe of the dam near the right abutment contact. It was reported by members of the Council who accompanied the inspection team that one structure supplied access to a gate valve for the water supply line. The second structure was utilized to supply reservoir water to a mine shaft during past mining of the coal seam below the dam. The water was reportedly supplied to the mine through a borehole.

d. <u>Reservoir Area</u>. The watershed is covered mostly with moderate to steep woodlands. The reservoir slopes to the south of the reservoir consist of an old refuse bank. It was reported by members of the Borough Council who accompanied the inspection team that a portion of the slope had slid into the reservoir several years ago. The reservoir surface area is relatively small, and the steep slopes to the south of the reservoir reportedly contain significant amounts of coal refuse. The area may be susceptible to landslides which could potentially affect the storage volume of the reservoir and overtopping of the dam by displacing water if the slopes should slide into the reservoir.

e. <u>Downstream Channel</u>. The downstream channel for the Cokeburg Water Supply Dam consists of a tributary to the South Branch of Pigeon Creek. A small business establishment is located approximately 1,000 feet downstream of the dam.

3.2 <u>Evaluation</u>. In general, the Cokeburg Water Supply Dam and appurtenant structures are in a seriously deteriorated condition. Maintenance of the dam and operating facilities is considered very poor. Major erosion was observed in the area of the outlet culvert for the spillway. The outlet culvert is in a seriously deteriorated condition. Caving in at the outlet of the culvert partially blocks the outlet. Brush and debris exist in the area of the outlet. No seepage was observed on the downstream slope or along the toe of the dam, although the structure has a history of seepage and settlement. No settlement areas were observed during the inspection.

SECTION 4 OPERATIONAL PROCEDURES

4.1 <u>Procedures</u>. The water level is maintained at the spillway crest elevation, 1072. Water is drawn from the reservoir to supply water requirements for the Borough of Cokeburg.

4.2 <u>Maintenance of the Dam</u>. No planned maintenance schedule exists for the dam. The embankment slopes are covered with brush and small trees which hampered the visual inspection.

4.3 <u>Maintenance of Operating Facilities</u>. No planned maintenance program exists for the operating facilities.

4.4 <u>Warning System in Effect</u>. There is no warning system in effect to warn downstream residents of large spillway discharges or imminent failure of the dam.

4.5 <u>Evaluation</u>. The maintenance of the dam and operating facilities is considered poor. The structure is in a seriously deteriorated condition. Trees and brush exist on the embankment slopes, and debris partially blocks the spillway outlet channel. The outlet culvert is caving in and erosion at the outlet is evident.

There is no warning system in effect at the dam. An emergency action plan should be available for every dam in the high and significant hazard category. Such plans should outline actions to be taken by the operator to minimize downstream effects of an emergency and should include an effective warning system.

SECTION 5 HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. <u>Design Data</u>. No calculations or design data pertaining to the hydrology or hydraulics associated with the dam were available.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillway reportedly has functioned adequately in the past.

c. <u>Visual Observations</u>. The spillway appeared to be in poor condition. A chain link fence surrounds the crest of the drop inlet structure. The fence has the potential to block inflow to the drop inlet, since debris could collect on the fence. The spillway discharge culvert is caving in at the outlet and the outlet is partially blocked.

The low spot on the top of dam (1075.0) was noted as existing near the left abutment of the structure.

d. <u>Overtopping Potential</u>. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.C. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable completion of the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. The pool level in the reservoir prior to the storm was assumed to be at the spillway crest elevation, 1072.0.

2. The top of dam was considered the low spot at elevation 1075.0.

3. The chain link fence which surrounds the intake to the drop inlet was ignored during the analysis. Debris could collect on the fence and block inflow to the drop inlet. 4. The embankment soils appeared to be highly susceptible to erosion; and based on the evaluating engineers judgement, a pool elevation of 1076.0 was sufficient to cause failure by overtopping.

5.3 <u>Summary of Overtopping Analysis</u>. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	2620	cfs
Spillway capacity	750	cfs

a. <u>Spillway Adequacy Rating</u>. The Spillway Design Flood is based on the hazard and size classification of the dam. The recommended Spillway Design Flood (SDF) for a small size dam is in the range of 1/2 PMF to PMF. The Spillway Design Flood for this dam was selected to be the PMF based on the downstream potential for loss of life. Based on the following definition provided by the Corps of Engineers, the spillway is rated as seriously inadequate as a result of our hydrologic analysis. The spillway and reservoir are capable of controlling less than 30% of the PMF without overtopping the embankment.

Seriously inadequate - All high hazard dams not capable of passing 50% of the Spillway Design Flood (PMF) and where there is a significant increase in the downstream hazard potential due to dam failure from that which exists prior to the failure.

5.4 <u>Summary of Dam Breach Analysis</u>. As the subject dam cannot satisfactorily pass 50% of the PMF, it was necessary to perform a dam breach analysis and downstream routing of the flood wave. This analysis determines the degree of increased flooding due to dam failure. The results of the dam breach analysis indicate that downstream flooding is significantly increased. Since flooding downstream is significantly increased due to dam failure, the spillway is considered seriously inadequate. The Cokeburg Water Supply Dam is classified as an unsafe, non-emergency structure. Input data for the HEC-1 dam breach program appear in Appendix D.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. <u>Visual Observations</u>. The inspection of the Cokeburg Water Supply Dam revealed several deficiencies which were considered as having a significant affect on the stability of the structure. Coke ovens were observed on the downstream slope near the left abutment of the structure. The coke ovens were open. The openings to the coke ovens were not sealed, and the potential exists for the fill material within the ovens to erode out of the openings. The existence of the coke ovens is verified by a 1919 Water Supply Commission inspection report. The potential exists for settlement of the material in the ovens, and the structures could collapse and cause settlement of the embankment. Information in the DER files suggest that some settlement has occurred near the right abutment of the structure. It is unclear as to the date associated with the settlement.

The outlet for the spillway discharge culvert is collapsing and debris partially blocks the outlet. The condition of the culvert outlet appears to be due to erosion and settlement in the area of the outlet.

No major erosion or settlement was observed on the embankment crest during the inspection. No seepage was observed on the downstream slope or along the toe of the embankment. Seepage estimated at 2 to 3 GPM was observed on the left interior wall of the culvert near the inlet. The upstream and downstream slopes contain considerable brush and trees. The existence of the trees on the embankment slopes increases the potential for the development of erosion cavities and slides.

b. <u>Design and Construction Data</u>. No design or construction data are available. Limited information is available in the DER files relative to the general characteristics of the site during various periods leading up to the present day facility. No known stability analysis exists for this dam.

c. Operating Records. No operating records are maintained.

d. <u>Post Construction Changes</u>. No post construction changes are known to have occurred at the dam in the recent past.

e. <u>Seismic Stability</u>. The dam is located in seismic zone 1. No seismic stability analyses are known to have been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. The conditions as previously discussed in Section 6.1a indicate that the static stability of the structure is questionable with regards to minimum factors of safety associated with current criteria.

SECTION 7 ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. <u>Safety</u>. The dam appears to be in poor condition and poorly maintained. The stability of the structure is questionable due to the existence of coke ovens in the downstream slope of the embankment and failure of the brick wall. The possibility also exists that erosion cavities exist within the embankment and could lead to potential piping of the structure or settlement of the embankment which would increase the potential for overtopping failure. Considerable erosion and/or settlement has occurred near the outlet of the spillway discharge culvert. The interior walls of the culvert at the outlet are caving in and debris partially blocks the outlet. Portions of the reservoir slopes may contain coal refuse which could lead to potential landslides affecting the storage and volume of the reservoir. During periods of heavy precipitation, a potential landslide could occur increasing the possibility for overtopping of the structure.

The structure has a past history of seepage, although no seepage was observed on the downstream slope or along the toe area of the structure during the inspection. Seepage estimated at 2 to 3 GPM was observed on the left interior wall of the culvert, at the inlet.

The visual observations, review of available data, hydraulic and hydrologic calculations and the past operational performance of the structure indicate that the Cokeburg Water Supply Dam's spillway is seriously inadequate. The spillway is capable of controlling 30% of the PMF without overtopping the embankment. No known stability analysis have been performed for this structure. The dam is an unsafe, non-emergency structure.

b. Adeqacy of Information. Sufficient information is available to complete a Phase I report.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. <u>Necessity for Further Investigation</u>. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required.

7.2 Recommendations/Remedial Measures.

1. A detailed stability and seepage analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction and should be conducted in conjunction with a detailed hydraulic and hydrologic analysis of the structure to increase the spillway capacity and to document the stability of the structure.

2. The fence which surrounds the inlet for the spillway should be removed. The location and type of fence is such that it may reduce the spillway capacity by collecting debris. The fence apparently serves as a security measure against injury to unauthorized personnel who may frequent the site. Other security measures should be implemented, and a trash rack provided, which does not hamper the capability of the spillway to discharge excess inflow to the reservoir.

3. The discharge culvert outlet for the spillway is caving in and debris partially blocks the outlet. The debris should be removed from the outlet, and the area immediately beyond the outlet and the walls of the culvert should be repaired.

4. The owner should make an evaluation to determine the extent of subsurface mining beneath the dam and its possible effects relative to subsidence.

5. The vegetation on the slopes of the structure should be removed under the direction of a professional engineer knowledgeable in dam design and construction to insure that removal of the vegetation does not adversely affect the stability of the structure.

6. It should be ascertained whether the 6" diameter water line which serves as the feed line for the water supply system is capable of serving as a drainline for the reservoir. If it is determined that the line is capable of serving as a drainline, some means of positive upstream closure of the line should be provided. If the line is determined unsuitable as a drainline, an upstream closure should be provided, or the line should be abandoned, and plugged; and some alternate method devised to drain the reservoir.

7. An investigation should be conducted to determine the type of material which forms the slopes immediately adjacent to the reservoir. The investigation should include the potential for the material to slide into the reservoir, thus reducing the storage potential of the reservoir and the potential for overtopping.

8. A safety inspection program should be implemented with inspections at regular intervals by a qualified personnel.

9. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

10. A regularly scheduled maintenance program should be prepared and implemented to insure the continued safe operation of the facility.

APPENDIX A CHECKLIST, VISUAL INSPECTION, PHASE I

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CHECK LIST VISUAL INSPECTION PHASE I STATE Pennsylv STATE Pennsylv

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		Cokeburg Water		Uachinuton	crark Pennsylvania In# 1094
NAME OF I	DAM _	Supply Dam	COUNTY .	100 9111160M	
TYPE OF 1	DAM .	Earthfill	[HAZARD CATECORY High
DATE(s)	INSPI	ECTION November 5, 1980	WEATHER	Clear and cool	TEMPERATURE 35°

None M.S.L. TAILWATER AT TIME OF INSPECTION _ M.S.L. POOL ELEVATION AT TIME OF INSPECTION 1071.2

INSPECTION PERSONNEL:

A-1

RECORDER R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates <u>Lee Karpoff, Council President - Cokeburg Borough Council</u> Mr. Michael Megles - Cokeburg Borough Councilman Mr. Charles Pscolka - Cokeburg Borough Councilmau James T. Hockensmith - L. Robert Kimball and Associates 0.T. McConnell - L. Robert Kimball and Associates 0.T. McConnell

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	None noted.	
SURFACE CRACKS		
	•	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Considerable erosion and/or settlement at outlet for spillway culvert.	The outlet is caving in and should be repaired.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Considerable erosion at the toe of the downstream slope adjacent to the left abutment in the area of the spillway outlet culvert.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No signs suggesting settlement or movement of the embankment noted during the inspection.	
RIPRAP FAILURES	No riprap on the upstream slope. Minor erosion observed.	

A-2

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETAT ION	Considerable vegetation on the upstream and downstream slopes.	Vegetation should be removed.
JUNCTION OF ENBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No deficiencies observed.	
ANY NOTICEABLE SEEPAGE	Minor seepage observed on the left interior wall of the spillway discharge culvert at the inlet. Seepage flow estimated at 2 to 3 gallons per minute.	
STAFF CAUCE AND RECORDER	None.	
DKA I NS	None.	

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CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not applicable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not applicable.	
DRAINS	Not applicable.	
WATER PASSAGES	Not applicable.	
FOUNDATION	Not applicable.	

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CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
STNIOL HTILONOM	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

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VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The outlet conduit is in a deteriorating condition and the outlet is caving in. Debris partially blocks the outlet.	n The outlet culvert should be repaired and debris removed at the outlet.
INTAKE STRUCTURE	Appeared to be in good condition except for a fence which surrounds the crest.	The fence should be removed since it hampers the capability of the spillway to discharge excess inflow
OUTLET STRUCTURE	Outlet structure constructed of masonry rubble with mortar. Outlet for the culvert is caving in.	to the reservoir.
OUTLET CHANNEL	Natural stream at outlet, debris exists in the channel.	The debris should be removed from the outlet channel.
EMERGENCY GATE	Gate valve on 6" water supply feed line. The control valve is located in a manhole at the downstream toe of the dam.	The valve was not operated during the inspection.

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Sector Sector

UNGATED SPILLMAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Semi-broad crest. Concrete appeared to be in good condition. A chain link fence surrounds the intake inlet.	The fence should be removed.
APPROACH CHANNEL	Lake, restricted by chain link fence.	
DISCHARGE CHANNEL	Masonry rubble culvert with concrete channel bottom to natural stream.	
BRIDGE AND PIERS	None.	

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GATED SPILLWAY

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VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNE'.	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

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DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel for the Cokeburg Water Supply Dam consists of a natural stream to a tributary of the South Branch of Pigeon Greek. The channel below the spiilway outlet culvert is partially blocked.	The debris blocking the channel should be removed.
SLOPES	Channel slopes appear to he stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	One small business is located approximately 1,000 feet downstream of the dam. The population would consist of employees at the business. Population estimated at 6 to 8 people.	

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RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
STOPES	Moderate to steep. Slopes may be formed by mine refuse. Stability of the slopes is questionably	Slopes should be investigated e. and stability analyzed if necessary.
	llnknown.	
SEDIMENTATION		

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INSTRUMENTATION

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VISUAL EXAMINATION OF	OBSERVATI ONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
P I EZOMETERS	Vone.	
OTHER	None.	



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APPENDIX B CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

ITEM AS-BUILT DRAWINGS AS-BUILT DRAWINGS REGIONAL VICINITY MAP REGIONAL VICINITY MAP CONSTRUCTION HISTORY TYPICAL SECTIONS OF DAM TYPICAL SECTIONS OF DAM OUTLETS - PLAN - DETAILS	CHECK LIST ENCINEERING DATA DESIGN, CONSTRUCTION, OPERATION PHASE 1 REMARKS None available. U.S.G.S. 7.5 minute Elisworth quadrangle. U.S.G.S. 7.5 minute Elisworth quadrangle. Ifmited information available in DER files. See Appen Approximate sketch in DER files. See Appen None. None. None.	Cokeburg Water NAME OF DAM Supply Dam ID# PA 1094 dix D.
- DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None.	

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ITEM	KEMARKS	
DESIGN REPORTS	None.	
GEOLOCY REPORTS	None.	
DESIGN COMPUTATIONS HYDROLOCY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None known to exist.	
MATERIALS INVESTICATIONS BORING RECORDS LABORATORY FIELD	IInknown.	
POST-CONSTRUCTION SURVEYS OF DAM	None known to have occurred.	
BOKKOW SOURCES	Hakaowa.	

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None known to have occurred in the recent past.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None known to have existed.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Information in the DFR files suggest that past settlement has occurred at the structure. No major failure to the structure reported due to the settlement.
MA I NTENANCE OPERATION RECORDS	Nou.

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APPENDIX C PHOTOGRAPHS

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COKEBURG WATER SUPPLY DAM PA 1094

Sheet 1

Front

(1)	Upper	left	-	View of upstream slope and left abutment.
(2)	Upper	right	-	View of upstream slope, embankment crest
				and right abutment.
(3)	Lower	left	-	View of the spillway intake structure.
(4)	Lower	right	-	View of seepage along the culvert wall
				directly inside the entrance to the
				culvert.
Back				
(5)	Upper	left	-	View of the approach to the spillwav
				culvert.
(6)	Upper	right	-	View of drop inlet section of spillway.
(7)	Lower	left	-	View of the outlet for the discharge
				culvert. Note the deterioration and
				collapse of the walls near the outlet.
(8)	Lower	right	-	Partial view of the downstream slope
				directly above the spillway discharge
				culvert. Note the deterioration of the
				coke oven structure and the obvious void

directly inside the oven entrance.

Sheet 2

Front

(9)	Upper	left -	View along the top of the outlet culvert.
			View from the crest looking down onto the
			top of the culvert. Note the erosion
			along the edges of the culvert.
(10)	Upper	right -	Downstream slope. View towards the left
			abutment.
(11)	Lower	left -	View of control valve which regulates
			flow to a borehole to a mine shaft
			located some distance below the
			embankment.

(12) Lower right - Downstream exposure.



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APPENDIX D HYDROLOGY AND HYDRAULICS

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APPENDIX D HYDROLOGY AND HYDRAULICS

<u>Methodology</u>. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Satety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. <u>Precipitation</u>. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 33" prepared by the U.S. Weather Bureau.

The index rainfall may be reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the commputer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

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3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed for each reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used is outlet controls in the routing.

The hydraulic capacity of the outlet works can either be alculated and input, or sufficient dimensions input, and the program will alculate in elevation discharge relationship.

Storige in the pool area is defined by in area - elevation relationship from which the computer calculates storige. Surface areas are either planimetered from available mapping or U.S.G.S. (7.) minute series topographic maps or taken from reasonably accurate design lata.

→. <u>Dam Overtopping</u>. Using given percentages of the PMF, the computer program will calculate the percentage of the PMF, which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Preand post failure water depths are calculated at locations where crosssections are input.

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NAME - F DAM: Cokeburg water signal as

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- Snyder Hydrogrups
- Parameters 2 mg (2) 2 p (3) 2 c (3) 1 (miles) (4) 2 c (miles) (4) 2
- Spillway Data Grest Length (tt) 40 Freeboard (ft) 5. Discharge Coefficient NA Exponent NA
- (1)Hydrometeorological Report 33 (Figure 1), ..., whither bureau and U.S. Army Corp of Engineers, 1956.
- (2)Hydrological zone defined by Corps of Englageers, Baltamare District, for determining Snyder's coefficients of and
- (3)Snyder's Coefficients.

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(4)L=Length of longest water course from outlet to be a solution. Lea=Length of water course from outlet to potht opposite two centroid of drainage area.

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CHECK LIST HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

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APPENDIX F GEOLOGY

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General Geology

The Cokeburg Water Supply Dam is located in the Pittsburgh Plateaus Section of the Appalachian Plateaus Province. This section typically consists of rounded hills and ridges formed through the erosion by streams of a former plain-like area. In the study area, the ridges are more definite and folds are broader than elsewhere. The sediments are deformed by several sub-parallel secondary folds which are superimposed upon a major spoon-shaped trough of first magnitude in southwestern Pennsylvania and adjacent regions. The axes of these folds trend about N30-50° E, plunging gently southward. The Cokeburg Water Supply Dam lies on the northwest limb of the Waynesburg Syncline, striking to the northeast. The strata dip gently, $1-2^\circ$, to the southeast. No major faulting is noted in the area.

The dam is underlain by strata of the lower and middle members of the Waynesburg Formation of Lower Permian and Upper Pennsylvanian Age. This formation is made up of alternating beds of shale and sandstone with many thin coal seams and discontinuous limestone beds. The dam is underlain in part by the Waynesburg A Coal Seam and by argillaceous limestones separated by siltstone and sandstone in places. In general, the Washington Formation is a poor producer of water, with the exception of its basal member, the Waynesburg Sandstone.

The Cokeburg Water Supply Dam is located in the Main Bituminous Coal Field. Principal coal beds which underly the dam are the Waynesburg "A", Waynesburg, and Pittsburgh, in decending order. The Waynesburg "A" coal has a thickness range of 14-28 inches. The Pittsburgh coal is about 440 feet beneath the dam and has been mined out (1964). These beds and several other coal beds of local economic value exist beneath the strata in the vicinity of the dam. Mine dumps are located to the north, east and west of the dam site.

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GEOLOGIC MAP OF THE AREA AROUND CHAMBERS DAM, COKEBURG WATER SUPPLY DAM AND BENTLEYVILLE DAM

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