Documentation of Initial Hazard Potential Classification Assessment

GMF Pond
Coffeen Power Station
Montgomery County, Illinois

Prepared for:
Dynegy

October 12, 2016

Stantec Consulting Services Inc.
Design with community in mind
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Executive Summary

This report documents the hazard potential classification assessment for the GMF Pond at the Coffeen Power Station as required per the CCR Rule (Reference 1) in 40 C.F.R. § 257.73(a)(2). The applicable hazard potential classifications are defined in the CCR Rule 40 C.F.R. § 257.53 as follows:

> (1) High hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.
>
> (2) Significant hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.
>
> (3) Low hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

Based on these definitions and the analysis herein, the GMF Pond is classified as a High hazard potential CCR surface impoundment.

This report contains supporting documentation for the hazard potential classification assessment. The hazard potential classification for this CCR unit was determined by review of a previous breach analysis. The review was conducted by Stantec in September, 2016.

1. Introduction

1.1. Background

The CCR Rule was published in the Federal Register on April 17, 2015. The Rule requires that a hazard potential classification assessment be performed for existing CCR surface impoundments that are not incised. A previously completed assessment may be used in lieu of the initial assessment provided the previous hazard assessment was completed no earlier than April 17, 2013. The applicable hazard potential classifications are defined in the CCR Rule 40 C.F.R. § 257.53, as follows (Reference 1):

High Hazard Potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.

Significant Hazard Potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

Low Hazard Potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

Dynegy has contracted Stantec Consulting Services Inc. (Stantec) to prepare hazard potential classification assessments for selected impoundments.[1]

It was determined that there is existing available hazard potential classification assessment documentation for the GMF Pond.

1.2. Location

The Coffeen Power Station is located in Montgomery County, Illinois approximately 1.5 miles south of Coffeen, Illinois. The plant is located on the east bank of Coffeen Lake, which is an impoundment created by Coffeen Lake Dam. The GMF Pond is located northeast of the power station. A site overview figure is included in Appendix C.

2. Source Data

The following information was used to perform the hazard assessment of the GMF Pond.

[1] Dynegy Administrative Services Company (Dynegy) contracted Stantec on behalf of the Coffeen Energy Center owner, Ilinois Power Generating Company. Thus, Dynegy is referenced in this report.

2.1. GIS DATA

Geographic Information Systems (GIS) data was collected for use in this study, including:

- Aerial Imagery obtained from 2015 NAIP Imagery Server (Reference 2);
- Streets obtained from the US Census Bureau, 2015 TIGER Roads layer (Reference 3);
- 1/3 Arc Second Digital Elevation Model (DEM) obtained from the United States Geological Service (USGS) National Map (Reference 4).

2.2. Record Documents

Dynegy provided the following Coffeen Power Station documents that were utilized in this assessment:

- Hanson Professional Service Inc., Breach Analysis for Coffeen Gypsum Stack Dam (2007) (Reference 5);
- Coffeen Lake Dam Emergency Action Plan (EAP), initially prepared by Hanson Professional Services Inc. (2008) and amended by Dynegy Operating Company (2014) (Reference 6).

3. Previous Analysis

3.1. Background

Stantec was provided previous assessment documentation by Dynegy for the GMF Pond and reviewed it for applicability of use for hazard classification determination per CCR Rule requirements (see Section 3.2). The previous assessment documentation includes a breach analysis prepared in 2007 by Hanson Professional Services Inc. (Hanson) for purposes of providing a recommended hazard classification per Illinois Department of Natural Resources Office of Water Resources (IDNR-OWR) guidelines.

The IDNR-OWR currently lists the GMF Pond as Class I, however there has not been a certified assessment provided or found from which this rating was made official. It is assumed that a Class I recommendation was provided from the former owner (Ameren Energy Generating Company) to IDNR per the previous assessment.

3.2. Applicability for Hazard Classification Determination

In order to summarize the previous analysis and document changes since the analysis, Stantec prepared a summary checklist (included as Attachment A). Stantec also prepared a flowchart (included as Attachment B) which served to identify changes that have occurred since the previous analysis and the impacts of

those changes on the hazard assessment. The flowchart was used to determine a path forward for the hazard assessment of the GMF Pond. A site overview figure is also included for reference as Attachment C.

The steps in the flowchart were reviewed as follows;

1) Is the structure an impoundment (per the CCR Rule Definition)? Yes (as determined by Dynegy);

2) Is the impoundment incised? No;

3) Has a previous hazard potential classification assessment been performed? Yes;

4) Is the analysis used to determine the hazard potential classification suitable for that purpose? Yes;

5) Have there been changes to the spillway(s), crest elevations or extents, storage volumes or downstream areas since the previous analysis that would impact the previous analysis or results? No;

6a) Is there survey or as-built information for the changed condition? N/A;

6b) Is the analysis used to determine the hazard potential classification suitable for that purpose? Yes.

The path forward identified on the flowchart is to create a hazard potential classification assessment referencing the previous breach analysis.

3.3. Review Summary

The previous assessment breach analyses utilized an approximate method of computing the inundation limits of gypsum slurry by computing a runout distance on a constant slope. The following parameters were used in the breach analyses; GMF gypsum stack was at its ultimate height (or final design height) of approximately 100 feet with a gypsum material volume of approximately 2,478 acre-feet, flat topography in the downstream areas, and breach outflow consisting of saturated gypsum material would act as non-Newtonian fluid. It was assumed that a breach of the earthen perimeter embankment would cause the saturated gypsum material to liquefy and release towards downstream areas in semi-circular pattern. The physical properties of saturated gypsum material and breach characteristics were based upon several referenced sources within the previous assessment. The breach was simulated at multiple locations along the earthen perimeter dike and the corresponding results were used to create inundation maps. The inundation maps depict two inundations limits; a 10 foot inundation depth area and a 5 foot inundation depth area. There are a total of 12 potentially impacted structures (11 residential) within the 5 foot inundation depth area. Resultant inundation extents

provided by the existing breach analysis indicate that a breach failure near the northwest corner of the GMF Pond perimeter dike would inundate eight occupied structures, seven being residential structures and one being a facility belonging to US Minerals. Three of the residences are located along County Rd 1575 E, another three on Fox Ln, and the final residence on Cips Trail just west of the US Minerals property. The existing breach analysis inundation maps also indicate that a breach to the east would inundate two residential structures along Red Ball Trail/County HWY 9 and a breach to the south would inundate frequently occupied Coffeen Power Station facilities. The hazard potential classification recommended based on the breach analysis was Class I per IDNR-OWR guidelines, which is equivalent to a High Hazard Classification as defined in the CCR Rule.

4. Conclusion

The breach analysis in the previous assessment documentation provided was found applicable for hazard potential classification determination per CCR Rule requirements. Inundation limits and depths from the existing breach analysis were evaluated for potential impacts on property and structures and the potential risk to human life. The existing breach analysis results indicate a probable threat to human life at nearby occupied residential structures and Coffeen Power Station facilities.

Due to the probable threat to human life, the impoundment fits the definition for a High hazard potential CCR surface impoundment (as defined in the CCR Rule §257.53) (Reference 1).

5. References

1. US Environmental Protection Agency. (2015). *Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR § 257 and § 261* (effective April 17, 2015).

2. NAIP Imagery Service. (2015). Illinois 1-meter resolution.

3. US Census Bureau. (2015). *TIGER Roads*.

4. USGS National Map. *1/3 Arc Second DEM*.

5. Hanson Professional Service Inc. (2007). *Breach Analysis for Coffeen Gypsum Stack Dam*.

6. Hanson Professional Service Inc. (October, 2010). *Coffeen Energy Center, Emergency Action Plan, Gypsum Stack Dam.* Amended by Dynegy Operating Company. (March, 2014).

Appendix A

Summary Checklist

Hazard Classification Potential Assessment Worksheet

The purpose of this document is to summarize the previous hazard assessment and analysis. One sheet will be prepared for each impoundment or landfill where there is a need for a hazard classification assessment.

Section 1.0 -- Previous Analysis Summary

Facility Name:	Coffeen Power Station
Unit:	GMF Pond
Location:	Coffeen, Illinois
Current Hazard Potential Classification:	Class I (High-Hazard) per IDNR-OWR
Date of Most Recent Assessment:	2007
Hydrologic Modeling Previously Performed:	Unknown
Hydraulic Modeling Previously Performed:	2007 (slurry breach flow of Gypsum Stack)
Inundation Mapping Prepared? (Y/N)	Y
Title of Previous Assessment Report(s):	Breach Analysis for Coffeen Gypsum Stack Dam. Hanson Professional Services Inc. (2007).
	Coffeen Energy Center Emergency Action Plan (EAP) Gypsum Stack Dam. Initially Prepared by Hanson Professional Services Inc. (October 2010). Amended by Dynegy Operating Company (March 2014).

Notes:

The 2007 Breach Analysis used the following breach parameters; stack was set at ultimate height (or final design height) of approximately 100 feet, breach considered in all directions with a breach at northwest portion of stack towards highest concentration of residences being the most critical, stack material and pond water included in slurry breach flow runout estimate, and slurry breach flow runout estimate calculated to travel 3,775 feet at an inundation depth of 5 feet or greater. The 2014 EAP lists residences within the inundation area identified in the 2007 Breach Analysis.

Section 2.0 -- Previous Modeling Inputs and Assumptions

Hydrologic Data

Topographic Data used to delineate watersheds:	Unknown
Breach Location(s):	Perimeter Earthen Embankment (analyzed breach in all directions)
Crest Elevation:	Approximately 720 feet (or 100-feet above surrounding grade)
Normal Pool Water Surface Elevation:	Unknown
Hydrographic Data used for Stage/Storage development:	Unknown
Principal Spillway Description/Elevations:	Unknown
Emergency Spillway Description/Elevations & source of information:	Unknown
Scenarios Modeled (i.e. Sunny Day, PMP, etc.):	It was assumed that the Gypsum Stack would impound approx. 2,478 acre-ft of material at its final design height of 100-feet and that in a breach scenario the entireity of the volume would be Gypsum in a saturated-state and flow as a non-Newtonian fluid. Unknown if a rainfall event was included as part of the breach analysis.
Survey date bridges, structures	Unknown.

Hydraulic Data

Topographic Data used to develop hydraulic model:	Unknown.
Boundary Condition Assumption:	Unknown.

Downstream Inundation Area

Inundation Mapping Performed?	Yes
Topographic Data used for Inundation Mapping	Unknown. It does not appear that topographic data was utilized when delineating the inundation extents.
Structures of concern identified in inundation area	522 CIPS Trail (Currently unoccupied)
	Andrew & Ruth Ann Theriac and grandson, Heath
	688 CIPS Trail (Currently unoccupied)
	Aimee Coatney
	Richard & Deborah Kent and son, Jarad
	Drury & Verna Emerson
	George Mayer
	U. S. Minerals (Mgr. – Eric White)
	Jackie Combs
	Jeffrey Combs
	Jennifer Huston
	32 Ash Lane (Currently unoccupied)

Other Assumptions:

Assumed the surrounding grade was relatively flat. Also, assumed that a breach towards the Coffeen Lake (southwest direction) would not significantly impact lake levels.

Section 3.0 -- Changes Since Previous Analysis

Impoundment Changes (if answer to any of these is "yes" - please add an explanation)

Has the containment dike been raised/lowered? (Y/N)	N/A - The breach analysis was based off of final stack design elevations that were determined prior to construction. The current stack height is nearly all incised at an elevation of approximately 626 feet.
Have inflows into the pond changed?	No
Have the spillways been modified? (Y/N)	No
Has the normal pool level of the impoundment changed? (Y/N)	No
Has the storage volume within the pond changed significantly? (Y/N)	N/A - as breach volume used was based on final design conditions.

Downstream Reach Conveyance Changes (if answer to any of these is "yes" - please add an explanation)

Has the water level for the receiving stream/area changed?	No

-Examples include downstream dam modification, change in dam operations, and new hydraulic studies
-Applicable for streams where the breach invert, downstream tailwater elevation, or downstream boundary condition was set based on an assumed water elevation for the receiving stream:

Has the receiving stream/area been modified significantly?	No

-Examples include channelization, channel lining, dredging, fill in the stream, significant sedimentation

Have downstream road crossings (bridges and culverts) been added/modified/removed?	No
Has the receiving stream/area ground cover changed significantly?	No

-Example clearing of vegetation or planting of new vegetation in a large area.

Are there any new obstructions in the floodplain?	No
Have levees/dikes been added/modified/removed from the floodplain?	No

Development in Downstream Area (if answer to any of these is "yes" - please add an explanation)

Is there new development within the downstream inundation area?	No

-Examples include new residences, businesses, public buildings, campgrounds, etc.

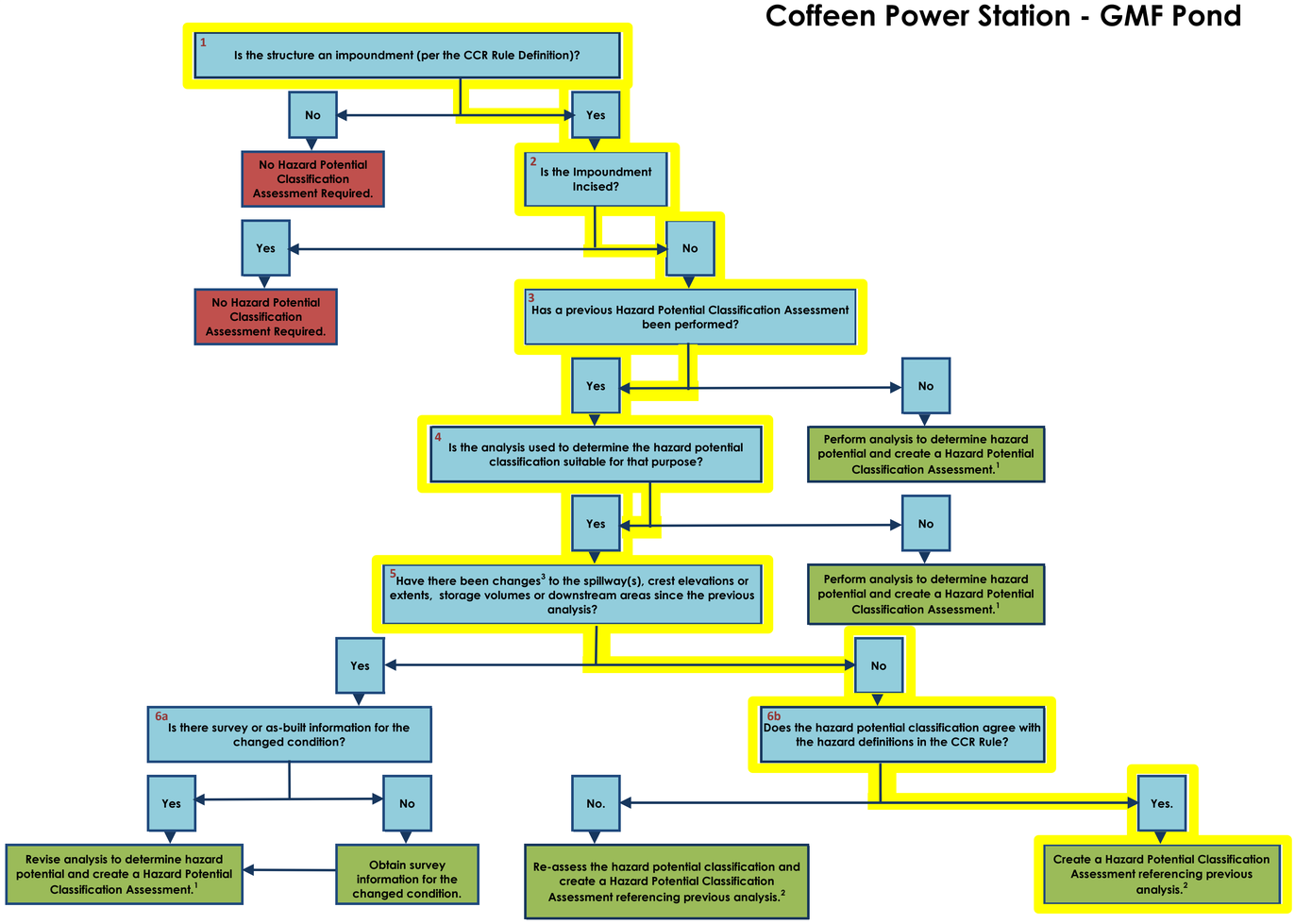
For impoundments previously identified as impacting a downstream structure, has the impacted structure(s) been removed since the previous analysis?	No

Notes:

Appendix B

Flowchart

Flow Chart for Completing Hazard Potential Classification Assessments per CCR Rule
Coffeen Power Station - GMF Pond



Legend

- 1 — Decision
- Decision Path Followed
- No further action required
- Further action is required

Definitions:

CCR Impoundment: natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR.

Incised CCR Impoundment: CCR surface impoundment which is constructed by excavating entirely below the natural ground surface, holds an accumulation of CCR entirely below the adjacent natural ground surface, and does not consist of any constructed dike portion.

Hazard Potential Classification means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances. The hazardous potential classifications include high hazard potential CCR surface impoundment, significant hazard potential CCR surface impoundment, and low hazard potential CCR surface impoundment, which terms mean:

High Hazard potential CCR surface impoundment: diked surface impoundment where failure of mis-operation will probably cause loss of human life.

Low hazard potential CCR surface impoundment: diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

Significant hazard potential CCR surface impoundment: diked surface impoundment where failure or misoperation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

Notes:

"analysis" refers to the basis of the hazard potential classification, which could include breach modeling or a visual assessment.

"classification" refers to the determination of the hazard potential classification.

"assessment" refers to the letter/report that will be generated for each impoundment to meet the CCR rule anddocuments the hazard potential classification. The letter/report will be certified by a PE.

[1] See report outline for hazard potential classification assessments for impoundments using a new or updated analysis.

[2] Document in a summary letter which will serve as the new Hazard Assessment.

[3] Engineering judgement should be used to determine whether the changes are significant enough to impact the analysis. Consideration should be given to whether the hazard potential is likely to change and to whether the inundation extents used in the EAP are likely to change.

Appendix C

Site Overview Figure

Notes

1. Coordinate System: NAD 1983 StatePlane Illinois West FIPS 1202 Feet
2. Aerial Source: 2015 NAIP Imagery
3. Impoundment Boundaries Provided by Client (Dated 9/9/2015)

Stantec DYNEGY

Project Location
Latitude: 39.059113
Longitude: -89.403293
Montgomery County, Illinois

175666013
Prepared by PV on 2016-10-05
Technical Review by NS on 2016-10-05
Independent Review by MM on 2016-10-05

Client/Project
Dynegy
Coffeen Power Station
Hazard Potential Classification Assessment

Figure No.
C.1

Title
Site Overview Figure
GMF Pond
Coffeen Power Station

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