

6.3 Chemistry/Radiation Protection Building

6.3.1 Summary of Chemistry/Radiation Protection Building

Baseline information for the Chemistry/Radiation Protection (CARP) Building is provided in Section 2.0, Site History, Description, and Baseline Condition.

The CARP Building is located inside of the PA, directly north of the Auxiliary Building, Turbine Building, Maintenance Shop, and Technical Support Center. The building's primary function is to provide controlled access to and from the Auxiliary Building and Containment. Access support groups such as Radiation Protection (RP), As Low As Reasonably Achievable (ALARA), and Chemistry are located in this building as well as employee locker rooms.

From field observations and a review of plans provided by OPPD, the CARP Building is an L-shaped steel-framed structure on a shallow foundation. Building dimensions are approximately 245 ft on the north by 109 ft on the west by 40 ft on the east. Access to surrounding buildings is achievable through corridors. The CARP Building is bordered by the cafeteria and office addition on its north, the Maintenance Shop on its east, and the Auxiliary Building, Turbine Building, and Technical Support Center on its south. The CARP Building is exposed on only its west side.

Shallow spread and isolated footings support the single-story superstructure, which is composed of steel framing. The roof is comprised of steel joists supporting metal roof decking. Exterior cladding on the building's west is composed of precast concrete wall panels. Interior walls shared with adjacent structures are cast-in-place reinforced concrete, precast concrete, or masonry walls.

6.3.2 Inputs/References Supporting the Analysis

Table 6.3-1 lists references provided by OPPD and other documents used to support HDR's analysis.

Document Title	OPPD Document Number (if applicable)	Date	Page Number(s)
CARP/Locker Addition Facility Foundation Plan East Area	7753-04-A-104 (#46868)	5/11/1989	
CARP/Locker Addition Facility Foundation Sections & Details Sheet 1	7753-04-A-105 (#46869)	5/11/1989	
CARP/Locker Addition Facility Foundation Sections & Details Sheet 2	7753-04-A-106 (#46870)	5/11/1989	
CARP/Locker Addition Facility Sections & Details Sheet 1	7753-04-A-118 (#46880)	5/11/1989	
CARP/Locker Addition Facility Sections & Details Sheet 2	7753-04-A-119 (#46881)	5/11/1989	
CARP/Locker Addition Facility Sections & Details Sheet 3	7753-04-A-120 (#46882)	5/11/1988	

Detailed site observations—field reports, field notes, and inspection checklists—for the CARP Building are provided in Attachment 8.

Observed performance and pertinent background data are as follows:

- The CARP Building was protected from floodwater by an Aqua Dam for the majority of the 2011 flood; however, the Aqua Dam failed for a short period of time because it was damaged, which allowed floodwater to enter the area inside the perimeter of the Aqua Dam. Approximate river elevation during the period of the breach was 1006 ft, which was 1 ft below the slab elevation of the CARP Building.

6.3.3 Assessment Methods and Procedures

6.3.3.1 Assessment Procedures Accomplished

Assessments of the CARP Building included the following:

- A visual inspection of perimeter rooms on the lowest level.
- A visual inspection of the exterior wall on the west side.
- An assessment of survey data collected to date.
- A review of as-built building plans to determine possible weak points in the building's construction that could be affected by the flood.
- Results of geophysical investigation by Geotechnology (see Attachment 6C).
- Results of geotechnical investigation by Thiele Geotech (see Attachment 6A).

6.3.3.2 Assessment Procedures Not Completed

No additional assessment procedures were identified for the CARP Building.

6.3.4 Analysis

Identified PFMs were initially reviewed as discussed in Section 3.0. The review considered the preliminary information available from OPPD data files and from initial walk-down observations. Nineteen PFMs associated with eight different Triggering Mechanisms were determined to be "non-credible" for all Priority 2 Structures, as discussed in Section 3.6. The remaining PFMs were carried forward as "credible." After the design review for each structure, the structure observations, and the results of available geotechnical, geophysical, and survey data were analyzed, a number of CPFMs were ruled out as discussed in Section 6.3.4.1. The CPFMs carried forward for detailed assessment are discussed in Section 6.3.4.2.

The following analysis of data was conducted for the CARP Building:

- Results of geophysical investigation by Geotechnology.

Seismic Refraction and Seismic ReMi tests performed around the outside perimeter of the power block as part of KDI #2 identified deep anomalies that could be gravel, soft clay, loose sand, or possibly voids.

- Results of geotechnical investigation by Thiele Geotech.

Six test borings were drilled, with continuous sampling of the soil encountered, to ground truth the Geotechnology seismic investigation results as part of the KDI #2 forensic investigation. Test bore

holes were located to penetrate the deep anomalies identified in the seismic investigation. The test boring data did not show any piping voids or very soft/very loose conditions that might be indicative of subsurface erosion/piping or related material loss or movement.

All of the SPT and CPT test results conducted for this Assessment Report were compared to similar data from numerous other geotechnical investigations that have been conducted on the FCS site in previous years. This comparison did not identify substantial changes to the soil strength and stiffness over that time period. SPT and CPT test results were not performed in the top 10 ft to protect existing utilities.

Data from inclinometers to date, compared to the original baseline measurements, have not exceeded the accuracy range of the inclinometers. Therefore, deformation at the monitored locations since the installation of the instrumentation has not occurred.

6.3.4.1 Potential Failure Modes Ruled Out Prior to the Completion of the Detailed Assessment

The ruled-out CPFMs reside in the Not Significant/High Confidence category and for clarity will not be shown in the Potential for Failure/Confidence matrix.

Triggering Mechanism 2 – Surface Erosion

CPFM 2a – Undermining shallow foundation/slab/surfaces

Reason for ruling out:

- Surface erosion was not observed near the CARP Building at the time of the site observations.

Triggering Mechanism 3 – Subsurface Erosion/Piping

CPFM 3a – Undermining shallow foundation/slab/surfaces (due to pumping)

Reasons for ruling out:

- No pumping occurred in close proximity to the CARP Building.
- No signs of degradation that could be attributed to this Triggering Mechanism and associated CPM were observed at the time of the site observations.

Triggering Mechanism 4 – Hydrostatic Lateral Loading (water loading on structures)

CPFM 4a – Overturning

CPFM 4b – Sliding

CPFM 4c – Wall failure in flexure

CPFM 4d – Wall failure in shear

CPFM 4e – Excess deflection

Reasons for ruling out:

- Distress to the structure that can be attributed to this Triggering Mechanism and associated CPFMs was not identified at the time of the site observations.

- The top-of-slab elevation is at 1007 ft, which is approximately the highest flood elevation. The differential height between the top of slab and the exterior grade surrounding the CARP Building is at most 3 ft and thus could create minimal hydrostatic lateral loading on the structure.
- The structure was protected from floodwater by an Aqua Dam for the majority of the 2011 flood. The CARP Building was subjected to floodwater when the Aqua Dam failed for a short period of time because it was damaged, which allowed floodwater to enter the area inside the perimeter of the Aqua Dam. The relative flood elevation during this time was at approximately 1006 ft, which is below the top-of-slab elevation and thus produced negligible hydrostatic lateral load on the structure.

Triggering Mechanism 5 – Hydrodynamic Loading

- CPFM 5a – Overturning
- CPFM 5b – Sliding
- CPFM 5c – Wall failure in flexure
- CPFM 5d – Wall failure in shear
- CPFM 5e – Damage by debris
- CPFM 5f – Excess deflection

Reasons for ruling out:

- The top-of-slab elevation is at 1007 ft, which is approximately the highest flood elevation. The differential height between the top of slab and the exterior grade surrounding the CARP Building is at most 3 ft and thus could create minimal hydrodynamic lateral loading on the structure.
- The structure was protected from floodwater by an Aqua Dam for the majority of the 2011 flood. The CARP Building was subjected to floodwater when the Aqua Dam failed for a short period of time because it was damaged, which allowed floodwater to enter the area inside the perimeter of the Aqua Dam. The relative flood elevation during this time was at approximately 1006 ft, which is below the top-of-slab elevation and thus produced negligible hydrodynamic lateral load on the structure.

Triggering Mechanism 6 – Buoyancy, Uplift Forces on Structures

- CPFM 6b – Cracked slab, loss of structural support
- CPFM 6c – Displaced structure/broken connections

Reason for ruling out:

- The top-of-slab elevation is at 1007 ft, which is approximately the highest flood elevation. Therefore, this Triggering Mechanism and associated CPFMs are not applicable.

Triggering Mechanism 7 – Soil Collapse (first time wetting)

CPFM 7a – Cracked slab, differential settlement of shallow foundation, loss of structural support

CPFM 7b – Displaced structure/broken connections

CPFM 7c – General site settlement

Reason for ruling out:

- Soil collapse due to first time wetting occurs immediately as soils are wetted. Degradation related to this Triggering Mechanism and associated CPFMs would have been apparent at the time of the site observations. No signs of movement were observed.

Triggering Mechanism 9 – Swelling of Expansive Soils

CPFM 9a – Cracked slab, differential heave of shallow foundation, loss of structural support

CPFM 9b – Displaced structure/broken connections

CPFM 9d – Additional lateral force on below-grade walls

Reason for ruling out:

- Degradation that could be attributed to swelling of expansive soils was not identified at the time of the site observations.

Triggering Mechanism 11 – Loss of Soil Strength Due to Static Liquefaction or Upward Seepage

CPFM 11a – Cracked slab, differential settlement of shallow foundation, loss of structural support

CPFM 11b – Displaced structure/broken connections

CPFM 11c – Additional lateral force on below-grade walls

Reason for ruling out:

- Degradation that could be attributed to static liquefaction or upward seepage was not identified at the time of the site observations.

6.3.4.2 Detailed Assessment of Credible Potential Failure Modes

All CPFMs for the CARP Building have been ruled out based on the building's relative proximity to the Missouri River, its elevation relative to high floodwater, type of construction, and site observations, as discussed in Section 6.3.4.1.

6.3.5 Results and Conclusions

In the assessment of the FCS Structures, the first step was to develop a list of all Triggering Mechanisms and PFMs that could have occurred due to the prolonged inundation of the FCS site during the 2011 Missouri River flood and could have negatively impacted these structures. The next step was to use data from various investigations, including systematic observation of the structures over time, either to eliminate the Triggering Mechanisms and PFMs from the list or to recommend further investigation and/or physical modifications to remove them from the list for any particular

structure. Because all CPFMs for the CARP Building have been ruled out, no Triggering Mechanisms and their associated PFMs remain credible for the CARP Building. Therefore, HDR has concluded that the 2011 Missouri River flood did not impact the geotechnical and structural integrity of the CARP Building because the potential for failure of this structure due to the flood is not significant.

OPPD