Historical Site Assessment
for Fort Calhoun Station

Technical Support Document (TSD) No. 20-001

Prepared by

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1 Executive Summary

To assist in decommissioning planning for the Fort Calhoun Nuclear Generating Station (FCS), this Historical Site Assessment (HSA) documents a comprehensive investigation that first identifies, and then evaluates and classifies on a preliminary basis, historical records and information pertaining to circumstances or events that may have resulted in radiological or non-radiological contamination during the operating history of the station, which has been owned and licensed to operate by the Omaha Public Power District (OPPD) since 1973. The goal of this approach is to facilitate effective review of site conditions in a principled manner.

A preliminary HSA with limited site sampling (soil, groundwater and sediment) was completed by TSSD Services Inc. in December 2016 [1] and [2]. The scope of the HSA was limited to exterior land segments, both within and outside the site protected area. Data gaps from that HSA have been addressed in this report, to include radiological and non-radiological constituents' impacts to buildings and structures. The sources of hazards reviewed herein include consideration of electrical transformers, storage tanks, hydraulic operated equipment, and site-wide hazards including lead, asbestos, and polychlorinated biphenyl (PCBs).

Our overall strategy in developing the HSA has been to thoroughly review and evaluate the existing documentation at FCS and to build upon that body of work to fully describe and document the radiological and non-radiological status of the site. We have identified radiological and non-radiological areas of concern, identified data gaps and recommended additional investigation and characterization activities needed to support the development of other decommissioning documents including those to develop the Derived Concentration Guideline Levels (DCGLs) and the License Termination Plan (LTP).

We have used the same general approach (incorporating lessons learned) that we have implemented in the successful performance of HSAs at other facilities. This approach includes reviewing work performed to date, reviewing site records and data, interviewing personnel, inspecting the principal systems, structures and components (SSCs) of the station, developing a site conceptual model, determining areas of concern, and evaluating and organizing all collected information in a structured fashion.

For the purposes of this report, the term "site" refers to the industrial portion of the OPPD-owned property. In addition, this HSA identifies areas of the station or SSCs where there is a credible basis for significant or actionable contamination. In some cases, there is no definitive information to indicate that these areas or SSCs have been contaminated. Rather, the identified areas or SSCs may be listed simply because of the materials used or stored there and the corresponding possibility that radiological or other contaminants may have been released from them to the surrounding environment.

We have used the guidance provided in NUREG-1757 Vol. 2 "Consolidated Decommissioning Guidance" and NUREG-1575 Rev 1 "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM) to develop a detailed HSA. All areas and SSCs have been given a preliminary classification based on available survey data, knowledge of

historical site operations, and results of employee interviews. The classification of an area or SSC or subsection of an area or SSC may be revised between now and the time of site closure or license termination when additional characterization data become available.

Historical information was reviewed and compiled into this HSA to identify areas where contamination existed, remains, or has the potential to exist. This information was primarily derived from the following sources (the full list of information sources is listed in Appendix A):

- interviews of long-tenured employees knowledgeable of site operations,
- records from the Nebraska Department of Environment and Energy (NDEE),
- FCS incident files such as Condition Reports (CRs), Incident Reports (IRs), Radiological Occurrence Report (RORs), Licensee Event Report (LERs), etc.,
- FCS special survey and operational radiological survey records,
- engineering reports of environmental assessments and subsurface investigations at FCS,
- the FCS file maintained in compliance with federal regulation 10 CFR 50.75(g),
- the FCS Offsite Dose Calculation Manual (ODCM),
- the FCS Updated Safety Analysis Reports (USAR),
- the FCS Spill Prevention, Control and Countermeasures (SPCC) Plan, August 2017,
- the FCS Annual Radioactive Effluent Release Reports,
- the FCS Annual Radiological Environmental Operating Reports, and
- the TSSD Services Inc. "Fort Calhoun Nuclear Station Historical Site Assessment Report," 2016, and
- the TSSD Services, Inc., "Fort Calhoun Nuclear Station Limited Non-Radiological Characterization Survey," 2016.

No ongoing releases of radiological or non-radiological contamination at the station are known to exist. Historical releases at the station have been managed in accordance with applicable radiological and non-radiological regulations. When leaks or spills occurred, they were immediately remediated by removal of the accessible contaminated material until sampling results indicated that the material was not detectable, remained at background levels, or were otherwise contained in place to minimize mobility. Nevertheless, it is possible that in some locations inaccessible contamination may remain. To that end, one of the purposes of this document is to identify potential data gaps to be addressed during the decommissioning effort, which we do by providing, on a preliminary basis, suggested investigation strategies, in the sections entitled "Recommended Future Investigation Activities".

The information developed by this HSA indicates that the areas and SSCs with a high probability of requiring remediation (Class 1) are located within Radiologically Controlled Areas (RCA). Migration of surface contamination from the RCA appears to be limited as has been determined from frequent site surveys conducted inside the Protected Area (PA).

In some instances, identified contaminated radiological areas or SSCs may have been the result of spills, leaks, or accumulation over time of radioactive material released from the

facility at levels lower than those that could be detected by real-time monitoring methods employed at the station which at the time were state-of-the-art and comparable to methods used throughout the nuclear industry. It is presumed that modern detection capabilities may either corroborate historical survey results or identify additional residual radioactivity.

For example, FCS has implemented guidance contained in NEI 07-07, "Industry Groundwater Protection Initiative" (GPI) [3]. The objective of FCS's Groundwater Protection Program is to identify, monitor and quantify the nature and extent of radiological contamination that may exist in site groundwater. To date, the GPI at FCS has not identified any plumes of radionuclides in site groundwater, however minor detections of tritium and Strontium-90 have episodically been present at concentrations just above the minimum detectable concentration (MDC) [4].

Long term employees with historical knowledge of station operations were interviewed regarding the plant operating history in November and December of 2019. The intent of the employee interviews was to capture the institutional knowledge of those familiar with plant operation and construction. As detailed below in our conclusions, based on those interviews, there do not appear to be any undocumented incidents of significant contamination at the station. Further, none of the identified impacted areas or SSCs is an imminent threat to human health or the environment.

2 Glossary of Key Terms

ACM: Asbestos Containing Material.
AFFF: Aqueous Film Forming Foam.
Ag: Silver.
ALARA: As Low As Is Reasonably Achievable.
Am: Americium.
ANI: American Nuclear Insurers.
AOC: Area of Concern.
ARERRs: Annual Radiological Effluent Release Reports.
AST: Aboveground Storage Tank.
bgs: Below Ground Surface.
Ce: Cerium.
CFS: Cubic Feet per Second.
Ci: Curie.
Cm: Curium.
cm2: Square Centimeters.
Co: Cobalt.
CPM: Counts Per Minute.
CR: Condition Report.
Cs: Cesium.
CSM: Conceptual Site Model.
CST: Condensate Storage Tank.
DAW: Dry Active Waste.
DCGLs: Derived Concentration Guideline Levels.
DMRs: Discharge Monitoring Reports.
DPM: Disintegrations Per Minute.
DQOs: Data Quality Objectives.
EDG: Emergency Diesel Generator.
EHC: Electro Hydraulic Control.
EPA: Environmental Protection Agency.
EPRI: Electric Power Research Institute.
Eu: Europium.
FCS: Fort Calhoun Station.
Fe: Iron.
FSAR: Final Safety Analysis Report.
FSS: Final Status Survey.
Gammas: Gamma Emitting Radionuclide.
gm: Gram.
GPI: Groundwater Protection Initiative.
gpm: Gallons Per Minute.
H-3: Tritium.
HP: Health Physics.
hp: Horsepower.

HSA: Historical Site Assessment.
HTD: Hard to Detect.
I&C: Instrument and Control.
I: Iodine.
IGSCC: Intergranular Stress Corrosion Cracking.
IR: Incident Report.
ISFSI: Independent Spent Fuel Storage Installation.
ISOCS: In-Situ Object Counting System.
kg: Kilogram.
KVA: Kilovolt Amps.
LER: Licensee Event Report.
LLD: Lower Limit of Detection.
LSA: Low Specific Activity.
LTMP: Long Term Monitoring Plan.
LTP: License Termination Plan.
MARSSIM: Multi-Agency Radiation Survey and Site Investigation Manual, NUREG-1575.
MCL: Maximum Contaminant Level.
MDA: Minimum Detectable Activity.
MDL: Minimum Detection Limit.
mg: Milligram.
mph: Miles per Hour.
mrem/yr: Millirem per Year.
mrem: Millirem.
msl: Mean Sea Level.
MW: Megawatt.
MWe: MegaWatts Electrical.
MWt: MegaWatts Thermal.
Nb: Niobium.
NDEE: Nebraska Department of Environment and Energy.
NEI: Nuclear Energy Institute.
Ni: Nickel.
NOAA: National Oceanic and Atmospheric Administration.
NPDES: National Pollutant Discharge Elimination System.
NR: Prefix denoting Non-Radiological classifications.
NRC: Nuclear Regulatory Commission.
O2: Oxygen.
ODCM: Off-site Dose Calculation Manual.
OPPD: Omaha Public Power District.
OSGS: Original Steam Generator Storage.
PA: Protected Area.
PCB: Polychlorinated Biphenyl.
pCi: PicoCurie.
PFAs: Perfluoroalkyl Surfactants.
ppm: Parts per Million.

Pu: Plutonium.
PWR: Pressurized Water Reactor.
RA: Restricted Area.
RAM: Radioactive Material.
RCA: Radiologically Controlled Area.
RCP: Reactor Coolant Pump.
RCRA: Resource Conservation and Recovery Act.
REMP: Radiological Environmental Monitoring Program.
RFI: RCRA Facility Investigation.
RMSA: Radioactive Material Storage Area.
RO: Reverse Osmosis.
ROCs: Radionuclides of Concern.
ROR: Radiological Occurrence Report.
RP: Radiation Protection.
RS: Radiological Survey.
RSLs: Federal Regional Screening Levels.
RW: Radioactive Waste, Radwaste.
SAFSTOR: Safe Storage.
Sb: Antimony.
SDSs: Safety Data Sheets.
SFP: Spent Fuel Pool.
SG: Steam Generator.
SIRWT: Safety Injection Refueling Water Tank.
Sn: Tin.
SPCC: Spill Prevention, Control and Countermeasures.
Sr: Strontium.
SSCs: Systems, Structures, or Components.
SVOCs: Semi-Volatile Organic Compounds.
TCLP: Toxicity Characteristic Leaching Protocol.
TID: Technical Information Document.
TRU: Transuranic.
U.S.: United States.
uCi: MicroCurie.
USAR: Updated Safety Analysis Report.
USGS: United States Geological Survey.
UST: Underground Storage Tank.
V&V: Verification and Validation.
VCP: Voluntary Cleanup Program.
VOCs: Volatile Organic Compounds.
WBC: Whole Body Counter.
Zr: Zirconium.

3 Introduction

Fort Calhoun Station is a one-unit Combustion Engineering design, two loop pressurized light water moderated and cooled nuclear reactor facility. Each reactor coolant loop, configured in parallel to the reactor vessel, consists of two reactor coolant pumps (RCP) and one steam generator. An electrically heated pressurizer is connected to the primary coolant system to maintain operating over-pressure conditions. Owned by the OPPD, the site is located in Blair, Nebraska, in Washington County Nebraska.

The reactor containment building provides a highly reliable, essentially leak-tight barrier against the escape of radioactivity which might be released from the reactor system in the event of an accident. It is a concrete structure in the form of a vertical cylinder with domed roof and a flat base.

The site for the Fort Calhoun Station contains approximately 540 acres on the west bank of the Missouri River, approximately 19.4 miles north of Omaha, Nebraska. OPPD has a perpetual easement on approximately 475 acres of land on the east bank of the river directly opposite the plant buildings (Figure 1). On the Western part of the site the ground rises sharply about 60 feet to a higher-level area which is bounded on the west by U.S. Highway 75, formerly U.S. Highway 73.

The NRC issued an operating license on August 9, 1973. The plant began commercial operation on September 23, 1973, initially at a maximum power level of 1420 megawatts thermal (MWt), corresponding to an electrical output of 481 megawatts electric (MWe). A license amendment was granted, permitting maximum reactor output to not more than 1500 MWt [5].

Other milestones related to the operational history of FCS are as follows:

- On May 15, 1984, a steam generator tube rupture due to intergranular stress corrosion cracking (IGSCC) occurred during hydrostatic pressure testing of the primary coolant system.
- In 1993, and again in spring 2011, the site experienced flooding events as a result of historic high Missouri river levels.
- On November 4, 2003, the NRC granted an operating license extension for an additional 20 years, to 2033.
- In the spring of 2011 flooding of the site caused an extended outage of the reactor.
- In December 2013 the reactor returned to operation after recovery from the flood of 2011.
- On October 24, 2016, the reactor was shut down for the final time.
- On November 13, 2016, the final reactor fuel off-load was completed.

As detailed above, the purpose of this HSA is to identify and catalog existing information describing operational occurrences at FCS that may have resulted in either radiological or non-radiological contamination. The scope of the HSA encompasses the site history from the beginning of site construction to January 3, 2020.

The HSA provides an assessment of the likelihood of contaminant migration, information useful for scoping and characterization surveys, and initial classifications of areas of interest as to whether they are impacted or non-impacted. The classification process is guided by MARSSIM [6] and applicable law, where relevant.

The information developed by this HSA preliminarily results in two tiers of progressive classification.

The first step is to designate "impacted" areas of the site, under the presumption that the period of operation and oversight has produced records and site-specific information sufficient to identify potentially impacted areas. Impacted classifications are made where there is credible information indicating the potential for contamination which requires further assessment. If insufficient data are available to confirm a classification of "Non-Impacted", the SSC or area has been classified conservatively as "Impacted - Class 3" until sufficient characterization data are obtained to support a classification of "Non-Impacted." [6].

The second step is to further delineate significance of the potential contamination, where possible, for those SSCs or areas designated as impacted. To do so, all impacted areas are classified as Class 1, Class 2 or Class 3, to indicate the degree to which impact may have occurred based on known information.

More specifically, these secondary classifications are subjective and reflect professional judgement based upon the available information. They are determined in accordance with guidance provided in MARSSIM [6]. Class 1 SSCs or areas have the greatest potential for contamination to exceed applicable release criteria, which have yet to be determined but are assumed to be similar to the screening values provided in NUREG-1757, Vol. 2, "Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria", [7] for purposes of this report. This ensures, therefore, that to be adequately characterized, a Class 1 SSC or area must receive greater scrutiny than a Class 2 or Class 3 SSC or area. Where there is credible, but not definitive, information about contamination, we have employed a default Class 3 classification [6].

Decommissioning is expected to address co-located radiological and non-radiological materials. Nonetheless, to facilitate review of SSCs or areas that may have been impacted with non-radiological contaminants in a consistent manner that accounts for the likely coincident remediation, the same approach described in MARSSIM for radiological contaminants has been applied to non-radiological materials, with the addition of a fourth "Impacted" classification designated as "Isolated". Isolated SSCs or areas are contained within buildings or structures. These SSCs or areas are shielded from processes such as precipitation, wind, runoff, infiltration and seepage that would otherwise distribute non-radiological contaminants to the natural environment. There is the potential that structural elements or building materials within these isolated SSCs or areas may have been impacted by release of contaminants within them but the risk of contamination of the natural environment from such incidents is negligible. The Isolated classification is applied solely to non-radiological contamination because the hazards unique to radiological contamination exist whether or not the contamination is isolated.

For the non-radiological classifications, MARSSIM's DCGLs, which are the site-specific radiological criteria for release of an area for unrestricted use, are replaced by applicable non-radiological criteria, e.g. the, federal maximum contaminant levels (MCLs) [8], or federal regional screening levels (RSLs) [9]. The Non-Radiological classifications are denoted by assigning an "NR" prefix, but as noted above the co-location of materials means that decommissioning will likely resolve most impacted radiological and non-radiological materials simultaneously.

Historic releases at the station have been managed in accordance with applicable radiological and non-radiological regulations. The NR classification is assigned to areas or SSCs where (1) materials are used or stored in relatively large volume, and (2) conditions are such that such historic use has a reasonable potential to contaminate media that could require remediation at the time of decommissioning. Thus, this assignment should not be equated to known contamination requiring action under applicable law. See also Section 5.1.1 for a discussion of NR impacted classification.

The purpose of this assessment is to assist in decommissioning planning for the station. Because decommissioning is a lengthy and iterative process, information in the HSA should be evaluated with respect to the impact of the elapsed time since the preparation of the HSA (due to radioactive decay, natural attenuation, or unforeseen events) on the intended use of the information. A Characterization Survey Plan [10] developed to support characterization for FSS has been developed, including designation of Survey Units over the FCS site. Where appropriate, cross reference of land areas by Survey Units in the plan are provided in this HSA where potential radiological impacts in exterior land areas are assigned. It should be noted that an area of approximately 120 acres beyond the tree line north of the plant contained on the west by the railroad bedding, and on the east by the Missouri river, has been free-released for unrestricted use. Additionally, 475 acres of privately owned land constituting a perpetual easement on the Iowa bank of the Missouri river has been free-released for unrestricted use.

The physical characteristics of the FCS site and its vicinity are described in Section 4. The method for preparing an HSA and completing the MARSSIM investigation process is discussed in Section 5. The assessment findings are presented in Section 6 and are subdivided into information pertaining to non-radiological and radiological impacts. The conclusions are presented in Section 7 of this report, and broad recommendations for future activities in Section 8. Classification summary tables are presented in Appendices B and C.

4 Property Identification

The FCS site is located on the west bank of the Missouri River at river mile 646.0 on 540 acres, approximately 19.4 miles northwest of Omaha, Nebraska (Figure 1). OPPD has a perpetual easement on 475 acres of land on the east bank of the river directly opposite the site (Figure 1). About 85 percent of the site area is on relatively level ground located in the alluvial plain of the river. On the western portion of the site the ground rises sharply about 60 feet to a higher-level area which is bounded on the west by United States (U.S.). Highway 75, formerly U.S. Highway 73.

Access to the site is provided by a private two-lane paved road, which connects FCS with Highway 75, which leads to Blair (to the north) and Omaha/Council Bluffs to the south. While the Missouri River abuts the site to the east, there is no boat landing providing river access to the site. A Union Pacific rail line passes through the western portion of the site and was used to ship supplies/material to the site.

The area adjoining the site is farmland and sparsely populated. The minimum exclusion distance is 1525 feet. The nearest privately owned land is farmland and is approximately 0.5 miles from the site. The nearest population center area of more than 25,000 is formed by adjacent cities of Omaha, Nebraska and Council Bluffs, Iowa to the southeast. Figure 1 shows the location of the site along the Missouri River.

4.1 Environmental Setting

The FCS Plant is situated within parts of Section 20 and 21, Township 18 North, Range 12 East of Washington County, Nebraska in the Modale quadrangle (Figure 1). The site is part of the Missouri River bottomland, which is approximately 8 miles wide at the site. The elevation of this plain averages about 1,000 feet above mean sea level at the site.

The Missouri River, which flows generally north to south, forms the northwest to southeast site boundary. This part of the river is referred to by the Corps of Engineers, hereinafter "Corps", as the Blair Bend. The river limits are under control of the Corps who have established a structure azimuth line which acts as another site boundary.

4.1.1 Physiography

Topographically, the site is part of the Missouri River bottom land, which is a nearly level plain about 15 miles wide at Blair to the north, 8 miles wide at the site and narrowing to 3 miles wide in the vicinity of Omaha-Council Bluffs to the south. The elevation of this plain averages about 1,000 feet above mean sea level at the site.

Starting from the Missouri River at about elevation 997 feet above mean sea level and traveling southwestward, the surface of the land falls to an old channel of the river before rising again to approximately 1,004 feet. Beyond this point, the land then gradually falls off to about 1,000 feet, rises again to approximately 1,020 feet, and then rises approximately 60 feet to a higher plateau at elevation 1,080 feet adjacent to Highway 75 [5].

4.1.2 Geology

The principal geologic features of the region include a 100 to 200-foot thickness of soil deposited by glacial action, streams, and wind, underlain by sedimentary bedrock of 500 to 2,500 feet in thickness consisting primarily of limestone, shale, and sandstone. There are no bedrock outcrops on the site, but there are exposures within three and five miles from the site at two limestone quarries [5].

Unconsolidated sediments at the plant site generally range from 65 to 75 feet in thickness. The soils are typically interstratified and cross-bedded. The beds change facies or grade laterally so rapidly that no bed lithologic correlation is possible from boring to boring. The boring data indicate that the upper 20 to 50 feet of soil are predominately silty sands, and the lower beds consist of fine sands with occasional interbedded lenses of gravel [5].

The bedrock beneath the site lies between 65 and 75 feet below the surface. The maximum relief of the bedrock surface in the site area is in the order of 13 feet. Some borings indicate a thin layer of clay on top of bedrock, others a soft to hard shale up to a thickness of seven feet. The bedrock consists of various types of limestone, shale, and sandstone formations [5].

4.1.3 Hydrology

The plant site is bounded on the northwest and southeast by a portion of Blair Bend of the Missouri River. The Corps maintains river structures to prevent further meandering of the channel within the alluvial flood plain; the structures take the form of pile dikes and bank revetments.

Two small streams flow across the site including Fish Creek along the northern, developed portion of the site and Long Creek along the southern, agricultural area of the property. These creeks drain the northern and southern portions of the site and discharge to the Missouri River.

There are six dams upstream of the plant site that control the river flow. These structures occur from Gavins Point along the South Dakota/Nebraska boundary (nearest to the site) to the most distant (Fort Peck, Montana). There are no dams, locks, or similar structures on the Missouri downstream of the plant site.

Flooding of the Missouri River has occurred several times at FCS. The flood stages occur as a function of spring snow melt. Significant flooding of the flood plain area at FCS has occurred on several occasions at the site, most notably in 2011, when the river overflowed its banks for several months.

Groundwater flow at FCS occurs within the overburden sequence (i.e., unconsolidated silty sands, sands and gravel above bedrock) and within the limestone, shale, and sandstone bedrock. The site-specific groundwater flow direction within the overburden and rock units is typically from west to east towards and discharging to the Missouri River.

Groundwater at the site is in hydraulic communication with the adjacent Missouri River, with the water table ranging from 2 to 20 feet below the ground surface depending on the river stage. However, under typical conditions, the depth to groundwater is approximately 15 to 20 feet below ground surface (bgs) [11]. Both soil units identified in Section 4.1.2 are water bearing with the deeper unit exhibiting a higher hydraulic conductivity. The hydraulic gradients below the site are relatively flat resulting in relatively slow groundwater velocity [11].

Water levels taken at the site show that the groundwater gradients at the site are nearly flat, with only a gentle slope toward the river. Water levels at the site varied from elevations 993.7 to 992.4 feet, while the river levels recorded during this same period ranged from elevations 993.2 to 992.4 feet [11]. Groundwater levels vary with changes in the river level. The rate of groundwater flow in the alluvial soils varies with the permeability, however, the groundwater flow rate, or velocity is very slow due to the low gradients. The hydraulic conductivity of the soils varies from about one-half to three feet per day in the upper sandy silt and silty sand. In the lower fine-to-coarse sands and gravels, hydraulic conductivities as high as 20 feet per day were measured [11].

According to site documents, groundwater flow directions have been reported to be both toward the Missouri River (easterly) and away from the Missouri River (southwesterly) [11]. Flow directions toward the river appear to represent times when Missouri River levels are relatively low, while groundwater flow directions away from the river appear to represent times when Missouri river levels are relatively high [11].

Locally, below the plant structures, a reverse osmosis water (RO) treatment plant withdrew groundwater to be used at the plant. The RO well operated from August 2007 until 2016 when the well was closed. The groundwater withdrawal associated with the RO well caused a cone of depression and altered groundwater flow. The extraction well was located at the northwest corner of the Old Warehouse (Figure 2). Testing during the well installation documented that the aquifer may produce approximately 500 gallons per minute (gpm). The production well was in service as of August 2007, continuously pumping about 200 gpm, and closing operation in 2016. Measurement of groundwater flow during operation of the RO well indicated that within 600 feet of the RO well, groundwater flow was toward the RO well (i.e. northwest) [11] (Figure 3).

In summation, the setting of the plant during the years of operation appears to be within a dynamic groundwater environment influenced by pumping of the RO well, river level, and seasonal amounts of precipitation.

4.1.4 Climatology

The general climate is classified as continental, i.e., hotter in summer and colder in winter than in lands near the ocean. Nebraska is located midway between two distinctive climatic zones, the humid east and the dry west. This geographic location gives rise to cyclic weather conditions representative of either zone, or combinations of both. Changes in weather result from the invasion of large masses of air with dissimilar properties. These air

masses tend to get their characteristics from either the warm and humid south-southeast, the warm and dry southwest, the cool and dry north-northwest, or the cold continental polar air of the north. The region is also affected by many storms or cyclones (areas of low pressure) which travel across the country, generally from west to east. Thus, periodic and rapid changes in the weather are normal, especially in the winter [5].

4.1.5 Meteorology

During 1970, a Rohn 160-foot guyed weather tower was installed on the Fort Calhoun Station plant site. This tower operated until June 1977. The weather tower was located more than 1/2-mile northwest of the reactor building. It was located upwind of the prevailing winds over the reactor in order to more accurately measure the winds prior to their passage over the reactor complex towards the greatest concentrations of population in the area [5].

In January 1974, the meteorology system was updated in accordance with a commitment to meet the intent of Safety Guide 23. Currently, the Fort Calhoun Station has a permanent 110M meteorological tower with appropriate meteorological measurements system [5].

Annual average precipitation for the region is about 28.50 inches, but annual amounts vary widely. For example, at Omaha in 1976, the total was 18.37 inches, while in 1965, the total was 44.85 inches. About 75 percent of the precipitation occurs during showers and thunderstorms during April through September [5]. Snowfall amounts to about 30.3 inches of snow for an annual average, but total annual amounts vary widely from year to year [5].

Environmental Setting Supporting Documents

7-12-1995 IWM 57477 DEQ Report HYDROGEOLOGICAL CHARACTERIZATION.pdf
Element Concentrations in Soils and other Surficial Materials of the Conterminous United States.pdf
FCS Flooding Recovery Action Plan 4.1 Plant and Facility Geotechnical and Structural Assessment, Revision 3, September 18, 2012.pdf
FCS Quad.jpg
IA_Modale_20151214_TM_geo.pdf
Surficial Geology of Fort Calhoun Geologic Units.pdf
Surficial Geology of Omaha and Council Bluffs.pdf
Terracon Hydrogeologic Assessment 2007.pdf

4.2 FCS Conceptual Site Model

As described in MARSSIM, the Conceptual Site Model (CSM) is a synthesis of known site information regarding the hydrogeology and groundwater flow domain, potential contaminants and their sources, mechanisms for their release to the environment, pathways for contaminant transport and exposure, and the potential human or environmental receptors of contamination. The CSM considers locations of known or suspected contamination, types and concentrations of contaminants, potentially contaminated media, mechanisms for their transport, locations of potential receptors, and locations of potential reference (background) areas.

The CSM is used to guide the site characterization process, including determinations regarding the media to be sampled and the chemical analyses to be performed, development of strategies for collection of data and recommendation of future investigation activities to fully assess the nature and extent of contamination [6]. As more site information is developed, the CSM must be evaluated and may be modified [6].

4.2.1 Hydrogeologic Setting

Fort Calhoun Station is situated on low flat land bordering the Missouri River (Figure 1). The Missouri River is a large perennial river that is the primary surface drainage feature in the vicinity of FCS. The river is also the site of regional ground water discharge. Because of its location on the flood plain of the river, the topography in the area of the power plant is flat. The resulting hydraulic gradient within the unconsolidated sediments in the flood plain is also relatively flat. This low hydraulic gradient, combined with moderate hydraulic conductivity of the generally fine-grained alluvial aquifer material, results in relatively slow ground water flow velocity beneath the site.

Land use within the flood plain adjacent to FCS is generally agricultural. A bluff located approximately 2,500 feet southwest of the river rises a few hundred feet and is upgradient from the plant. A few residences are located on the bluff. No large withdrawals of ground water that would divert flow off-site exist near the plant. A surface-water municipal supply drawing from the Missouri River is located upstream of FCS in the nearby town of Blair, Nebraska. This municipal supply system is the source of potable water for FCS. The water supply for the City of Omaha is also drawn from the Missouri River, about 20 miles downstream from FCS.

Process water for FCS was purified in a RO treatment plant. The source of water to the treatment plant was a production well located at the northwest corner of the Old Warehouse. Testing during construction of the well determined that it is capable of producing approximately 500 gpm. The production well was in service as of August 2007, continuously pumping about 200 gpm. The RO Well was closed in 2016. Prior to the use of the RO well, process-water was extracted from the Missouri River via the water plant located in the Service Building basement. The system transferred water from the river to a

settlement tank within the water treatment plant where caustics, acids, and other water treatment chemicals were added. The water was then sent to ion exchange resin tanks to remove metals. Backwash of the ion exchange tanks was then piped to the Former Chemical Treatment Lagoons.

The radius of influence of the "RO well" has not been determined quantitatively but can be assumed to be several hundred feet. Water levels measured during the fall of 2007 in some of the newly constructed monitoring wells within the protected area indicated a direction of ground water flow towards the RO well [11]. In late October and November, the ground water flow direction within approximately 600 feet of the RO well was toward the northwest, but at distances greater than about 600 feet from the well, the direction reversed to flow to the southeast (toward the Missouri River) [11] (Figure 3).

Section 2.5 of the Final Safety Analysis Report for FCS notes that a significant portion (70 to 75 percent) of the local annual precipitation falls in showers and thunderstorms that occur during the period April through September [5]. This pattern of rainfall is reflected in ground water levels measured at FCS. Water levels measured in site wells on September 10 and 11, 2007 were approximately three feet higher than those measured in the same wells on November 30, 2007 [11].

The observed ground water gradients in the protected area suggest that during the spring, summer and early fall, when most precipitation occurs and river flow is relatively high, bank storage is recharged by river flow and the direction of ground water flow near the river is away from the channel. As river flow recedes during the late fall and winter, bank storage is reduced and groundwater near the river reverses to flow toward the river. In addition to the groundwater flow in the PA, this reversal of groundwater gradients near the river is also documented by the ongoing landfill closure program. Groundwater flow in the landfill area is characterized quarterly as part of the closure monitoring activity. The observed groundwater flow direction is to the west, away from the river in the 2nd Quarter 2013 (June 11, 2013) [12], and to the east towards the river in the 4th Quarter (November 28, 2012) [13](Figure 4).

The effect on groundwater flow of pumping the RO well is superimposed on the effects of river flow. During operation of the RO well, at distances from the well less than about 600 feet, the RO well continually induced ground water flow toward it (Figure 3). At greater distances from the well within the industrial area of the plant, the effects of low river stage during the late fall and winter predominated to cause a reversal of ground water flow toward the river. The hinge line along which the reversal in ground water flow direction occured appeared to be approximately 600 feet from the RO well (Figure 3). This distance is the presumed radius of influence of the well within the Restricted Area (RA).

The Missouri River is in hydraulic connection with ground water in the alluvial aquifer within its floodplain. During periods of relatively high river stage, which occur generally from April through September when precipitation is greatest, river water recharges the nearby alluvial aquifer and induces ground water flow gradients outward from the river channel. These gradients reverse seasonally, during periods of lower river stage.

4.2.2 Potential Sources of Environmental Contamination

Potential sources of soil and groundwater contamination, both radiological and non-radiological, include various tanks, drains and pipelines containing radioactive liquids; radiologically contaminated components and equipment stored in temporary containers (e.g., Sea Land containers); tanks, drums and equipment containing fuel oil, diesel fuel, hydraulic oil and lubricating oil; station transformers containing mineral oil dielectric fluid and Polychlorinated Biphenyl (PCB)-containing oil; and spills from chemical storage areas, machine shops and paint shops.

Contaminants from these sources potentially could be released directly to the soil where infiltrating precipitation would transport them to the groundwater. Residual contamination on plant equipment and impermeable surfaces potentially could be mobilized in storm water and potentially infiltrate groundwater. Minor spills and leaks of fuel oil, diesel fuel, hydraulic oil and lubricating oil have occurred from various pieces of mobile equipment during the operating history of the station. These minor releases were immediately isolated and cleaned up in accordance with FCS plans CH-HM-0007 "Determination of Reportable Quantity from Releases of Hazardous Substances and Oil" [14] and SO-G-106 "Hazardous Material Incident Response Plan" [15]. It is therefore unlikely that significant residual contaminants from these releases remain to impact local soil and/or groundwater quality.

As part of the GPI, 13 monitoring wells were installed at FCS in 2007. The wells are primarily installed as paired wells monitoring the shallow and deep portions of the overburden aquifer [11]. An additional four shallow monitoring wells were installed in the Protected Area following review of the on-site monitoring program in 2008 [16]. The known monitoring well details are summarized in Table 1.

Table 1: Summary of FCS Monitoring Well Details

Well ID	Installation Date	Well Depth (ft bgs)	Screen Length (ft)	Screen Interval (ft bgs)		Well Diameter (in)	Ground Surface Elevation (ft)	Top of Casing Elevation (ft)
PA Wells								
MW-1A	8/27/2007	24.0	10.0	13.5	23.5	2.0	1004.6	1007.02
MW-1B	8/20/2007	50.0	5.0	45.0	50.0	2.0	1004.5	1007.01
MW-2A	8/23/2007	24.0	10.0	14.0	24.0	2.0	1004.9	1007.23
MW-2B	8/23/2007	50.0	5.0	45.0	50.0	2.0	1004.9	1007.21
MW-3A	8/24/2007	23.0	10.0	13.0	23.0	2.0	1004.7	1007.06
MW-3B	8/24/2007	50.0	5.0	45.0	50.0	2.0	1005.2	1007.06
MW-4A	8/16/2007	22.0	10.0	12.0	22.0	2.0	1003.4	1005.75
MW-4B	8/15/2007	50.0	5.0	45.0	50.0	2.0	1003.3	1005.79
MW-5A	8/16/2007	22.0	10.0	12.0	22.0	2.0	1003.5	1006.02
MW-5B	8/17/2007	50.0	5.0	45.0	50.0	2.0	1003.5	1005.96
MW-6	8/27/2007	22.0	10.0	12.0	22.0	2.0	1003.8	1006.21
MW-7	8/20/2007	24.0	10.0	12.0	22.0	2.0	1002.9	1005.42
MW-8	8/27/2007	17.0	10.0	6.5	16.5	2.0	1007.3	1009.58
MW-9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1007.08
MW-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1006.68
MW-11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1003.89
MW-12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Landfill Wells								
MW-1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1007.81
MW-2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1006.46
MW-3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1006.33
MW-4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1008.92
MW-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1004.43

N/A- Data not available

A quarterly Groundwater Sampling Plan including the 13 monitoring wells installed in 2007 and the four additional wells within the Protected Area has been developed for FCS (Figure 5). The 17 monitoring wells are sampled quarterly as part of FCS's Groundwater Protection Program. The samples are analyzed for tritium and gamma-emitting radionuclides. Hard to detect radionuclides, including Iron-55, Nickel-63, and Strontium 90 are also analyzed on a less frequent basis.

The five landfill wells are part of the NDEE Landfill closure activity and are monitored quarterly for RCRA metals.

4.2.2.1 Potential Non-Radiological Contaminant Sources

There are no current known unauthorized releases to the environment in plant systems containing non-radiological contaminants. SSCs that have in the past or may in the future have a potential to release such materials to the environment include:

- Underground Storage Tanks (UST) and Above Ground Storage Tanks (AST) containing fuel oil, lube oil, hydraulic oil and other petroleum products
- Transformers containing mineral oil dielectric fluid
- Mobile and stationary hydraulic systems
- Oil-filled mechanical equipment
- Chemical and drum storage areas
- Storm drain system

Figure 6 shows the layout of the Storm Drain System at the station and the preliminary radiological and non-radiological classifications of the storm drains. The location and preliminary classification of external areas of interest is summarized in Figure 7. Figure 7 shows the locations of hazardous material storage areas and transformers containing mineral oil dielectric fluid. The location and classification of non-radiological and radiological facilities are shown in Figure 9 and Figure 10, respectively.

Table 2 summarizes the recorded releases to the environment of non-radiological contaminants that have occurred during the operating history of FCS. Table 2 includes FCS Corrective Action Reports pertaining to releases of hazardous materials at the station. Copies of documentation related to each incident in Table 2 are available through electronic links to this report.

Table 2: Summary of Corrective Action Reports Concerning Non-Radiological Incidents at Fort Calhoun Station

Report Number	Date	Description of Incident
CR-1996-00095	1/24/1996	Hydrazine leak from CF-18 Chemical Feed hydrazine tank Turbine Building
CR-1996-00528	4/29/1996	Amerzine 35 spill Chemical Storage Rm G 5 gal
CR-1996-00551	5/1/1996	FUEL OIL spill on SIDE OF THE TURBINE BUILDING from FW-54 DAY TANK VENT LINE 3-5 gal
CR-1996-01186	10/2/1996	Fuel Oil leak from Aux FW-54 2-3 gal
CR-1997-00545	5/5/1997	Seal Oil spill transferring oil from RC-3B Containment to Room 66 Aux
CR-1997-00969	8/4/1997	Hydrochloric Acid spill Old Warehouse 2.5 gal
CR-1997-01381	10/8/1997	Hydraulic Oil Spill in parking lot adjacent to Tertiary Building 1 gal
CR-1998-00334	3/4/1998	HYDRAULIC OIL SPILL UNDERNEATH HE-37 OIL LEAKED INTO A FLOOR DRAIN UNDERNEATH OF HE-37 Warehouse truck lift

Report Number	Date	Description of Incident
CR-1998-01867	10/7/1998	Gasoline spill during filling of Gasoline fuel storage tank FO-43B 1 gal to ground
CR-1998-02177	12/17/1998	A SPILL OF ONE (1) LITER OF HYDRAULIC FLUID from Garbage Truck NORTH SIDE MAINTENANCE SHOP
CR-1999-00708	4/21/1999	A 1-GALLON BOTTLE OF TOLUENE Shattered Old Warehouse
CR-1999-00934	5/26/1999	CF-244 TO BE LEAKING ETA-ETHANOLAMINE 2 gal to Berm-Enclosure area
CR-1999-01965	10/4/1999	Refueling Fuel Oil spill at Diesel Generator Outside Turbine Building Truck Bay 2 gal
CR-2001-00181	1/29/2001	CAR IN THE STATION PARKING LOT DUMPED ITS OIL ON THE GROUND 1 gal
CR-2001-01152	4/2/2001	Oil spill from Dumpster at Water Plant Bottle Dock 1 gal to soil
CR-2001-02660	8/10/2001	Oil leak from oil disposed in Dumpster near Turbine Building 3-foot stain in soil
CR-2001-02787	8/25/2001	Gasoline Leak from Truck parked on N Side of Maintenance Building
CR-2002-01178	5/7/2002	Lube Oil leak from LO-9 Turbine Building 5 gal
CR-2002-02448	7/2/2002	Gearboxes for all 6 Traveling Screens (CW-2ABCDEF) leaking oil Intake
CR-2002-04225	12/11/2002	Transformer Oil leak from T-4 Transformer Switchyard berm-contained 5-7 gal
CR-2002-04400	12/3/2002	Sulfuric Acid Release Water Treatment Plant 1000 liters directed to Acid Neutralizing Sump
CR-2003-01495	4/28/2003	Hydraulic Oil leak North side of Maintenance Building long-term release
CR-2003-02851	7/29/2003	COMBUSTIBLE MATERIALS LOCKER IN RM 6 AUXILIARY BUILDING OIL POOLED IN THE BOTTOM OF THE LOCKER
CR-2003-04954	10/29/2003	T1 Transformer Oil Cooling Pump leaking oil 1 gal Switchyard
CR-2003-04956	10/29/2003	Oil Circulating Pump from DG-1 leaking oil Aux Building 1 gal
CR-2003-05354	11/25/2003	Gasoline-Kerosene leak from Cabinet in New Weld Shop 1 gal
CR-2003-05627	12/12/2003	Fuel Oil leak from FO-127 Turbine Building 1 gal
CR-2004-01746	5/12/2004	Oil-containing equipment released 7 gallon oil to ground outside PA

Report Number	Date	Description of Incident
CR-2004-01864	5/23/2004	Oil Leak from Charging pump A CH-1A Aux Building Rm 6 1 gal
CR-2004-02697	8/3/2004	Lube Oil leak from DG-1 Oil circulating pump Aux 1 gal
CR-2004-02771	8/9/2004	Oil leak from main feedwater Pump FW-4B migrated to Turbine Building Sump 11 gal
CR-2004-02916	8/22/2004	Fuel Oil leaking from FO-127 Turbine Building Rm 63 1 gal
CR-2004-02994	8/29/2004	Oil Leak from Raw Water Strainer AC-12A Motor Intake 1 gal
CR-2004-04001	11/18/2004	Fuel Oil leak from Feedwater Pump Aux 1 gal
CR-2005-00410	2/2/2005	MINOR CHEMICAL BURNS TO BOTH HANDS FROM A LIQUID ORGANIC ACID
CR-2005-00490	2/8/2005	Bobcat Oil spill Maintenance Yard NW of and outside of PA 1 gal
CR-2005-01706	3/28/2005	Hydraulic oil spill on gravel PA 2 gal
CR-2005-02519	5/16/2005	Gasoline spill and Fire Sanitary Lagoons while refueling portable pump
CR-2005-02554	5/18/2005	Oil Leak from Containment Spray Pumps SI-3A, SI-3B and SI-1A Containment
CR-2005-03647	7/25/2005	EHC fluid release from hydraulic fluid pump ECH-3B 3 gal
CR-2006-00742	2/23/2006	EHC spill near Haz Mat shed in PA 1 gal
CR-2006-01985	5/8/2006	Fuel Oil spill from overfill of FO-1 Aux Building
CR-2006-02550	6/15/2006	Hydraulic oil leak near old steam generator storage 7 gal
CR-2006-02616	6/21/2006	Oil spill from compressor in OCA
CR-2006-02733	6/27/2006	Fuel oil leak from portable generator near Intake
CR-2006-03382	8/8/2006	EHC fluid leak Turbine bldg 1 gal
CR-2006-03493	8/15/2006	Hydraulic Oil-Brake fluid release near FO-1 enclosure 1 gal
CR-2006-04284	9/24/2006	Lube Oil spill near Old Warehouse several gal
CR-2007-00649	2/9/2007	Hydraulic oil release from EHC-3B Turbine Building 3 gal
CR-2007-01701	4/16/2007	Fuel Oil Spill near Intake Structure
CR-2007-01703	4/16/2007	Fuel oil leak from portable generator near Intake structure 2 gal
CR-2007-2022	5/5/2007	Oil leak from CW-2f gearbox Intake structure no leak to river
CR-2007-2766	7/3/2007	Boric acid Room 62 CVCS Piping north end of room Aux Building

Report Number	Date	Description of Incident
CR-2007-3777	9/14/2007	Hydrazine spill in Turbine Building truck bay 1-2 gal
CR-2008-0468	1/31/2008	Fuel oil leak from engine control panel DG-2 Aux Building
CR-2008-1664	3/17/2008	Fuel oil leak AS-1 Aux Building 1 gal
CR-2008-2566	4/21/2008	Oil leak from HE-47 Aux 1-2 gal
CR-2008-2942	5/1/2008	Boric acid release on wall ceiling and conduits 994' elev Containment (A Bay side)
CR-2008-4766	7/15/2008	Oil leak from dumpster NE corner of Old Warehouse 1 gal
CR-2008-5696	9/6/2008	Fuel oil leak FO-30 FP-1B Fuel oil day tank 1-gal
CR-2008-6440	10/23/2008	Fuel Oil leak from FO-34A and FO-34B Aux Building
CR-2008-6825	11/14/2008	Battery Acid spill to New Warehouse floor
CR-2009-1096	3/9/2009	Oil leak Intake Structure basement from CW-1A circ water pump
CR-2009-1734	4/10/2009	Oil spill NW side of New Warehouse 5 gal
CR-2009-2108	5/4/2009	Diesel oil spill from portable generator Room 66 1-2 gal
CR-2009-2905	6/24/2009	Diesel fuel spill north of New Warehouse from portable generator 2 gals
CR-2009-2919	6/24/2009	Oil spill at Sally Port north of Security
CR-2009-3169	7/10/2009	Hydraulic Oil spill SE side of New Warehouse trash compactor leak
CR-2009-3259	7/18/2009	Fuel oil leak from filling FO-27 (diesel fire pump oil tank)
CR-2009-4424	9/22/2009	Hydraulic Oil spill southeast side of New Warehouse - 1 gal
CR-2009-5391	11/5/2009	Hydraulic Oil leak Corridor 4 of RCA from elevator shaft
CR-2009-5510	11/8/2009	Boric acid seeping through walls in Aux basement
CR-2009-5838	11/18/2009	Hydraulic Oil spill to Turbine Building Elevator shaft 5-gal
CR-2010-4381	9/9/2010	Oil pump at Transformer T-1 Switchyard leaking
CR-2010-4441	9/11/2010	Hydraulic Oil spill in front of Service Building
CR-2011-4159	5/6/2011	Boric Acid on pipe penetrations in Aux Building
CR-2011-4910	5/23/2011	Lube Oil Leak (100 gal) to Turbine Building Sump and release to River
CR-2011-4911	5/23/2011	Hydrogen Seal Tank Oil Leak Turbine Building basement
CR-2011-8783	10/27/2011	AS-1 Aux Boiler Fuel Oil Leak
CR-2012-01404	2/23/2012	Gearbox for CW-2D Traveling Screen Leaked Oil into Circulating Cell (Circ water discharge)

Report Number	Date	Description of Incident
CR-2012-02369	3/28/2012	Fuel Oil Leak from Delivery Vehicle from Diesel Fuel Station to Sally Port
CR-2012-05973	6/26/2012	Hydraulic Oil Spill Sally Port Vehicle Gate
CR-2012-08156	7/20/2012	Oil Leaking from PS-DG-1 Aux Building
CR-2012-08334	7/23/2012	LPSI Pump Oil Leak Aux Building
CR-2013-07209	3/30/2013	Leaking Oil from DG-2
CR-2013-14036	7/9/2013	Diesel Fuel Spill by Dry Cask Storage
CR-2013-14240	7/12/2013	Boric Acid Spill Room 69 Aux Building
CR-2013-16788	8/27/2013	Chemical Spill Room G New Warehouse
CR-2013-23248	12/27/2013	Lube Oil Leaking from CF-15 Turbine Building
CR-2014-03147	3/12/2014	Oil Pool under DG-2 Aux Building
CR-2015-01344	2/1/2015	Skid Loader Hydraulic Oil Leak
CR-2015-02684	3/5/2015	Mobile Crane Hydraulic Oil Leak near Intake Structure
CR-2015-03554	3/28/2015	Fuel oil spilled from FO-2C (DG-1 fuel oil base tank) Aux Building
CR-2015-06569	5/16/2015	EHC Oil Leak Turbine Building
CR-2015-06609	5/17/2015	Oil sheen inside the PA near Vehicle Maintenance
CR-2015-14338	12/30/2015	Oil sheen inside the PA Vehicle Maintenance
CR-2016-00178	1/7/2016	Oil sheen inside the PA Maintenance Vehicle Parking Area
CR-2016-00764	1/25/2016	Spilled oil sample in Aux Building
CR-2016-02872	3/23/2016	Non reportable active traveling screen motor oil leak
CR-2016-05648	6/28/2016	Maintenance Equipment Fuel Leak

Most of the releases recorded in FCS files and listed in Table 2 were of less than 25 gallons of petroleum or 10 gallons of hazardous materials and were managed consistent with Determination of Reportable Quantity from Releases of Hazardous Substances and Oil [14] and Hazardous Material Incident Response Plan [15]. The most significant incidents included several petroleum releases and significant flooding of the Missouri River in 2011. The petroleum releases include a 100-gallon lube oil leak in the Turbine Building in 2011, and a historic release of approximately 200 gallons of diesel fuel in 1986.

The lube oil release impacted the Turbine Building sump and approximately five gallons of lube oil was released to the Missouri River before the sump flow was shutoff. Due to the release to the river, the NDEE was notified and appropriate actions were initiated. As the lube oil was released to the river, no current or future issues from the release will impact the site.

Review of NDEE records identified several reported releases that are summarized in Table 3. These NDEE reported releases are also identified in the CR reports included in Table 2. One significant release identified in the NDEE records was the historic release of fuel oil at the site that occurred on October 21, 1986. The NDEE records (Spill Report No. 10266-

MBS-1925) indicated that approximately 200 gallons of fuel oil was spilled at the site by a contractor removing surface tanks. A sand dike was established to contain the release and contaminated soil was removed and disposed off-site. No specific details regarding the location of the spill or any post-removal site characterization was included in the records. Interviews with current personnel at FCS revealed no knowledge regarding the historic fuel oil release.

Table 3 Summary of NDEE Reported Releases

NDEE Notification Number	Date	Description of Incident
022312-SM-1431	2/23/12	Broken gearbox spilled lube oil into the circulation cell.
052411-M-0005	5/24/2011	A seal failed on a piece of equipment and approx. 100 gal. of lube was-released. Approx. 5 gal of oil spilled into the Missouri River.
062611-NH-1030	6/26/2011	Flood water breached outer protective levee (aqua dam). Many plastic fuel cans (storing gasoline, diesel, and oil) of 2 to 5 gallon capacity were stored within the outer wall to service portable pumps, generators, etc. Some containers damaged and some washed to Missouri River. Sheen on water within plant. No visible sheen on River.
063011-NH-1848	6/30/2011	Explosion and fire while refueling a dewatering pump. Approximately 0.5 gallons of gasoline released, one worker injured. Whatever fuel didn't bum was released to the river.
082112-DB-0913	08/21/12	During a recent inventory check, OPPD discovered that a pad-mounted transformer (PM8NN2938) was damaged. It is assumed that the damage was caused by the 2011 Missouri River flood (specific date unknown). It is also assumed that the damaged transformer released transformer oil into the flood waters. OPPD purchased the transformer in 1961 and assumes the oil contained PCBs.
102686-MBS-0925	10/22/1986	200 gallons of fuel released to ground.

Several flood events of the adjacent Missouri River have historically impacted the FCS site. The most significant flooding occurred in 2011 when flood waters covered most of the site for several months (Figure 11). During the 2011 flooding event, a soil berm was constructed around the Switchyard to protect the transformers and equipment in the yard

and the area around the PA was diked with sandbags (Figure 11). Likewise, FCS constructed aqua berms and raised walkways to protect the plant components in the PA.

The FCS site remained flooded for approximately 3 months. Plant personnel interviewed as part of this HSA recalled a site-wide 3 to 4-foot water level with a strong current. During the flood recovery, the berm surrounding the switchyard was removed and the majority of the soil was returned to the hill on the west side of the property where it was originally located. According to interviewees, samples from sandbags from inside the PA were surveyed for release; some samples showed detectable Cesium-137. However, interviewees also stated that sand showing detectable Cesium-137 was disposed of as radioactive waste. Following flood recovery and special oversight of the NRC, the plant was allowed to restart and return to service in December 2013.

In addition to the operational impacts related to the 2011 flooding event, the flood has significantly impacted the site soils. The flow of river waters across the site has most likely resulted in both erosion of the surficial soils and deposition of new river sediments. Likewise, the presence of the river water across the site has also acted to drive surface water down through the former unsaturated soils, mobilizing contaminants into the subsurface soils and providing an oxidizing environment for bioremediation of petroleum constituents.

Several other areas at FCS outside of the PA and industrialized area have the potential to be impacted by site activities. These locations include the following:

- Agricultural Land,
- Fire Training Area,
- Firing Range,
- Fish Creek Wetlands,
- Chemical Treatment and Sanitary Lagoons (old and current), and
- Landfill (closed).

These exterior locations at FCS are further discussed in Section 6.3.2.

4.2.2.2 Potential Radiological Contaminant Sources

No current releases to the environment in plant systems containing radioactive liquids are known. SSCs with radionuclides that have a direct or indirect pathway to ground and have the potential to impact the environment have been identified. SSCs that could provide a direct pathway to ground include:

- Buried process piping (e.g. waste liquid discharge).
- Secondary Plant system piping contaminated during primary to secondary system leakage events.
- Buried piping associated with Radwaste operations
- Building walls and floors exhibiting through-leakage pathways
- Turbine Building Floor Drains

- Raw water system piping

Examples of other SSCs that could provide an indirect pathway to ground include:

- washout of gaseous effluents from the main stack
- sewage collection and treatment system
- auxiliary and radwaste building roof drains to the yard areas and storm drain system piping
- air conditioner condensate

Several releases to the environment of radionuclides have occurred during the operating history of FCS. Survey reports and event descriptions pertaining to each release are available as electronic links to this report. Table 4 contains the releases that are listed in either the 10 CFR 50.75(g) file maintained by FCS to document operational occurrences that may, singly or collectively, have significance for decommissioning or were identified to have occurred prior to 10 CFR 50.75(g) file initiation but deemed noteworthy.

Table 4: Summary of Events Concerning Radiological Incidents at Fort Calhoun Station

Report Number	Date	Description of Incident
82-1555	10/16/82	Leak from Waste Evaporator
No report #	August 1983	SIRWT Overflow results in release outside RR Bay Door
LER-84-008	5/16/84	Steam Generator tube rupture event
IR-89-0359	3/9/89	Floor drain backup in Rooms 18, 19 and Corridor 4
ROR-89-003	9/4/89	Room 23 leak
ROR-90-050	2/22/90	Reactor coolant spraying from level indicator onto containment floor
IR-90-0134	3/12/90	Spent Fuel Pool Overflow
ROR-90-288	5/15/90	Room 6 flooded due to open drain line
IR-91-0323	9/23/91	Radioactive material identified in West Sanitary Lagoon
ROR-92-029	4/15/92	Catch basin overflow in Room 59 results in approximately 5 gallon leak of reactor coolant onto floor.
ROR-92-050	9/17/92	Primary sample sink overflow results in water over 90% of Room 60 floor area.
ROR-92-059	11/20/92	Spent Regeneration Tank spill spreads contamination to Room 23
IR-95-0107	2/17/95	Elevated Tritium concentrations identified in river water analysis
CR-2002-04256	12/16/02	Water leakage in Old Warehouse entered posted Radiological and Contamination Areas.
CR-2004-02476	7/20/04	Water leakage in Old Warehouse in the vicinity of RCP motor and RV thermal shield.
CR-2005-05512	12/1/05	Spent Fuel Pool Liner leak rate increase detected

CR-2014-11308	9/11/14	Crack in Rm 16 floor leads to groundwater in-leakage and potential path of out-leaks of contamination.
CR-2015-05944	5/7/15	Roof leaks into Radwaste Building pose potential contamination control risk.
CR-2015-09724	8/9/15	Contaminated water leaking from waste pump leaks through ceiling, contaminating a clean controlled area within an RCA.
CR-2016-05044	6/4/16	Fire main flushes caused a contaminated floor drain to back up and contaminate a significant portion of Room 18—an area that is normally a clean controlled area in the RCA.
CR-2016-05876	7/7/16	Water intrusion into old warehouse RCA.

The dominant plant-related radioactive contaminants identified in the Protected and Owner-Controlled Areas are Iron-55, Cobalt-60, Nickel-63, Cesium-137, and H-3 (tritium). In addition to tritium, periodic ground water sampling has identified the presence of low level concentrations of Sr-90. Based on a period of nearly a decade of operation with failed fuel in the 1990s, system and structure contamination from transuranic radionuclides is also a concern. Contaminated media include primarily soil, sediment, water, concrete, asphalt and steel. Additionally, some components such as insulation, filters, tanks and pipes conveying radioactive liquids or gases are, or potentially may be, contaminated.

4.2.2.3 Groundwater Impacts

The FCS Groundwater Protection Program was initiated in 2007 when 13 new monitoring wells were installed at the site [11]. The 13 new monitoring wells were located in the PA area to form the Groundwater Sampling Plan for FCS. Following review of the groundwater plan in 2008, four additional shallow monitoring wells were added to the program [16]. The 17 monitoring wells are sampled quarterly as part of the FCS Groundwater Protection Program [3] (Figure 5). The samples are analyzed for tritium and gamma-emitting radionuclides. Hard to detect radionuclides, including Iron-55, Nickel-63, and Strontium-90 are also analyzed on a less frequent basis. Review of sampling results from 2011 through 2018 demonstrates that the groundwater sampling activities have detected sporadic Strontium-90 (up to 0.9 pCi/L) in several shallow wells, but no other hard to detect radionuclides [4].

Tritium has been detected at concentrations less than 416 pCi/L in only one monitoring well (MW-6) over the 2011 through 2018 groundwater monitoring time period [4]. The minimal tritium detections and the minor sporadic detections of Srontium-90 indicate that groundwater at the FCS site is not significantly impacted by radiological contaminants, and that a plume of tritium or Strontium-90 is not migrating off-site.

The tritium detected in MW-6 has occurred on three occasions, 2nd and 3rd quarter 2014 (223 and 416 pCi/L, respectively) and 2nd quarter 2018 (241 pCi/L). The tritium concentrations detected are very near the minimum detection limit (MDL) and combined

with the non-detect status in all other monitoring wells suggests that the values are potentially false positive.

The episodic but low strontium-90 concentrations reported in the shallow monitoring wells within the PA suggests that a small Srontium-90 release has occurred at the site.

4.2.3 Contaminant Transport

Contaminant transport at FCS is generally controlled by precipitation-driven infiltration through the unsaturated soils from the ground surface down to the water table and by dissolved groundwater flow at depths below the water table. Additionally, the historic flood events at the site have created other transport processes including river currents across the site providing both erosion and deposition of site surficial soils and driving surface water and associated contaminants into previously unsaturated soils.

Groundwater flow at FCS is generally east towards the Missouri River, as the river is in hydraulic connection with groundwater in the alluvial aquifer within its floodplain. During periods of relatively high river stage, which occur generally from April through September when precipitation is greatest, river water recharges the nearby alluvial aquifer and induces ground water flow gradients outward from the river channel. These gradients reverse seasonally, during periods of lower river stage. Superimposed on the natural gradient reversals, were the effects of the RO Well which acted to draw groundwater towards the well up to a distance of approximately 600 feet (Figure 3).

In this regard, potential contamination dissolved in groundwater in the PA area may not migrate off-site. Contaminated groundwater within approximately 600 feet of the RO Well may be captured by the pumping well. Additionally, contaminants in groundwater could be incorporated in bank flow related to seasonal high river stages and would tend to flow west of the riverbank.

As described in Section 4.1.2, the native unconsolidated deposits on the FCS site consist of an upper 20 to 50 feet of predominately silty sands, and the lower beds consist of fine sands with occasional interbedded lenses of gravel [5]. The groundwater table beneath the PA of the station occurs within the silty sands and transport of contaminants released to the environment at or near the ground surface would be primarily within the shallow unconsolidated aquifer [16]. The bedrock beneath the station is sedimentary bedrock 500 to 2,500 feet in thickness consisting primarily of limestone, shale, and sandstone [5]. The bedrock units would not be expected to contribute significantly to contaminant transport at the station.

Gamma-emitting radionuclides produced at the station have an affinity for soil particles and are generally immobile in the environment because of their adsorption to soil. Tritiated groundwater, on the other hand, is mobile and tritium or other non-radiological materials released near the ground surface can be expected to migrate through unsaturated overburden (e.g., silty sand, sands, and structural fill, etc.) via precipitation-driven infiltration and transport. This predominantly downward migration will continue until the tritiated water or dissolved non-radiological material encounters saturated overburden (i.e.,

water table), and then will follow the local hydraulic gradient in the water table. The concentrations of contaminants transported through the groundwater domain generally will decrease with distance from their source.

4.2.4 Potential Contaminant Receptors

Radioactive material is carefully managed within radiation control areas at the station and discharge of radioactive effluents and solid wastes is continuously monitored. These controls are practiced to ensure that exposure of human and ecological receptors to radiological contaminants is below levels established by the NRC, the FCS ODCM, and are as low as reasonably achievable (ALARA).

Fort Calhoun Station receives its freshwater supply from the Blair Township public water supply system, whose source is the Missouri River upstream from the FCS site. Groundwater from the site is not a source of potable water but is the source for process water at the site. OPPD controls all property within the restricted area. The minimum exclusion distance is 2,986 feet. The nearest privately owned land is farmland and is approximately 0.5 miles from the site. Access to the area is restricted to employees and contractors. There are no private or public land holdings, drinking or irrigation water sources existing between the site and the river. Therefore, no exposure to groundwater contaminants via water supply systems is reasonably expected.

Fort Calhoun Station has 11 permitted outfalls that discharge storm water into the adjacent marshes, and streams and two NPDES outfalls (Figure 6). The NPDES outfalls are routinely monitored for pH, oil and grease and total suspended solids in accordance with requirements of the station's National Pollutant Discharge Elimination System (NPDES) Permit. A summary of the NPDES reporting results is included in the Annual Radiological Effluent Release Report and indicates that the station is in compliance with the NPDES permit requirements [4].

Samples of Missouri River water, sediment, and fish are sampled from the river as a component of the station's REMP program. Each of the samples is analyzed for gamma-emitting radionuclides. The river water samples are also analyzed for tritium. Annual reports detailing the results of REMP monitoring in 2013-2015 were reviewed for the preparation of this HSA. These reports confirm that no radioactivity attributable to FCS was detected in samples collected for the REMP program [4].

FCS Conceptual Site Model Supporting Documents

20170724-P-MRNRD-Final-GMP-Vol-I.pdf
7-12-1995 IWM 57477 DEQ Report HYDROGEOLOGICAL CHARACTERIZATION.pdf
ENWRA Hydrogeological Study.pdf
EPRI FCS GW Assess Final.pdf
Groundwater Plan.pdf
Groundwater Wells.pdf
PBD-37 Groundwater Protection.pdf

Reconnaissance of Ground-Water Quality in Papio-Missouri River 1992 USGS.pdf
Surficial Geology of Fort Calhoun Geologic Units.pdf
Surficial Geology of Omaha and Council Bluffs.pdf
Terracon Hydrogeologic Assessment 2007.pdf
TSD 08-015 Evaluation of FCS GW Protection Program Rev1 Final.pdf

5 MARSSIM Investigation Process

The HSA is the first step in a process described in MARSSIM. The purpose of MARSSIM is to provide a standardized approach to demonstrating compliance with a dose or risk-based regulation. MARSSIM provides guidance to prepare and implement a statistically valid site investigation and survey plan that will support termination of the NRC operating license for a facility [6].

5.1 Approach and Rationale

The primary tasks in the site investigation and survey process are:

- Historical Site Assessment
- Scoping Survey
- Characterization Survey
- Remedial Action Support Survey
- Final Status Survey
- Regulatory Agency Confirmation and Verification

A phased approach is used in the site investigation process so that the information developed during each successive task benefits from and builds upon information from previous tasks. If a scoping survey determines that an area impacted by radioactivity at levels above background or other contaminants above background is smaller or the contaminants are fewer or less concentrated than had been identified by the HSA, fewer resources and less effort can be expended during the characterization survey and later tasks. In this way, investigation can proceed most efficiently. A brief discussion of each of the tasks in the MARSSIM process follows [6].

5.1.1 Historical Site Assessment

The intent of an HSA is to document a comprehensive investigation that identifies and evaluates historical information pertaining to events that may have resulted in contamination during the operating history of the subject site. Contaminants of interest include both radiological and non-radiological materials and may have impacted SSCs of the plant or environmental media within the owner-controlled property. The information developed by the HSA is evaluated to identify and differentiate, through meaningful classifications, potentially "impacted" areas of the site [6]. Non-impacted areas are defined by implication.

As defined in MARSSIM, which pertains only to plant derived residual radioactivity, a "non-impacted" area is any area "where there is no reasonable possibility (extremely low potential) of residual contamination." An "impacted" area is defined in MARSSIM as "any area that is not classified as non-impacted" and "Areas with a possibility of containing residual radioactivity in excess of natural background or fallout levels." Areas determined to

be impacted are further classified (based on preliminary information) as Class 1, Class 2 or Class 3, depending upon the apparent extent of their impact [6].

As defined in MARSSIM, Class 1 areas are those that have, **or had prior to remediation**, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiation surveys) at concentrations greater than the site release criteria. Examples of Class 1 areas include:

- site areas previously subjected to remedial actions,
- locations where releases are known to have occurred,
- former burial or disposal sites,
- waste storage sites, and
- areas with contaminants in discrete solid pieces and with high specific activity.

Class 2 areas are those that have, **or had prior to remediation**, a potential for radioactive contamination or known contamination, but not at concentrations expected to exceed the site release criteria. To justify changing the classification from Class 1 to Class 2, there should be measurement data that provides a high degree of confidence that no individual measurement would exceed the site release criteria. Examples of areas that might be classified as Class 2 include:

- locations where radioactive materials were present in an unsealed form,
- potentially contaminated transport routes,
- areas downwind from stack release points,
- upper walls and ceilings of buildings or rooms subjected to airborne radioactivity,
- areas handling low concentrations of radioactive materials, and
- areas on the perimeter of former contamination control areas.

Class 3 areas are potentially impacted areas that are expected to contain levels of residual radioactivity at only a small fraction of the site release criteria, based on site operating history and previous radiation surveys. Examples of areas that might be classified as Class 3 include buffer zones around Class 1 or Class 2 areas, and areas with very low potential for residual contamination but with insufficient information to justify a non-impacted classification [6].

To classify the relative risk that SSCs or areas may have been impacted with non-radiological contaminants, the same approach described in MARSSIM for radiological contaminants has been applied, with the addition of a fourth "impacted" classification designated as "Isolated". Isolated SSCs or areas are contained within buildings or structures. These SSCs or areas are shielded from processes such as precipitation, wind, runoff, infiltration and seepage that would otherwise distribute non-radiological contaminants to the natural environment. There is the potential that structural elements or building materials within these isolated SSCs or areas may have been impacted by release of contaminants within them but the risk of contamination of the natural environment from such incidents is negligible. The Isolated classification is applied solely to non-radiological contamination because the hazards unique to radiological contamination exist whether or not the contamination is isolated.

In lieu of radiological site release criteria non-radiologically contaminated areas can be evaluated for classification by considering various applicable regulatory criteria such as the NDEE Nebraska Voluntary Cleanup Program [17], U.S. EPA National Primary Drinking Water Standards [8] or U.S. EPA Regional Screening Levels [9]. The prefix NR (Non-Radiological) has been applied to these classifications to differentiate them from MARSSIM-based classifications.

A classification of "NR impacted" does not imply a determination that a RCRA facility investigation (RFI) or corrective action will be required under the Federal Resource Conservation and Recovery Act (RCRA) or a NDEE environmental remediation program. The classification has been assigned to some areas or SSCs because materials used or stored there have the potential to contaminate media that could require remediation at the time of decommissioning. Scoping and characterization activities conducted at that time will determine the need for clean-up of areas or SSCs where non-radiological contaminants may have been released to the environment. Only those areas or SSCs where contamination is shown to exist at concentrations greater than the site closure criteria will become RCRA or NDEE Areas of Concern (AOC).

NR Class 1 areas have the greatest potential for contamination and, therefore, receive the highest degree of investigative effort using a graded approach, followed by NR Class 2, NR Class 3 and NR Isolated areas. Non-impacted areas do not receive any level of investigative effort because they have no plausible potential for residual contamination [6].

5.1.2 Scoping Survey

Scoping surveys are conducted after the HSA is completed and consist of measurements, sampling, and analysis. The number and locations of these measurements, samples, and analyses are based on the HSA data and professional judgment. If the results of the HSA indicate that an area is Class 3 or NR Isolated, and no residual contamination at concentrations greater than a small fraction of the site release criteria is found during the scoping survey, the area may be downgraded to Non-Impacted or confirmed as Class 3 and a Class 3 characterization survey and final status survey (FSS) would be performed. However, if the scoping survey of an area with a preliminary classification of Class 3 or NR Isolated identifies residual contamination at concentrations greater than a small fraction of the site release criteria, the area must be reclassified as Class 2 (or Class 1) and a characterization survey performed, followed by an FSS with rigor appropriate for the class.

5.1.3 Characterization Survey

This type of survey is a detailed environmental characterization of an area. The characterization survey is a comprehensive survey and generates substantial data. This survey includes preparation of a reference grid, systematic (random) as well as judgment (biased) measurements, and surveys of different media (e.g., surface soils, groundwater, interior and exterior surfaces of buildings). The decision as to which media will be surveyed

is a site-specific decision addressed throughout the site investigation process and informed by the results of the HSA [6].

The data obtained during the site characterization survey will inform follow-on phases of the site decommissioning. The radiological or other contaminant information developed will be used to determine the scope and extent of contamination, to evaluate and select potential methods for any required remediation, and to determine the classification and ultimate disposal method for waste generated during the remediation. Ultimately, the characterization survey will provide sufficient information to successfully design a License Termination Plan that will be approved by federal and/or state regulatory agencies to terminate the site operating license with the goal of release of the site for unrestricted use [6].

5.1.4 Remedial Action Support Survey

If an area is adequately characterized and is determined to be contaminated at concentrations greater than applicable site release criteria, remediation/decontamination ordinarily will be required before the area can be released for unrestricted use. A remedial action support survey is performed while remediation is being conducted and guides the cleanup in a real-time mode. The remedial action support survey also provides the basis for determining when a site or survey unit is ready for the FSS [6].

5.1.5 Final Status Survey

The FSS is used to demonstrate final compliance with release criteria regulations. The primary objectives of the FSS are to select/verify survey unit classification and to demonstrate that the potential dose or risk from residual contamination is less than the release criteria for each survey unit. The FSS process consists of four principal elements:

- Planning
- Design
- Implementation
- Assessment

Although the term Final Status Survey, as defined in MARSSIM, pertains to the assessment of residual radioactivity, it is being expanded in this HSA to encompass sampling and analysis of non-radiological contaminants as well. Additionally, since "release criteria" may also refer to other than license termination criteria, for non-radiological contaminants, the broader "applicable site release criteria" will be used throughout this report.

5.1.5.1 Planning

Final Status Survey planning includes review of the HSA and other pertinent characterization information to establish Data Quality Objectives (DQOs), the final survey unit classification, and the radionuclides or other contaminants of concern. The HSA reviews historical use of licensed and hazardous material at the facility and the levels of

potential contamination through personnel interviews and review of plant records and presents preliminary area classifications based on this data. After scoping and characterization surveys are completed, a final classification is assigned to site buildings and areas based upon their potential for contamination. Areas that have no reasonable potential for residual contamination from site operations receive a final classification of non-impacted [6].

As described above, areas or SSCs with reasonable potential for residual contamination from site activities are classified as impacted areas. Impacted areas are divided into three, and in some instances four (for non-radiological contaminants), classifications based upon the potential contamination levels and how the contamination is distributed. Areas with the same classification are broken into survey units. Survey units are fundamental elements for which FSSs are designed and executed. The classification of a survey unit ordinarily dictates how large it can be in terms of surface area [6].

Before the survey process can proceed to the design phase, concentration levels that correspond to the maximum annual radiological dose criterion prescribed by federal regulation 10 CFR 20.1402 (25 mrem/yr) must be established. These concentrations are established for either surface contamination (measured in disintegrations per minute [DPM] per 100 cm^2) or volumetric contamination (measured in pCi/gm). The concentrations are used in the survey design process to establish the minimum sensitivities required for the available survey instruments and techniques, and in some cases, the spacing of fixed measurements or number of samples to be collected within a survey unit. Surface or volumetric concentrations that correspond to the maximum annual dose criteria are referred to as DCGLs which are site-specific license termination and site release criteria [6].

5.1.5.2 Design

After the license termination criteria are established, a survey design is developed and documented for each survey unit. The plan is documented as a Survey Package that selects the appropriate survey instruments and techniques to provide adequate coverage of the survey unit through a combination of scans, fixed measurements, sampling and analysis. The Survey Package implements the DQOs for its survey unit and provides instructions for carrying out the survey. The Survey Package documents the assessment of survey results, the statistical basis used to determine if the survey unit contains residual contamination at concentrations greater or less than the DCGLs or other applicable site release criteria, and the review and approval of the package [6].

Where radionuclides or other contaminants of concern are present in background at levels that impact the DCGLs or other applicable site release criteria, the planning effort may include establishing appropriate reference areas to determine baseline concentrations for those radionuclides or other contaminants and their variability. A reference coordinate system may be used for documenting locations where measurements were made and to allow replication of survey efforts if necessary. This process ensures that data of sufficient quantity and quality are obtained to make decisions regarding the suitability of the survey design assumptions and whether or not the unit satisfies the applicable site release criteria.

Approved site procedures will direct this process to ensure consistent implementation and adherence to applicable requirements [6].

5.1.5.3 Implementation

Survey implementation is the process of carrying out the survey plan/package for a given survey unit. Implementation consists of scan measurements, fixed measurements, and collection and analysis of samples. Scan measurements for residual radioactivity will always be made, while fixed measurements and sampling may not be necessary. Data are collected and stored using a data management system [6].

5.1.5.4 Assessment

Data assessment includes data Verification and Validation (V&V), review of survey design bases, and data analysis. For a given survey unit, the survey data are evaluated to determine if the residual activity levels in the unit are less than the applicable release criteria and if any areas of elevated activity exist.

In some cases, data evaluation will serve to show that all of the measurements made in a given survey unit are below the applicable site release criteria. In this case, demonstrating compliance with the applicable site release criteria requires little more in the way of analysis [6].

In other cases, residual radioactivity or other contamination may exist with measurement results both above and below the applicable site release criteria. In these cases, statistical tests may be performed to inform the decision as to whether or not the survey unit satisfies the applicable site release criteria. The statistical tests that might be required to make decisions regarding the residual activity levels remaining in a survey unit relative to the applicable site release criteria ordinarily are considered in the survey design to ensure that a sufficient number of measurements are collected.

Quality assurance and control measures are employed throughout the FSS process to ensure that all decisions are made on the basis of data of acceptable quality [6].

5.1.6 Regulatory Agency Confirmation and Verification

The regulatory agencies responsible for the site often confirm whether the site is acceptable for release and any limitations thereon. This confirmation may be accomplished by the agency or an impartial party contracted by the agency. Although some actual measurements may be performed by the agency or its contractor, much of their work for confirmation and verification may involve evaluation and review of documentation and data from completed survey activities. The evaluation may include site visits to observe survey and measurement procedures or split sample analyses by the regulatory agency's laboratory. Therefore, accounting for confirmation and verification activities during the planning stages is important to each type of survey [6].

5.2 Documents Reviewed

Appendix A contains an all-inclusive list of files consisting of all the supporting documents reviewed during the generation of this report. For ease of access, the supporting documents are also listed in their relevant subsections of the HSA.

5.3 Property Inspections

Site tours were conducted in 2019 during the weeks of November 4 through 12, and December 10 through 12.

Physical tours of the following buildings and contained systems and components were conducted:

- Chemistry and RP Building
- Auxiliary Building
- Turbine Building
- Spent Fuel Pool
- Radioactive Waste Building
- Maintenance Building
- Intake Structure
- New Warehouse
- New Security Gatehouse
- Chemical Storage Area
- Vehicle Maintenance Facility
- Old Steam Generator Storage Area (external)
- Training Center

Tours of the following areas were also conducted:

- Plant Yard
- Switchyard (external)
- ISFSI (external)
- FLEX Building (external)

5.4 Personnel Interviews

Several station employees were consulted during the preparation of this HSA regarding information related to their work responsibilities and their recollection of historical contamination events that may have significance during plant decommissioning. Those interviewed and assigned to assist the HSA team combined for nearly 200 years of site-experience. The awareness and understanding of impacts of historical plant events was evident in those interviewed. A brief summary of those consulted, by employee experience, and the nature of the information discussed is contained in Table 5.

Table 5: FCS Employee Discussion Subjects

Employee Experience	Discussion Subjects
Operations, Operations/Plant Management	Operational events, general plant knowledge over 33 years, system and structure application changes, fuel integrity performance, environmental releases
Regulatory Affairs, Plant Licensing, Outage and Work Management,	Operational events, general plant knowledge over 27 years, system and structure application changes, fuel integrity performance
Operations Management	Operational events, general plant knowledge over 30 years, system and structure application changes, fuel integrity performance
Chemistry/Environmental Specialist	Operational events, general plant history over 27 years, environmental spills and releases, flood events and mitigation/recovery actions, sewage treatment history
Environmental Specialist, Radiological Effluent Specialist	Operational events, general plant knowledge over 27 years environmental spills and releases, flood events and mitigation/recovery actions,
Chemistry/RP Supervision, Hazmat coordinator	Radwaste and Hazmat practices, Hazmat generator status, radiological survey practices
Chemistry operations, general plant knowledge	Plant chemistry operations and general plant knowledge over 23 years.
RP Supervision	Survey practices, radiological history, general plant knowledge over 11 years on site experience.

Based on the consultations with those listed above, there do not appear to be any undocumented incidents of contamination at the station that would be significant for its decommissioning.

6 Assessment Findings

A total of ninety-four (94) areas of interest on the FCS site have been evaluated for potential impact by either radiological or non-radiological contaminants. The areas of interest are subdivided into the following categories: Building or Structure (24). Chemical and Drum Storage Area (3), Exterior Area (14), Oil-Filled Mechanical Equipment (6), Site-Wide Impacts (6), Storage Tanks (15) and Transformers (26).

For non-radiological contaminants, twenty-two (22) are classified as Non-Impacted, twenty-five (25) are classified as Isolated areas, eleven (11) as Class 3 areas, two (2) as Class 2 areas, and thirty-four (34) as Class 1 areas.

For radiological contaminants, forty-nine (49) of the areas of interest have been determined to be Non-Impacted. The remaining forty-five (45) areas have been classified preliminarily as having the potential for being Impacted, including three (3) classified as Class 1 areas, four (4) as Class 2 areas, thirty-four (34) as Class 3 areas, two (2) areas as a combination of Class 2 and Class 3, and two (2) as a combination of classifications Class 1 and Class 2.

None of the impacted areas are considered to be an imminent threat to human health or the environment that would warrant immediate corrective action. Appendix B summarizes the non-radiological findings, including preliminary area classifications for those areas potentially impacted. Appendix C summarizes the radiological findings, including preliminary area MARSSIM classifications for those areas potentially impacted. The map coordinates listed in Appendices B and C refer to the areas shown in the figures.

The following sections provide a detailed breakdown of non-radiological and radiological assessment findings, by category (i.e. site-wide impact, building or structure, exterior area, etc.). For each area of interest classified as Impacted, the sections provide a description and history, known or potential contaminants, potentially contaminated media, preliminary classification, recommended future investigation activities, and support documents. The timing for implementation of the recommended future investigation activities is to be determined by the site based on the schedule for decommissioning activities.

6.1 Non-Impacted Areas

6.1.1 Non-Radiological

Based on identified historical use there is a very low probability that non-radiological contaminants have impacted the environment in the area of the following list of site facilities or areas. Therefore, these facilities have been assigned a preliminary classification of NR Non-Impacted.

- Access Road Security Guardhouse
- Administration Building
- Equipment Storage Area
- Fire Protection Equipment

- Former Sanitary Lagoons
- Neutralization Chemical Pumphouse
- New Security Building
- North Slough
- Old Security Building
- OSGSF Building
- Radwaste Building
- RO Unit
- Sanitary Lagoons
- Sanitary Wastewater Land Application Area
- South Slough
- Training Center
- Utility Building

6.1.2 Radiological

Based on identified historical use, no site facilities were identified as MARSSIM Non-Impacted.

6.2 Site-Wide Non-Radiological and Radiological Impacts

The impacts listed in this section are distributed throughout the site and their occurrence is not restricted to one building, area or component.

6.2.1 Asbestos-Containing Material

Description and Historical Use

Asbestos Containing Material (ACM) may be present in pump, valve fittings and gaskets, pipe and wire wrap, floor and ceiling tiles, building insulation, siding and in roofing materials. FCS has developed Asbestos Engineering Controls and Work Practices (CH-HM-0008) and an Asbestos Management Plan (SA-FC-15-0016) [18] [19]. ACM has been used in various locations throughout the plant. To understand the specific distribution and type of ACM at the FCS facility, an Asbestos characterization has been initiated at the plant and the preliminary data are included in a spreadsheet document [20]. The data collected to date indicate that the Auxiliary and Turbine Buildings have numerous locations where ACM has been identified. ACM is most likely present in building material, roofing material, and floor tiles within other buildings at the plant [20].

Known and Potential Contaminants

The non-radiological contaminant is Asbestos. If handled properly, this material is not expected to pose a risk of contamination to environmental media such as soil or groundwater.

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Pipe Insulation
- Penetration Sealants
- Building Materials
- Floor Tiles
- Piping
- Roofing Materials
- Tank Insulation
- Pump and Valve Gaskets
- Wire Insulation

Preliminary Classification

Because of the human health risks associated with exposure to airborne ACM, areas containing the material are assigned a preliminary classification of NR Isolated.

Recommended Future Investigation Activities

- Complete the Asbestos characterization for the site.
- Confirm information included in the spreadsheet to support appropriate ACM abatement and disposal activities.

Supporting Documents

Asbestos Label and 653 Data.xlsx
CH-HM-0008.docx
SA-FC-15-0016 Asbestos Management Plan.docx

6.2.2 Lead and Lead-Based Paint

Description and Historical Use

Various plant equipment, component and structure coatings potentially contain lead-based paint. Any building built during the original plant construction period should be considered to contain lead-based paint due to the potential of the manufacturer having used lead-containing paint as the primer on structural steel. Based on this approach, structural steel in the Auxiliary Building, Turbine Building, and Containment Building most likely have lead paint. Initial lead paint characterization activities have been conducted in the Turbine Building and Auxiliary Building and many locations have been identified as containing lead paint [21].

Lead blocks and blankets are used for shielding in some RRA's, including in the Containment Structure and the Auxiliary Building.

Lead-acid batteries are components of the station emergency DC electrical supply. Waste lead-acid batteries are stored in the Chemical Storage and Hazardous Material Storage Buildings prior to off-site disposal. In-service batteries are located in switchgear rooms and in some of the fire protection panels as back up to water curtains in the Auxiliary Building. Various small batteries for lighting and backup power are located inside buildings throughout the station.

Known and Potential Contaminants

The non-radiological contaminants are Lead, Batteries and Lead-Based Paint. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Building Surfaces
- Lead-Based Paint
- Batteries
- Lead Shielding

Preliminary Classification

Because of the human health risks associated with exposure to lead, areas containing the material is assigned a preliminary classification of NR Isolated.

Recommended Future Investigation Activities

- Complete an inventory of building surfaces and SSCs with lead-based paint coatings.
- Inventory lead blankets, shielding blocks and lead-acid batteries.

Supporting Documents

Aux Building Battery Rooms.docx
FCS Turbine Building-XRF Lead Results 01102017.pdf
Lead Assessment.pdf

6.2.3 Mercury-Containing Components

Description and Historical Use

Electrical switches, relays, thermostats, thermometers, gauges, mercury vapor lamps, electronic components, etc. containing mercury are used in various locations throughout the station, including the Containment Building (Figure 2, Grid C6) and the Turbine Building (Figure 2, Grid C7).

Known and Potential Contaminants

The non-radiological contaminant is Mercury. If handled properly, this material is not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Mercury-Containing Components
- Mercury vapor lamps
- Thermometers
- Thermostats
- Gauges
- Fluorescent Lights
- Electrical Switches and Relays

Preliminary Classification

Because of the human health risks associated with exposure to mercury and mercury vapor, areas containing the material are assigned a preliminary classification of NR Isolated.

Recommended Future Investigation Activities

- Prepare an inventory of mercury-containing components in site SSCs to support appropriate disposal and manage potential risks associated with mercury exposure

Supporting Documents

List Of Mercury Components In The Plant For War Room Follow Up.Pdf
Mercury Switches Identified In The Plant.Pdf

6.2.4 PCB-Containing Components

Description and Historical Use

FCS has 30 transformers that include retrofilled (formerly filled with PCB oil that has been refilled with non-PCB oil) and non-PCB oil filled transformers [1]. Many of the transformers are located on concrete pads with no observed secondary containment (see Section 6.3.6). Retrofilled transformers still contain limited PCB's which leach out of the transformer internals into the oil. Because the original transformers were provided with PCB-containing dielectric fluid, there is a potential that legacy contamination of soil or groundwater with PCBs could exist. The use of PCBs was banned in 1979 due to their environmental toxicity and persistence. A summary of non-PCB and retrofilled Transformers is provided in the following list: [1]

- Main transformer
- Step-up transformer
- Two 161 kV transformers (T1 and T2)
- Shunt reactor
- Two 345 kV auto transformers (T3 and T4)
- Two-unit auxiliary transformers (T1A1 and T1A2)
- Two house service transformers (T1A3 and T1A4)
- Emergency power transformers
- EE-95 transformer
- Six 4,160-480-volt transformers
- Service Building/Maintenance transformer
- TSC transformer
- New Warehouse transformer
- Training Center transformer
- Admin Building transformer
- Firing Range transformer
- Rad Waste Building transformer
- ILRT Compressor transformer
- Two Old Warehouse transformers
- 6-Bay Building transformer

PCB-containing fluorescent light ballasts and capacitors have been used in various locations throughout the station. Most of these components have been removed from the site but a few remain.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil, Capacitors, and Light Ballasts. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Dielectric Oil
- Capacitors
- Fluorescent Light Ballasts

Preliminary Classification

Because of the human health risks associated with exposure to PCBs, areas with components containing the material are assigned a preliminary classification of NR Isolated.

Recommended Future Investigation Activities

- Prepare an inventory of PCB-containing components in site SSCs.

Supporting Documents

08-22-2012 RA 57477 DEQ Memo External SITE STATUS.pdf
08-22-2012 RA 57477 DEQ Notification RELEASE.pdf
HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf
PCB Results.pdf

6.2.5 Sewage Collection System

Description and Historical Use

The sewage collection system collects sewage from all on site facilities and pumps the waste stream to the sewage lagoons. Original waste sewage lagoons, located immediately south of the plant Administration Building (Figure 2 , Grid E6) have been retired in place and replaced by two new ("East" and "West") sanitary lagoons located due south of the original lagoons.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Piping
- Sludge

Preliminary Classification

Because the Sewage Collection System has processed radiation worker biowaste during over 30 years of reactor operation, this system has processed and aggregated internal radioactivity contamination and external worker contamination. Evidence of this contamination stream has been manifested in historical system sampling and radiological analyses. The Sewage Collection System is presumed not to contain non-radiological contamination, while some radiological contaminants may have accumulated within the system. Preliminary classifications of NR Non-Impacted and Radiological Class 3 are assigned to the Sewage Collection System.

Recommended Future Investigation Activities

- Obtain radiological analyses of water, and sludge from new waste lagoons
- Obtain radiological analyses of soil samples from former waste lagoons
- Obtain radiological analyses of piping and structure internal surfaces during maintenance and demolition activities.

Supporting Documents

Release in Sanitary Lagoons.pdf

6.2.6 Storm Drain System and Outfalls

Description and Historical Use

The Storm Drain System conveys drainage from roads, parking areas, roof drains and grassy surfaces throughout the station to 11 outfalls discharging to the adjacent Missouri River and drainage ditches (Figure 6). These points are identified as monitored outfalls and are authorized under Nebraska Industrial Storm Water General Permit NER910677 [22]. As there are no oil/water separators used to manage storm water at FCS, there is a potential for petroleum constituents to be present within the storm water outfalls.

Storm water outfalls SW01 through SW03 and SW10 drain parking areas and do not require specific monitoring. All of the other stormwater outfalls require quarterly visual inspection and benchmark sampling [22]. Storm drains (catch basins) are located along several of the piped portions of the Storm Drain System in both the PA and other portions of the site (Figure 6). The storm drain catch basin sediments may include both radiological and non-radiological constituents.

Fort Calhoun Station has an authorization to discharge under the National Pollutant Discharge Elimination System/Nebraska Pretreatment Program, NPDES/NPP Permit No. NE0000418. Two NPDES outfalls are located at the site and include the facility Discharge Line (Outfall 001) and Outfall 003. The permit authorizes the facility to discharge wastewater and is subject to the limitations, requirements, prohibitions and conditions set forth in the permit [22].

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Constituents, Oil and Grease, and RCRA Metals.

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Drain Pipes
- Storm Drain Sediment
- Concrete

Preliminary Classification

Because the Storm Drain System receives drainage from all parts of the PA and industrial portion of the station, it has the potential to contain a wide variety of contaminants, both non-radiological and radiological. As such, despite monitoring, some contaminants may have accumulated within the system. Therefore, the Storm Drain System is assigned a preliminary classification of NR Class 3 and a Radiological Class 3.

Recommended Future Investigation Activities

- Chemical analysis for oil and grease, petroleum constituents, and RCRA Metals in samples of sediment in storm drain catch basins, pipes and in sediment samples near system outfalls. If contamination is detected in the initial sediment samples, additional sampling of soil and groundwater near areas determined to be impacted is warranted.
- Direct radiological measurements and radiological contamination surveys of the system structures and components.

Supporting Documents

06-26-2011 RA 57477 DEQ Notification RELEASE.pdf
06-27-2011 RA 57477 DEQ Notification INCIDENT REPORT.pdf
06-30-2011 RA 57477 DEQ Notification RELEASE.pdf
07-07-2011 RA 57477 DEQ Memo External RELEASE.pdf
07-25-2011 RA 57477 DEQ Notification RELEASE.pdf
08-05-2011 RA 57477 DEQ Notification RELEASE.pdf
2019 SWPPP final.pdf
2-22-2016 PCS 57477 DEQ Letter STORMWATER MANAGEMENT PLAN AMENDMENT.pdf
6-17-2014 PCS 57477 DEQ Report NONCOMPLIANCE.pdf
FCS Stormwater Drainage Map.pdf
SPCC Plan Final 05187B00.pdf

6.3 Non-Radiological Impacts

6.3.1 Building or Structure

6.3.1.1 Auxiliary Building

Description and Historical Use

The Auxiliary Building (Figure 2, Grid C 6/7) is adjacent to the Containment Building. The Auxiliary Building contains all support systems for reactor operations that are not located in the Containment Building. In addition to reactor support systems typical of a PWR Auxiliary Building, the structure also contains the spent fuel pool, spent fuel support systems, emergency diesel generators, emergency core cooling and shutdown cooling systems. The Emergency Diesel Generator Day Tanks are located in the Auxiliary Building. Numerous minor oil leaks/spills have occurred within the Auxiliary Building over the operational history of the station. These minor releases were appropriately cleaned up consistent with CH-HM-007 [14] and SO-G-106 [15].

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Products, Oil and Grease, PCB-Containing Dielectric Oil. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)
- Building Surfaces
- Pipe Insulation

Preliminary Classification

Based on the activities conducted in the Auxiliary Building and the types of materials that could have been released a preliminary classification of NR Isolated is assigned to the building.

Recommended Future Investigation Activities

- Inspect the concrete floor for indications of staining, cracks or openings that could release the potential contaminants to the environment.

Supporting Documents

Asbestos Label and 653 Data.xlsx
CR-FCS-1996-01186-Fuel Oil leak from Aux FW-54 2-3 gal.pdf
CR-FCS-1997-00545-Seal Oil spill transferring oil from RC-3B Containment to Room 66 Aux.pdf
CR-FCS-2003-02851-COMBUSTIBLE MATERIALS LOCKER IN RM 6 AUXILIARY BUILDING OIL POOLED IN THE BOTTOM OF THE LOCKER.pdf

CR-FCS-2003-04956- Oil Circulating Pump for DG-1 leaking oil Aux Building 1 gal.pdf
CR-FCS-2004-01864-Iol Leak from Charging pump A CH-1A Aux Building Rm 6 1 gal.PDF
CR-FCS-2004-02697-Lube Oil leak from DG-1 Oil circulating pump Aux 1 gal.PDF
CR-FCS-2004-04001-Fuel Oil leak from Feedwater Pump Aux 1 gal.PDF
CR-FCS-2006-01985-Foel Oil spill from overfill of FO-1 Aux Building .PDF
CR-FCS-2007-2766-Boric acid Room 62 CVCS Piping north end of room Aux Building .PDF
CR-FCS-2008-0468-fuel oil leak from engine control panel DG-2 Aux Building.pdf
CR-FCS-2008-1664-Fuel oil leak AS-1 Aux Building 1 gal.PDF
CR-FCS-2008-2566-Oil leak from HE-47 Aux 1-2 gal.PDF
CR-FCS-2008-6440-Fuel Oil leak from FO-34A and FO-34B Aux Building.pdf
CR-FCS-2009-2108-Diesel oil spill from portable generator Room 66 1-2 gal.PDF
CR-FCS-2009-5391-Haydraulic Oil leak Corridor 4 of RCA from elevator shaft.pdf
CR-FCS-2009-5510-Boric acid seeping through walls in Aux basement.pdf
CR-FCS-2011-4159-Boric Acid on pipe penetrations in Aux Building.pdf
CR-FCS-2011-8783-AS-1 Aux Boiler Fuel Oil Leak.pdf
CR-FCS-2012-08156-Oil Leaking from PS-DG-1 Aux Building.pdf
CR-FCS-2012-08334-SI-1A, LPSI Pump Oil Leak Aux Building.pdf
CR-FCS-2013-02851-Oil Spill Room 6 Aux Building.pdf
CR-FCS-2013-07209-Leaking Oil from DG-2.pdf
CR-FCS-2013-14240-Boric Acid Spill Room 69 Aux Building.pdf
CR-FCS-2014-03147-Oil Pool under DG-2 Aux Building.pdf
CR-FCS-2015-03554-Fuel oil spilled from FO-2C (DG-1 fuel oil base tank)Aux Building.pdf
CR-FCS-2016-00764-Spilled oil sample in Aux Building.pdf

6.3.1.2 Chemical and Radiation Protection Facility

Description and Historical Use

The Chemistry and Radiation Protection (CARP) Building (Figure 2, Grid C6/7), is located on the north side of the Auxiliary Building. This building contains a clean (non-radioactive) Chemistry laboratory, office spaces, and personnel locker rooms. A controlled personnel access point to the primary Radiologically Controlled Area, RCA, comprised of the Auxiliary, Radwaste and Containment Buildings, as well as the Spent Fuel Pit is accessed from the CARP. The chemistry laboratory used Nessler's reagent to assess ammonia in waste material. Nessler's reagent is an aqueous solution of potassium iodide, mercuric chloride, and potassium hydroxide which is used to determine the presence of ammonia in a specific material. Use and disposal of this reagent has the potential to release mercury to the drain system.

Known and Potential Contaminants

The non-radiological contaminant is Mercury. If handled properly, this material is not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Floor Drain/Laboratory Sump

Preliminary Classification

Based on the activities conducted in the CARP and the types of materials that could have been released a preliminary classification of NR Isolated is assigned to the CARP.

Recommended Future Investigation Activities

- Inspect the CARP drain system for indications of staining, cracks or openings that could release the potential contaminants to the environment and collect samples from the drain for mercury analysis.

6.3.1.3 Containment Building

Description and Historical Use

The Containment Building (Figure 2, Grid C6) is a reinforced concrete structure in the form of a vertical cylinder with domed roof and a flat base designed to prevent radiological material release under normal operating and accident conditions. All penetrations through the steel-lined concrete structure for electrical conductors, pipe, ducts, air locks and hatch doors are of the double barrier design. The structure contains the reactor vessel, control rod elements, reactor coolant pumps, steam generators and pressurizer and system piping supporting reactor operation. A polar bridge crane is installed above the operating floor to handle the reactor vessel head and reactor internals during refueling and for maintenance operations within the reactor containment.

Known and Potential Contaminants

The non-radiological contaminants are Lubricating Oil, Petroleum Products, Oil and Grease, PCB-Containing Dielectric Oil, Lead, and Asbestos. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)
- Lead Paint
- Building Surfaces
- Pipe Insulation

Preliminary Classification

Because the lube oil-containing reactor coolant pumps/tanks are within the Containment Structure it is not likely that releases that may have occurred in the building have caused gross contamination of soil or groundwater. This building is assigned a preliminary classification of NR Isolated.

Recommended Future Investigation Activities

- Inspect the concrete floor of the building for indications of staining, cracks or openings that could release the potential contaminants to the environment.

Supporting Documents

Asbestos Label and 653 Data.xlsx
CR-FCS-2005-02554-OIl Leak from Containment Spray Pumps SI-3A, SI-3B and SI-1A Containment.PDF
CR-FCS-2008-2942-Boric acid release on wall ceiling and conduits 994' ele Containment (A Bay side) .pdf
HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf

6.3.1.4 Flex Equipment Storage Building

Description and Historical Use

The Flex Equipment Storage Building contains equipment stored for deployment under beyond design basis accident conditions. Limited personnel access is attained in this building located in the outer western perimeter of the Owner Controlled Area. Though built late in the plant's life cycle, it is used to contain spare firefighting equipment previously free-released from the RCA following use in drills and potentially, live-fire fighting evolutions. Additionally, trucks, generators and fuel are also stored in the Flex Equipment Storage Building.

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Products, Oil and Grease. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Because the fuel and equipment storage within the Flex Equipment Storage Building, this building is assigned a preliminary classification of NR Isolated.

Recommended Future Investigation Activities

- Inspect the concrete floor of the building for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.1.5 Hazardous Material Storage Building

Description and Historical Use

This building known as the Hazardous Material Storage Building (also known as Hazmat Shed) is located adjacent to and west of the former Old Warehouse (Figure 2, Grid C5). A second Storage Building was built at a later date (see Section 6.3.1.12). The building is not a RCRA Storage Area as the site is classified as a Small Quantity Generator. The generator status for the site was upgraded to a Large Quantity Generator for a short period of time following the 2011 flood to manage the waste material associated with the 2011 flood.

This building continues to store chemicals and hazardous waste. The building floor lies directly on the soils (i.e. "slab on grade") and there are no floor drains. Personnel interviews noted that during past operations, if the building was filled the hazardous materials would be placed outside the building to await off-site disposal. There are also accounts of the area being flooded, offering the potential for chemicals to be discharged to the soils outside the doorways. No known releases are documented for this building or outside of the building.

Based on the materials stored in the building and on the soils adjacent to the building, a limited characterization of site soils was completed in 2016 [2]. Two soil borings (DP0201 and DP0202) were installed on the south and north side of the Hazardous Materials Storage Building and soil samples were analyzed for VOCs, SVOCs, metals, SPLP for metals, and PCBs and the results were compared to NDEE VCP remedial goals for residential soils [2].

VOCs and PCBs were not detected, and several metals (arsenic, cobalt, iron and manganese exceeded the NDEE VCP remedial goals for residential soils but were below the industrial remedial goals. SPLP results were non-detect except for arsenic and selenium that exceeded the NDEE VCP groundwater cleanup standard. These results suggest that arsenic soil concentrations are most likely consistent with background soil values [23].

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Constituents, Volatile Organic Compounds, and PCB-Containing Dielectric Oil.

Potentially Contaminated Media

- Soil
- Groundwater
- Building Materials (Floor)

Preliminary Classification

Based on the drum storage both inside and outside the Hazardous Material Storage Building, a preliminary classification of NR Class 2 is assigned to the building.

Recommended Future Investigation Activities

- Inspect the concrete floor for indications of staining, cracks or openings that could release the potential contaminants to the environment.
- Additional soil sampling to confirm the preliminary results and assess the background arsenic distribution is recommended.

Supporting Documents

DNEE VCP 2018 Revised VCP Remediation Goals.pdf
HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf
VCP 2018 Revised VCP Guidance Document Final.pdf

6.3.1.6 Intake Structure

Description and Historical Use

The Intake Structure (Figure 2, Grid C7) is located on the east perimeter of the plant protected area along the bank of the Missouri River. The building houses circulating water, fire water and raw water system pumps which draw and filter water from the Missouri River. The building consists of a structural steel frame enclosed by resin wall panels. The intake structure is made of heavily reinforced concrete below the 1009.5 -foot elevation and extends over the Missouri River. Minor leaks associated with traveling screen gearboxes and circulating water pumps have occurred over the years at the Intake Structure

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Constituents and Oil and Grease. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Because the oil-containing pumps and gearboxes associated with the Intake and the occurrence of historic oils leaks, this building is assigned a preliminary classification of NR Isolated.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

Supporting Documents

02-23-2012 RA 57477 DEQ Notification RELEASE.pdf
2-23-2012 RA 57477 DEQ Notification INCIDENT REPORT.pdf
CR-FCS-2002-02448-Gearboxes for all 6 Traveling Screens (CW-2ABCDEF) leaking oil Intake.PDF
CR-FCS-2004-02994-Oil Leak from Raw Water Strainer AC-12A Motor Intake 1 gal.PDF
CR-FCS-2006-02733-Fuel oil leak from portable generator near Intake .PDF
CR-FCS-2007-01701-Fuel Oil Spill near Intake Structure.PDF
CR-FCS-2007-01703-Fuel oil leak from portable generator near Intake structure 2 gal.PDF
CR-FCS-2007-2022-Oil leak from CW-2f gearbox Intake structure no leak to river .PDF
CR-FCS-2009-1096-Oil leak Intake Structure basement from CW-1A circ water pump.PDF
CR-FCS-2009-3259-Fuel oil leak from filling FO-27 (diesel fire pump oil tank).PDF

CR-FCS-2012-01404-Gearbox for CW-2D Traveling Screen Leaked Oil into Circulating Cell (Circ water discharge).pdf
CR-FCS-2016-02872-Non reportable active traveling screen motor oil leak.pdf

6.3.1.7 Maintenance Garage

Description and Historical Use

The maintenance Garage is a steel and concrete slab-on-grade structure built in 2005, and located outside the plant Protected Area southwest of the former Old Warehouse Building (Figure 2, Grid C5). Plant vehicle storage, and maintenance is conducted in this multi-stall garage facility. A portion of this facility was also used to store spare fire protection equipment, some of which was potentially surveyed for free-release from the RCA. No known releases have been documented either inside or outside of the building. During the 2011 flood, the 6-Bay Maintenance Garage building was submerged in water.

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Constituents, Oil and Grease, Volatile Organic Compounds, and Waste Oil.

Potentially Contaminated Media

- Building Materials (Floor)
- Soil
- Groundwater

Preliminary Classification

Based on the vehicle maintenance activities conducted at the garage this building is assigned a preliminary classification of NR Class 3.

Recommended Future Investigation Activities

- Inspect the concrete floor of the building for indications of staining, cracks or openings that could release the potential contaminants to the environment. If staining and/or cracks in the concrete floor are observed, additional soil and groundwater sampling activities may be warranted.

Supporting Documents

CR-FCS-2001-02787-Gasoline Leak from Truck parked on N Side of Maintenance Building.pdf
CR-FCS-2003-01495-Hydraulic Oil leak North side of Maintenance Building long-term release .PDF
CR-FCS-2015-14338-Oil sheen inside the PA Vehicle Maintenance.pdf
CR-FCS-2016-00178-Oil sheen inside the PA Maintenance Vehicle Parking Area.pdf
HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf
VCP 2018 Revised VCP Guidance Document Final.pdf

6.3.1.8 Maintenance Shop

Description and Historical Use

The Maintenance Shop is located immediately northeast of the Containment Building (Figure 2, Grid C7) and houses maintenance equipment and tooling as well as workspace for plant maintenance evolutions. Periodically, temporary RCAs were established within this area as required for plant work. Prior to the construction of the Maintenance Garage, the Maintenance Shop was used for vehicle and equipment maintenance. The Maintenance Shop was built in 1978 and adjoins the Service and Turbine Buildings to the south in the PA. The original building was a rectangular-shaped structure and included an overhang under which were bays for vehicle maintenance. A rectangular-shaped addition was made to the northern portion of the Maintenance Shop in 1987.

The Maintenance Shop also includes two lube oil storage areas, one for new lube oil (360 gallons) and a second for used lube oil (155 gallons) [24]. The lube oil is stored in 55-gallon drums (used lube oil) or 60-gallon drums (new lube oil). No leaks or releases are known to have occurred in the lube oil storage areas.

Known and Potential Contaminants (used oil)

The non-radiological contaminants are Petroleum Constituents, Volatile Organic Compounds, and RCRA Metals.

Potentially Contaminated Media

- Building Materials (Floor)
- Soil
- Groundwater

Preliminary Classification

Based on the vehicle maintenance, lube oil storage, and shop maintenance activities conducted at the garage this building is assigned a preliminary classification of NR Class 3.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment. If staining and/or cracks in the concrete floor are observed, additional soil and groundwater sampling activities may be warranted.

Supporting Documents

CR-FCS-1998-02177-A SPILL OFONE (1) LITER OF HYDRAULIC FLUID from Garbage Truck NORTH SIDE MAINTENANCE SHOP.pdf
CR-FCS-2003-05354-Gasoline-Kerosene leak from Cabinet in New Weld Shop 1 gal .PDF
HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf
VCP 2018 Revised VCP Guidance Document Final.pdf

6.3.1.9 New Warehouse

Description and Historical Use

The New Warehouse (Figure 2, Grid B6), is constructed of steel and building materials on a concrete pad. The building houses two levels of new plant supplies and equipment and includes a storage area for lube oil and hydraulic oil that accommodates up to 70 55-gallon drums [24]. This building also houses decontamination showers used in the event of radiological contamination of personnel. Minor spills have occurred in the building, but no releases to the environment have been documented.

Known and Potential Contaminants

The non-radiological contaminants are Lubricating Oil and Hydraulic Oil. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Based on the volume of petroleum products stored in the New Warehouse, a preliminary classification of NR Isolated is assigned to the building.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

Supporting Documents

CR-FCS-2008-6825-Battery Acid spill to New Warehouse floor.PDF
CR-FCS-2009-1734-Oil spill NW side of New Warehouse 5 gal.pdf
CR-FCS-2009-2905-Diesel fuel spill north of New Warehouse from portable generator 2 gals.PDF
CR-FCS-2009-3169- Hydraulic Oil spill SE side of New Warehouse trash compactor leak.PDF
CR-FCS-2009-4424-Hydraulic Oil spill southeast side of New Warehouse - 1 gal .PDF
CR-FCS-2013-16788-Chemical Spill Room G New Warehouse.pdf

6.3.1.10 Old Warehouse

Description and Historical Use

The Old Warehouse (Figure 2, Grid C6) was located immediately outside the west perimeter of the Protected Area. This slab-on-grade building constructed of steel and concrete was demolished in 2018. It was used to house low level radioactive waste packaged for shipment and disposal, and contaminated plant equipment (e.g. RCP motors) stored for re-deployment post maintenance. The building was the site of numerous flooding events associated with operation of the nearby (north) reverse osmosis (RO) water purification unit. Prior to demolition, the northern end of the building was used for the RO system. During the 2011 flood the northern portion of the Old Warehouse was encased in an Aqua Dam to keep the flood waters from impacting the RO system and sea-land containers which contained radioactive waste.

Historically the Old Warehouse was used to store radioactive waste in sea-land containers, but some equipment maintenance was also completed in the building. In association with the RO system, the Old Warehouse also housed the following chemicals in addition to various petroleum-based products:

- Sulfuric Acid
- Sodium Hypochlorite;
- Sodium Hydroxide; and
- Citric Acid.

Due to the natural buffering capacity of soils, acids and caustics do not typically have a significant impact to the environment.

Information gleaned during interviews indicated that one or more spills that flowed out the overhead doors occurred in the Old Warehouse. These spills coupled with historic floods offer a migration pathway to impact shallow soils.

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Constituents and RCRA Metals.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the materials potentially stored in the Old Warehouse, maintenance activities conducted, and spills that potentially flowed out of the building a preliminary classification of NR Class 3 is assigned.

Recommended Future Investigation Activities

- Phased investigations initiating with shallow soil samples should be analyzed for petroleum constituents and RCRA metals in the area of the building and its immediate vicinity. If the soil samples are impacted, additional groundwater sampling is recommended.

Supporting Documents

CR-FCS-1997-00969-Hydrochloroic Acid spill Old Warehouse 2.5 gal.PDF
CR-FCS-1998-00334-HYDRAULIC OIL SPILL UNDERNEATH HE-37 OIL LEAKED INTO A FLOOR DRAIN UNDERNEATH OF HE-37 Warehouse truck lift.pdf
CR-FCS-1999-00708-A 1-GALLON BOTTLE OF TOLUENE Shattered Old Warehouse.pdf
CR-FCS-2006-04284-Lube Oil spill near Old Warehouse several gal.PDF
CR-FCS-2008-4766-Oil leak from dumpster NE corner of Old Warehouse 1 gal.PDF
HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf
VCP 2018 Revised VCP Guidance Document Final.pdf

6.3.1.11 Service Building

Description and Historical Use

The Service Building (Figure 2, Grid C7), housed the water treatment facility and personnel office space. The water treatment system generated purified river water for in-plant use. Water was transferred from the river to a settlement tank within the Service Building and there used caustics, acids, and other water treatment chemicals such as Acids-Bases and Sodium Chloride to remove particles from the water or change the pH [1]. The water was then sent to ion exchange resin tanks to remove metals. Backwash of the ion exchange tanks was then piped to the two lagoons. Based on results from the soil boring studies, the lagoons appear to have had a clay layer lining the lagoons [2]. Chemicals used for the water treatment activities included Sodium Hydroxide, Hydrochloric Acid, Alum, Calcium Carbonate (lime), and Chlorine. The water treatment system was retired-in-place when the Reverse Osmosis system was deployed in 2007.

In addition to the water treatment activities, the Service Building also included the Auxiliary (diesel) boiler, diesel fuel transfer pumps and piping and lead acid batteries.

During the flood of 1993/94, the lagoons were flooded and washed out. In 2002, the east lagoon was overflowed and the berm between the lagoons had to be cut [1]. The system was abandoned (circa 1990) when a supply connection was made to the City of Blair's municipal water supply [25]. After abandonment, the ion exchange resin from the lagoons was placed in the landfill (See Section 6.3.2.6).

Known and Potential Contaminants

The non-radiological contaminants are Sodium Hydroxide, Hydrochloric Acid, Chlorine, Diesel Fuel and Lead.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Based on the activities conducted in the Service Building and the types of materials that could have been released, a preliminary classification of NR Isolated is assigned to the building.

Recommended Future Investigation Activities

- Inspect the concrete floor for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.1.12 Storage Building

Description and Historical Use

The Storage Building (Figure 2, Grid B5) is located outside the northwest boundary of the PA, northeast of the Switchyard and north of the former Old Warehouse. The building is used to store chemicals and hazardous materials in a remote location of the site. Transport of material into this building was often conducted using site forklifts and equipment transiting the PA.

This building is known to store chemicals, but not hazardous wastes. Additional information on the chemicals stored in this building were not available, but it is anticipated that lubricants, degreasers, hydraulic fluids, etc. are stored here. There are also accounts of numerous drums of materials being stored outside the building in this area, prior to offsite disposal. No known releases from the drums were identified inside or outside of the building

Based on the materials stored in the building and on the soils adjacent to the building, a limited characterization of site soils was completed in 2016 [2]. Two soil borings (DP0203 and DP0204) were installed on the southern and eastern sides of the Storage Building and soil samples were analyzed for Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), metals, SPLP for metals, and PCBs and the results were compared to NDEE Voluntary Cleanup Program (VCP) remedial goals for residential soils [2].

VOCs and PCBs were not detected, and several metals (arsenic, cobalt, iron and manganese exceeded the NDEE VCP remedial goals for residential soils but were below the industrial remedial goals. The concentrations of these four metals were also consistent with published background soil values [23]. SPLP results were non-detect except for arsenic and selenium that exceeded the NDEE VCP groundwater cleanup standard. These results suggest that arsenic soil concentrations are most likely consistent with background soil values [23].

Known and Potential Contaminants,

The non-radiological contaminants are Petroleum Constituents, Volatile Organic Compounds, Semi-Volatile Organics, and RCRA Metals.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on drum storage both inside and outside the Storage Building, a preliminary classification of NR Class 2 is assigned identified for the building.

Recommended Future Investigation Activities

- Inspect the concrete floor for indications of staining, cracks or openings that could release the potential contaminants to the environment.
- Additional soil sampling to confirm the preliminary results and assess the background arsenic distribution is recommended.

Supporting Documents

CR-FCS-1996-00528-Amerzine 35 spill Chemical Storage Rm G 5 gal .PDF
DNEE VCP 2018 Revised VCP Remediation Goals.pdf
HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf
VCP 2018 Revised VCP Guidance Document Final.pdf

6.3.1.13 Turbine Building

Description and Historical Use

The Turbine Building (Figure 2, Grid Location C7) is a large concrete and steel building housing the turbine, generator, condenser, heater bay, auxiliary boiler, and various secondary plant support systems and components. The Turbine Building is also used to store various petroleum materials including Lube Oil and includes numerous pieces of oil-filled mechanical equipment (see Sections 6.3.3 and 6.3.4). Numerous minor oil leaks/spills have occurred within the Turbine Building over the operational history of the station and floor drains/sumps have been impacted by oil spills in the building (Table 2). These minor releases were appropriately cleaned up consistent with SO-G-106 [15].

In addition to the Lube Oil and petroleum storage in the Turbine Building, numerous locations containing ACM have been identified and ACM is present in building material, Penetration Sealants Piping, Valves and Heat Exchangers (see Section 6.2.1).

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Constituents, Oil and Grease, and Dielectric Oil. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)
- Floor Drains
- Pipe Insulation

Preliminary Classification

Based on the activities conducted in the Turbine Building and the types of materials that could have been released a preliminary classification of NR Isolated is assigned to the building.

Recommended Future Investigation Activities

- Inspect the concrete floor for indications of staining, cracks or openings that could release the potential contaminants to the environment. The Turbine Building has a sump that has conveyed oil NPDES outfall 001 (Table 2).

Supporting Documents

05-24-2011 RA 57477 DEQ Notification INCIDENT REPORT.pdf
07-07-2011 RA 57477 DEQ Memo External RELEASE REPORT.pdf
07-25-2011 RA 57477 DEQ Memo External RELEASE REPORT.pdf
Asbestos Label and 653 Data.xlsx
CR-FCS-1996-00095-Hydrazine leak from CF-18 Chemical Feed hydrazine tank Turbine Building .PDF

CR-FCS-1996-00551-FUEL OIL spill on SIDE OF THE TURBINE BUILDING from FW-54 DAY TANK VENT LINE 3-5 gal.pdf
CR-FCS-1999-01965-Refueling Fuel Oil spill at Diesel Generator Outside Turbine Building Truck Bay 2 gal.pdf
CR-FCS-2002-01178-Lube Oil leak from LO-9 Turbine Building 5 gal .pdf
CR-FCS-2003-05627-Fuel Oil leak from FO-127 Turbine Building 1 gal.PDF
CR-FCS-2004-02771-Lube OIL leak ON FW-4B Turbine Building 11 gal.pdf
CR-FCS-2004-02771-Oil leak for main feedwater Pump FW-4B migrated to Turbine Building Sump 11 gal.pdf
CR-FCS-2004-02916-Fuel Oil leaking from FO-127 Turbine Building Rm 63 1 gal.PDF
CR-FCS-2005-03647-ECH fluid release from hydraulic fluid pump ECH-3B 3 gal.PDF
CR-FCS-2006-03382-EHC fluid leak Turbine Building 1 gal .PDF
CR-FCS-2007-00649-Hydraulic oil release from ECH-3B Turbine Building 3 gal.PDF
CR-FCS-2007-3777-Hydrazine spill in Turbine Building truck bay 1-2 gal.PDF
CR-FCS-2008-5696-Fuel oil leak FO-30 FP-1B Fuel oil day tank 1-gal.PDF
CR-FCS-2009-5838-Hydraulic Oil spill to Turbine Building Elevator shaft 5-gal.pdf
CR-FCS-2011-4910 Lube Oil Leak (100 gal) to Turbine Building Sump and release to River.pdf
CR-FCS-2011-4911-Hydrogen Seal Tank Oil Leak Turbine Building basement.pdf
CR-FCS-2013-23248-Lube Oil Leaking from CF-15 Turbine Building.pdf
CR-FCS-2015-06569-EHC Oil Leak Turbine Building.pdf
FCS Turbine Building-XRF Lead Results 01102017.pdf

6.3.2 Exterior Areas

6.3.2.1 Agricultural Land

Description and Historical Use

Agricultural Land is located adjacent to both the north and south sides of FCS. These agricultural lands are leased to local farmers for use. Typical farming practices include the use of pesticides, herbicides, and fertilization to assist in crop production. It is unknown what specific chemicals or practices were used on the surrounding Agricultural Lands [1].

The agricultural activities have reportedly used tractors and other equipment in the farming activities. Historical records indicate that there was a diesel AST installed to refuel the farming equipment. OPPD had the tank and removed, however it is not documented how long the AST was in use or if any releases were associated with this AST. The location of the AST was in the Agricultural Land on the north side of the plant [1].

Known and Potential Contaminants

The non-radiological contaminants are Diesel Fuel Constituents, Petroleum Constituents, Pesticides, and RCRA Metals.

Potentially Contaminated Media

- Soil

Preliminary Classification

Based on the potential agricultural activities conducted across the Agricultural Land and the presence of a fuel AST, a preliminary classification of NR Class 3 is assigned to the lands

Recommended Future Investigation Activities

- Visual inspection of the former AST area and reconnaissance surficial soils sampling to assess presence of pesticides in the shallow soils. If soil staining is observed, additional soil samples analyzed for Diesel Range organics are recommended.

Supporting Documents

OPPD-FCS HSA Report Final 10-14-2016.pdf

6.3.2.2 Fire Training Area

Description and Historical Use

The fire training area is located to the west of the equipment storage area in the Switchyard and this outdoor area provides a means for hands on fire training (Figure 2, Grid B4). Currently, the area consists of a concrete pad with a central drain that discharges directly to Fish Creek. The area also contains two sealand containers, a propane tank, a cross pan, and other fire training equipment (fire extinguishers, rest area, etc.) [1].

The sealand containers are used to start fires using wooden pallets and straw as the fuel; water is used to extinguish the flames. The propane tank, which was installed approximately 12 years ago, is used to start fires in the cross pan which is then put out with water. It was also reported that during fire training activities the central pad drain is covered, preventing materials from draining to Fish Creek, allowing only rainwater and water from the pallet and straw fire suppression activities to drain from the pad.

Prior to use of propane, the cross pan fires were started using diesel fuel. Based on interviews, the fuels were first stored in 55-gallon drums, and later transported in 5-gallon containers. These activities allowed for potential releases of the fuel oils to the pad and soils in the area.

After the fires were extinguished, the extra fuel oil was collected from the cross pan for potential future use and the embers were containerized for off-site disposal. The area was then cleaned by spraying the burn pan and sealand containers with water, where the residual water was then drained to Fish Creek via a drain in the burn pad [1]. Additionally, although the cross pan was covered when not in use, it was possible for rainwater to fill or overfill the container, releasing residual oils to the pad, and then to Fish Creek.

The fire extinguishers used for fire prevention training are Aqueous Film Forming Foam (AFFF) dry type fire extinguishers. These fire extinguishers are known to contain perfluoroalkyl surfactants (PFAs) or proprietary fluorosurfactants based on the safety data sheets (SDSs). These PFAs are currently recognized by EPA as an emerging compound in the environment [1].

Based on the Fire Training activities and the materials utilized, a limited characterization of site soils was completed in 2016 [2]. Three soil borings (DP1001, DP10022, and DP1003) were installed in the Fire Training area and a groundwater sample (GW1004) was located downgradient of the Fire Training Area between the Fire Training Area and Fish Creek (Figure 2). Soil samples were analyzed for SVOCs and metals and the groundwater sample was analyzed for VOCs and PFAs. The results were compared to NDEE VCP remedial goals for residential soils and groundwater [17].

Soil samples had low concentrations of SVOCs, well below NDEE VCP remedial goals. Several metals (arsenic, cobalt and iron) exceeded NDEE VCP remedial goals, but are consistent with background levels [23]. VOCs were not detected in the groundwater sample, but total PFAs were detected at 3.15 micrograms per liter (μg/L). NDEE has not promulgated remedial goals for PFAs.

Known and Potential Contaminants

The non-radiological contaminants are Semi-Volatile Organics, RCRA Metals, and Perfluoroalkyl Surfactants.

Potentially Contaminated Media

- Soil
- Sediment
- Storm Water

Preliminary Classification

Based on the Fire Training activities and the results of the limited site characterization a preliminary classification of NR Class 1 is assigned to the Fire Training Area.

Recommended Future Investigation Activities

- Additional investigations to determine the lateral and vertical extent of PFAs in site groundwater may be warranted.

Supporting Documents

HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf

6.3.2.3 Firing Range

Description and Historical Use

The firing range is located north of the PA, on the north side of Fish Creek (Figure 2). The firing range consists of three berms and a shelter area. On the south corner of the firing range is a tower used for rifle practice, and there is a simulated indoor or obstructed view scenario practice area in the northeast corner.

The bullets used at the firing range are known to contain lead and lesser concentrations of other metals. Other potential contaminants include perchlorate, as it is commonly used as a stabilizer in the smokeless powder [1].

Due to the concerns regarding the potential for lead in the firing range soil berms, a lead assessment was completed by B2 Engineering in August of 2014 on the firing range soil berms [26]. Twelve soil samples from soil berm locations were sampled and the results of the lead characterization indicated levels of elevated lead in the exterior of the north berm. The lead levels ranged from 42.2 to 5335.7 milligrams per kilogram (mg/kg) (exceeding the industrial soil criteria of 750 mg/kg [17]. Additionally, four of the samples were assessed using the Toxicity Characteristic Leaching Protocol (TCLP), and TCLP values of 150 milligrams per liter (mg/L) were reported, exceeding the Hazardous Waste Criteria of 5 mg/L.

A Limited Site characterization was completed in 2016 and included installing two soil borings (DP1101 and DP1102), two surface soil samples (SS1101 and SS1102) and a groundwater sample (GW1101) located downgradient from the firing range [2]. The soil samples were analyzed for metals and perchlorate and the groundwater sample was analyzed for metals.

Similar to other soil sampling results, concentrations of arsenic, cobalt, manganese and iron had concentrations exceeding the NDEE VCP remedial action guidelines and are interpreted as background levels. Lead was detected at concentration ranging from 4.8 mg/kg to 230 mg/kg in the soil samples. Perchlorate was not detected in the soil samples. The groundwater sample had elevated concentrations of arsenic, barium, chromium, and lead greater than the USEPA MCLs and these four compounds plus aluminum, cobalt, iron, manganese, and vanadium are greater than the NDEQ VCP Groundwater Remedial Goals [2].

Known and Potential Contaminants

The non-radiological contaminants are Lead and RCRA Metals.

Potentially Contaminated Media

- Soil
- Sediment
- Groundwater
- Storm Water

Preliminary Classification

Based on the site characterization soil sampling results a preliminary classification of NR Class 1 is assigned to the Firing Range.

Recommended Future Investigation Activities

- Due to the levels of lead identified in soil and groundwater, additional evaluations are warranted to confirm the nature and extent of lead in soil and groundwater.
- Soil sampling to confirm the background distribution of arsenic, cobalt, manganese and iron is also recommended.

Supporting Documents

HSA Combined.pdf
Lead Assessment.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf

6.3.2.4 Fish Creek and Wetlands

Description and Historical Use

Fish Creek flows along the north side of the PA discharging to wetlands and the Missouri River (Figure 2, Grid A/B 3/4/5). The creek drains the farmland to the north and receives stormwater water runoff from the Fire Training Area, Switchyard, Firing Range, and the Plant.

Based on the varied potential inputs to the creek a Limited Site Characterization was conducted along the portion of the creek directly north of the site [2]. The assessment included three sediment samples (SD1401, SD1402, and SD1403) along the creek. The sediment samples were analyzed for polyaromatic hydrocarbons, PFAs, TAL Metals, and VOCs including perchlorate. The sampling results were below NDEE VCP remedial guidelines except for arsenic, cobalt, iron and manganese. These metals are interpreted to represent background levels across the FCS site [2] [23]. While other compounds were detected at concentrations below the NDEE remedial guidelines, SVOCs and PFAS were detected in the creek sediment samples.

Known and Potential Contaminants

The non-radiological contaminants are Semi-Volatile Organics, RCRA Metals, Volatile Organic Compounds, and Perfluoroalkyl Surfactants.

Potentially Contaminated Media

- Sediment

Preliminary Classification

Based on the detected compounds identified in the creek sediments a preliminary classification of NR Class 1 is assigned to Fish Creek.

Recommended Future Investigation Activities

- Additional characterization of creek sediments for SVOCs, polyaromatic hydrocarbons, and PFAs to support an ecological risk assessment of the creek.

Supporting Documents

HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf

6.3.2.5 Former Chemical Treatment Lagoons

Description and Historical Use

Two lagoons were formerly located outside of the southeast corner of the PA s (Figure 2, Grid D7). The lagoons included residuals of ion exchange resin to remove constituents such as metals. The lagoons included a clay layer, and the lagoon system received water from the water treatment process in the Service Building.

During the flood of 1993/94, the lagoons were flooded and washed out. In 2002, the east lagoon was overflowed and the berm between the lagoons had to be cut. Other reports include an ammonia release and an exothermic chemical explosion in the transfer lines from the Service Building [1]. The system was abandoned (circa 1990) when a supply connection was made to the City of Blair's municipal water supply [25]. After abandonment, the ion exchange resin residuals from the lagoons was placed in the landfill (See Section 6.3.2.6).

A limited site characterization was completed for the Former Chemical Lagoons that included the installation of two soil borings through the former lagoons (DP0101 and DP0102) and one soil boring downgradient of the lagoons (DP0103) [2]. Soil samples from the soil borings were analyzed for metals and SPLP. The soils had concentrations of arsenic, cobalt, iron and manganese that exceeded NDEE VCP remedial guidelines [1] [2]. All of the SPLP results were below NDEE VCP remedial guidelines for groundwater. The soil results are interpreted to consistent with background levels [2] [23].

Known and Potential Contaminants

The non-radiological contaminant is RCRA Metals.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the results from the limited site characterization a preliminary classification of NR Class 3 is recommended for the former Chemical Lagoons.

Recommended Future Investigation Activities

- Additional soil sampling to confirm the preliminary results and assess the background arsenic distribution is recommended.

Supporting Documents

HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf

6.3.2.6 Landfill

Description and Historical Use

This land area, (Figure 2, Grid E6/7) located southeast of the Administration Building consists of buried material from pre-operation construction activities. The landfill also received resin residuals from the closure of the former Chemical Treatment Lagoons (see Section 6.3.2.5). The landfill is monitored in compliance with NDEE Landfill closure criteria (Permit Number NE0054712). The closure activities include quarterly groundwater sampling and analysis of four monitoring of wells located around the landfill and one upgradient monitoring well, and evaluation of the groundwater data collected (Figure 4). The groundwater monitoring includes metal and pH sampling and analysis, water elevations and groundwater flow evaluation, and was initiated in 2001. The analysis completed for the closure process has typically shown decreasing trends for the metals and that the values are generally less than that reported for the upgradient monitoring well [27].

Known and Potential Contaminants

The non-radiological contaminant is RCRA Metals.

Potentially Contaminated Media

- Groundwater

Preliminary Classification

Based on the results of the long-term groundwater monitoring and the program oversight by NDEE a preliminary classification of NR Class 3 is recommended for the Landfill.

Recommended Future Investigation Activities

No data gaps are identified as the NDEE is providing oversight for the closure program.

Supporting Documents

1-24-2013 IWM 57477 DEQ Report GROUNDWATER RESULTS 4 Quarter 2012.pdf
2-17-1995 IWM 57477 DEQ Plan INVESTIGATION WORK PLAN - Landfill Closure.pdf
4-12-2016 IWM 57477 DEQ Letter EVALUATION OF POST CLOSURE CARE TERMINATION.pdf
5-12-2016 IWM 57477 DEQ Letter POST CLOSURE CARE TERMINATION FACILITY RESPONSE.pdf
7-12-1995 DEQ Report CLOSURE POST-CLOSURE Water Treatment Sludge closure.pdf
7-12-1995 IWM 57477 DEQ Report HYDROGEOLOGICAL CHARACTERIZATION.pdf
8-11-2016 IWM 57477 DEQ Memo External REQUEST INFORMATION NDEQ.pdf
Groundwater Monitoring Report 2011 2nd Quarter for FCS 11-EA-152.pdf
Groundwater Monitoring Report 2011 4th Quarter for FCS 12-EA-011.pdf
Groundwater Monitoring Report 2012 4th Quarter for FCS.pdf
Groundwater Monitoring Report 2013 2nd Quarter for FCS 13-EA-139.pdf
Groundwater Monitoring Report 2013 4th Quarter for FCS.pdf

Groundwater Monitoring Report 2014 2nd Quarter for FCS.pdf
Groundwater Monitoring Report 2014 4th Quarter for FCS 15-EA-005.pdf
Groundwater Monitoring Report 2015 2nd Quarter for FCS.pdf
Groundwater Monitoring Report 2015 4th Quarter and NDEQ Response Package for FCS.pdf
HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf

6.3.2.7 Protected Area Yard

Description and Historical Use

The Protected Area Yard surrounds the entire Containment, Auxiliary Building, Turbine Building and support buildings including the Service Building, Intake Structure and New Warehouse (Figure 2). Numerous minor petroleum-related releases have occurred in the PA (see Section 4.2.2.1). Most of the releases recorded in FCS files and listed in Table 2 were of less than 25 gallons of petroleum or 10 gallons of hazardous materials and were managed consistent with Determination of Reportable Quantity from Releases of Hazardous Substances and Oil [14] and Hazardous Material Incident Response Plan [15].

While the petroleum-related releases have generally been remediated within the PA, three ASTs and three USTs used to store fuel oil are located in the PA, along with seven transformers (see Section 6.3.6) (Figure 2). The transformers are located in a small switchyard on the south side of the Turbine building and total 30,061 gallons of transformer oil [24]. While minor spills related to refueling the USTs and ASTs most likely have happened, no specific releases related to the ASTs, USTs or transformers are known to have occurred.

Known and Potential Contaminants

The non-radiological contaminants are Dielectric Oil, Petroleum Constituents, and Fuel Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the numerous petroleum-related releases in the PA and the presence of both ASTs and USTs preliminary classification of NR Class 3 is designated for the PA Yard.

Recommended Future Investigation Activities

- Sampling and analysis of the existing monitoring wells in the PA area. While no significant non-radiological releases are documented in the PA, the long-term history of the minor petroleum-related releases has potentially impacted groundwater in the PA. These monitoring wells have never been sampled for non-radiological constituents and FCS should analyze the groundwater samples for total petroleum hydrocarbons.

Supporting Documents

CR-FCS-2001-02660-Oil leak from oil disposed in Dumpster near Turbine Building 3-foot stain in soil.pdf
CR-FCS-2004-01746- Oil-containing equipment released 7 gal oil to ground outside PA.PDF
CR-FCS-2005-01706-Hydraulic oil spill on gravel PA 2 gal.PDF
CR-FCS-2006-00742-ECH spill near Haz Mat shed in PA 1 gal.PDF

CR-FCS-2006-02733-Fuel oil leak from portable generator near Intake .PDF
CR-FCS-2006-03493-Hydraulic Oil-Brake fluid release near FO-1 enclosure 1 gal .PDF
CR-FCS-2007-01701-Fuel Oil Spill near Intake Structure.PDF
CR-FCS-2007-01703-Fuel oil leak from portable generator near Intake structure 2 gal.PDF
CR-FCS-2009-1734-Oil spill NW side of New Warehouse 5 gal.pdf
CR-FCS-2009-2905-Diesel fuel spill north of New Warehouse from portable generator 2 gals.PDF
CR-FCS-2009-2919-Oil spill at Sally Port north of Security.PDF
CR-FCS-2009-3169- Hydraulic Oil spill SE side of New Warehouse trash compactor leak.PDF
CR-FCS-2009-4424-Hydraulic Oil spill southeast side of New Warehouse - 1 gal .PDF
CR-FCS-2010-4441-Hydraulic Oil spill in front of Service Building.pdf
CR-FCS-2012-02369-Fuel Oil Leak from Delivery Vehicle from Diesel Fuel Station to Sally Port.pdf
CR-FCS-2012-05973-Hydraulic Oil Spill Sally Port Vehicle Gate.pdf
CR-FCS-2013-14036-Diesel Fuel Spill by Dry Cask Storage.pdf
CR-FCS-2015-01344-Skid Loader Hydraulic Oil Leak.pdf
CR-FCS-2015-02684 Mobile Crane Hydraulic Oil Leak near Intake Structure.pdf
CR-FCS-2015-06609-Oil sheen inside the PA near Vehicle Maintenance.pdf
CR-FCS-2015-14338-Oil sheen inside the PA Vehicle Maintenance.pdf
CR-FCS-2016-00178-Oil sheen inside the PA Maintenance Vehicle Parking Area.pdf

6.3.2.8 Switchyard

Description and Historical Use

This area (Figure 2, Grid B/C 4/5) located outside the west perimeter of the plant PA, contains switchgear providing offsite electrical power to the station and connecting site electrical generation lines to the grid. The Switchyard includes 11 transformers that total 98,563 gallons of transformer oil [24]. All of the transformers are located on concrete pads. Five of the larger transformer pads are surrounded by secondary containment berms (see Section 6.3.6).

Oils containing PCBs were routinely used in transformers prior to being banned in 1979 due to their environmental toxicity and persistence. All transformers at FCS now contain non-PCB oil [24], as PCB-containing transformers had the PCB-containing oil removed and replaced with non-PCB dielectric oil. Prior to 1979 on-site transformers most likely had PCB-containing oil and residual PCBs may still be detectable in these transformers.

Herbicides are also commonly used for weed suppression, and although recent and acceptable products have short half lives and are not anticipated to impact the environment, historically other products may have been used.

No significant transformer oil leaks have been identified within the Switchyard, but several leaking transformers have been identified over the years of Switchyard operation. These minor releases could impact shallow soils and over time migrate to groundwater.

Fish Creek flows along the northern border of the Switchyard and surface runoff from the Switchyard area has the potential to migrate into the creek (Figure 2 and Figure 6).

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil, Dielectric Oil, and Petroleum Constituents.

Potentially Contaminated Media

- Soil
- Groundwater
- Sediment

Preliminary Classification

Based on the large volume of dielectric oil contained in the transformers and the numerous leaks that have been reported in the Switchyard a preliminary classification of NR Class 1 is identified for the Switchyard.

Recommended Future Investigation Activities

- Evaluate soils in an around the Switchyard, sediments in nearby Fish Creek, and groundwater for PCBs, Petroleum Constituents, and herbicides.

Supporting Documents

CR-FCS-2002-04225-Transformer Oil leak from T-4 Transformer Switchyard berm-contained 5-7 gal.PDF
CR-FCS-2003-04954-T1 Transformer Oil Cooling Pump leaking oil 1 gal Switchyard .pdf
CR-FCS-2010-4381-Oil pump at Transformer T-1Switchyard leaking.pdf
HSA Combined.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf

6.3.3 Chemical and Drum Storage Areas

In addition to the Storage Building (see Section 6.3.1.12) and Hazardous Material Storage Building (see Section 6.3.1.5) where waste products have been stored prior to off-site disposal, there are three additional areas where petroleum products are stored including two Lube Oil storage rooms in the Maintenance Shop and one storage area in the New Warehouse [24].

6.3.3.1 Oil Storage Room Drums 1

Description and Historical Use

A room in the Maintenance Shop is used for the storage of new Lube Oil. The material is stored in 60-gallon steel drums and up to six drums (360 gallons) are designated for the storage area [24] (see Section 6.3.1.8). No record of a release of lube oil in the drum storage room has been found.

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Constituents and Oil and Grease. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

A preliminary classification of NR Isolated is identified for the New Lube Oil Storage room.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.3.2 Oil Storage Room Drums 2

Description and Historical Use

A room in the Maintenance Shop is used for the storage of used Lube Oil. The material is stored in 55-gallon steel drums and up to three drums (155 gallons) are designated for the storage area [24] (see Section 6.3.1.8). No record of a release of lube oil in the drum storage room has been found.

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Constituents and Oil and Grease. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

A preliminary classification of NR Isolated is identified for the used Lube Oil Storage room.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.3.3 Warehouse Storage Oil Drums

Description and Historical Use

A room in the New Warehouse is used for the storage of engine oil and hydraulic oil [24]. The material is stored in 55-gallon steel drums and up to 70 drums (3,850 gallons) are designated for the storage area [25](see Section 6.3.1.9). No record of a release of lube oil in the drum storage room has been found.

Known and Potential Contaminants

The non-radiological contaminants are Petroleum Constituents and Oil and Grease. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

A preliminary classification of NR Isolated is identified for the New Warehouse Oil Storage room.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.4 Oil-Filled Mechanical Equipment

The following sections describe locations containing Oil-Filled Mechanical Equipment.

Supporting Documents

SPCC Plan Final 05187B00.pdf

6.3.4.1 Electro Hydraulic Control Fluid System

Description and Historical Use

The Turbine Building includes a 400-gallon Electro Hydraulic Control (EHC) Fluid Reservoir Tank (Figure 2, Grid Location C7). The EHC system provides hydraulic fluid at sufficient pressure to operate the turbine valves and combined intermediate valves. Because of the high temperature involved, normal hydraulic fluid would pose a fire hazard. To avoid this, the EHC system utilizes "Fyrquel EHC" as an operating medium. The product is not considered a hazardous waste and is not regulated by the EPA [24]. The EHC Fluid Reservoir capacity is 400 gallons. Minor leaks associated with the EHC system have occurred with no impact to the environment.

Known and Potential Contaminants

The non-radiological contaminants are Electrohydraulic Control Fluid, Lubricating Oil Constituents, and Lubricating Oil. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)
- Floor Drains

Preliminary Classification

Based on its location within the Turbine Building and the volume of EHC fluid that could be released from the tank a preliminary classification of NR Isolated is assigned to EHC Fluid Reservoir Tank.

Recommended Future Investigation Activities

- Inspect the concrete floor for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.4.2 Elevator Hydraulic Oil Tank

Description and Historical Use

The mechanical equipment to operate the elevator contains hydraulic oil and an elevator hydraulic oil tank is located in the southern end of the Maintenance Shop (Figure 2) [24]. The single-walled steel tank contains 200 gallons of hydraulic oil. A five-gallon hydraulic oil leak occurred in the elevator shaft in November 2009. The minor release was cleaned up consistent with SO-G-106 [15].

Known and Potential Contaminants

The non-radiological contaminant is Hydraulic Oil. If handled properly, this material is not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Based on the location within Maintenance Shop and the volume of hydraulic oil that could be released from the elevator mechanical equipment, a preliminary classification of NR Isolated is assigned to the elevator tank.

Recommended Future Investigation Activities

- Inspect the mechanical equipment that operates the elevator and the concrete floor of the elevator shaft for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.4.3 Lube Oil Conditioning Unit

Description and Historical Use

A 2,000-gallon Lube Oil Conditioning Unit is located in the Turbine Building (Figure 2) [24]. No record of a release of lubricating oil from the Lube Oil Conditioning Unit has been found.

Known and Potential Contaminants

The non-radiological contaminants are Lubricating Oil and Lubricating Oil Constituents. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)
- Building Surfaces

Preliminary Classification

Because a relatively large volume of Lube Oil is stored as part of the Lube Oil Conditioning Unit, this unit is assigned a preliminary classification of NR Isolated.

Recommended Future Investigation Activities

- Inspect the concrete floor for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.4.4 Primary Coolant Pump Motors

Description and Historical Use

Four RCPs are located in the Containment Structure (Figure 2, cell B6). The four RCPs have a lubricating oil reservoir (125 gallons per pump) [24]. The RCPs also have a drain tank designed to completely contain the four RCP oil sumps. No record of a release of lubricating oil from the RCP has been found.

Known and Potential Contaminants

The non-radiological contaminants are Lubricating Oil and Lubricating Oil Constituents. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)
- Building Surfaces

Preliminary Classification

Based on its location within the Containment Structure and the volume of lubricating oil that could be released from the RCPs a preliminary classification of NR Isolated is assigned to RCPs.

Recommended Future Investigation Activities

- Visual inspection of the RCP Reservoir and surrounding area for indications of a release of the potential contaminants to the Containment Structure floor.

6.3.4.5 Seal Oil System

Description and Historical Use

The Seal Oil System is located in the Turbine Building (Figure 2, Grid C7). The Seal Oil System reservoir has a capacity of 170 gallons and provides lubrication for turbine generator bearings [24]. No record of a release of seal oil from tank has been found.

Known and Potential Contaminants

The non-radiological contaminants are Lubricating Oil and Lubricating Oil Constituents. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)
- Building Surfaces

Preliminary Classification

Based on its location within the Turbine Building and the volume of Seal Oil that could be released from the Seal Oil System, a preliminary classification of NR Isolated is assigned to the tank.

Recommended Future Investigation Activities

- Inspect the concrete floor for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.4.6 Training Center Generator

Description and Historical Use

The Training Center Generator Tank (capacity 150 gallons) is located on the east side of the Training Center (Figure 2, Grid D5). The single-walled above ground tank supplies the Training Center Generator [24]. The generator has a containment basin below the tank to prevent releases to the environment. No record of a release of diesel fuel oil from the Training Center Generator has been found.

Known and Potential Contaminants

The non-radiological contaminants are Diesel Fuel and Petroleum Constituents.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on its location outside the Training Center along with it's significant fuel volume, but with the containment basin that would minimize releases to the environment, a preliminary classification of NR Class 3 is assigned to the generator.

Recommended Future Investigation Activities

- Visual inspection of the concrete containment basin and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.5 Storage Tanks

The following sections describe the various Storage Tanks located on site.

Supporting Documents

CR-FCS-1998-01867-Gasoline spill during filling of Gasoline fuel storage tank FO-43B 1 gal to ground.PDF
CR-FCS-2003-05627-Fuel Oil leak from FO-127 Turbine Building 1 gal.PDF
CR-FCS-2004-02916-Fuel Oil leaking from FO-127 Turbine Building Rm 63 1 gal.PDF
CR-FCS-2006-03493-Hydraulic Oil-Brake fluid release near FO-1 enclosure 1 gal .PDF
CR-FCS-2008-5696-Fuel oil leak FO-30 FP-1B Fuel oil day tank 1-gal.PDF
CR-FCS-2008-6440-Fuel Oil leak from FO-34A and FO-34B Aux Building.pdf
CR-FCS-2009-3259-Fuel oil leak from filling FO-27 (diesel fire pump oil tank).PDF
SPCC Plan Final 05187B00.pdf

6.3.5.1 Administration Building Outdoor Diesel Fuel Storage Tank FO-56

Description and Historical Use

The Administration Building Outdoor Diesel Fuel Storage Tank (FO-56, Capacity 500 gallons) is an aboveground double-walled steel storage tank. This tank is located adjacent to the southwest corner of the Administration Building (Figure 2, Grid D6). No record of a release of diesel fuel from the Storage Tank has been found.

Known and Potential Contaminants

The non-radiological contaminant is Diesel Fuel.

Potentially Contaminated Media

- Soil

Preliminary Classification

Based on the double wall protection of the AST, a preliminary Classification of NR Class 3 is assigned to the AST.

Recommended Future Investigation Activities

- Visual inspection of the AST fill pipe and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.5.2 Auxiliary Boiler Storage FO-10

Description and Historical Use

The Auxiliary Boiler Fuel Oil Storage Tank (Capacity 18,000 gallons) is a single-walled steel UST with no internal tank protection. The associated piping is of bare steel (no cathodic protection) [25]. This UST is located adjacent to the south side of the Service Building (Figure 2, Grid C7). No record of a release of diesel fuel from the UST has been found.

Known and Potential Contaminants

The non-radiological contaminant is Diesel Fuel.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the underground burial and the amount of Diesel Fuel Oil stored in the UST, a preliminary Classification of NR Class 1 is assigned to the UST.

Recommended Future Investigation Activities

- Visual inspection of the UST fill pipe and surrounding area for indications of a release of the potential contaminants to the environment. Chemical analysis for diesel fuel constituents in soil samples from the tank grave when the tank is removed.

6.3.5.3 Diesel Fire Pump Storage Tank

Description and Historical Use

The Diesel Fire Pump is the backup fire safety system to the electric fire pump and is located on the west side of the Intake Structure Building (Figure 2, Grid C7). The Diesel Fire Pump Storage Tank is a steel double-walled AST (capacity 500 gallons). Minor fuel oil leaks have been reported for the Diesel Fire Pump system.

Known and Potential Contaminants

The non-radiological contaminant is Diesel Fuel.

Potentially Contaminated Media

- Soil

Preliminary Classification

Based on the double wall protection of the AST, a preliminary Classification of NR Class 3 is assigned to the AST.

Recommended Future Investigation Activities

- Visual inspection of the AST fill pipe and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.5.4 Emergency Diesel Generator Auxiliary Day Tank

Description and Historical Use

The Emergency Diesel Generator Auxiliary Day Tank is located in the Auxiliary Building, (Figure 2, Grid C7). The tank includes two single-walled steel 550-gallon ASTs that are located in a sunken concrete floor [25]. No record of a release of diesel oil from the tank has been found.

Known and Potential Contaminants

The non-radiological contaminant is Diesel Fuel. If handled properly, this material is not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Based on the location within the Auxiliary Building and the volume of diesel fuel that could be released from the ASTs, a preliminary classification of NR Isolated is assigned to tanks.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.5.5 Emergency Diesel Generator Day Tank

Description and Historical Use

The Emergency Diesel Generator Day Tank is located in the Auxiliary Building, (Figure 2, Grid C7). The tank includes two single-walled steel 550-gallon ASTs that are located in a sunken concrete floor [24]. No record of a release of diesel oil from the tank has been found.

Known and Potential Contaminants

The non-radiological contaminant is Diesel Fuel. If handled properly, this material is not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Based on the location within the Auxiliary Building and the volume of diesel fuel that could be released from the ASTs, a preliminary classification of NR Isolated is assigned to tanks.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.5.6 Emergency Diesel Storage FO-1

Description and Historical Use

The Emergency Diesel Storage Tank (FO-1, Capacity 18,000 gallons) is a single-walled UST constructed of steel with no internal tank protection. The associated piping is of bare steel (no cathodic protection) [24]. This UST is located adjacent to the south side of the Containment Building (Figure 2, Grid C7). No record of a release of diesel fuel from the UST has been found.

Known and Potential Contaminants

The non-radiological contaminant is Diesel Fuel.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the underground burial and the amount of Diesel Fuel Oil stored in the UST, a preliminary Classification of NR Class 1 is assigned to the UST.

Recommended Future Investigation Activities

- Visual inspection of the UST fill pipe and surrounding area for indications of a release of the potential contaminants to the environment.
- Chemical analysis for diesel fuel constituents in soil samples from the tank grave when the tank is removed.

6.3.5.7 FW-54 Day Tank

Description and Historical Use

Feedwater-54 Day Tank is a steel single-walled AST with a capacity of 160 gallons. The AST is located in the Turbine Building (Figure 2, Grid Location C7). The AST is located within a concrete diked area [24]. No record of a release from this tank has been found.

Known and Potential Contaminants

The non-radiological contaminant is Diesel Fuel. If handled properly, this material is not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Based on the location within the Turbine Building and the volume of diesel fuel that could be released from the AST, a preliminary classification of NR Isolated is assigned to tank.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.5.8 Lube Oil Storage Tank

Description and Historical Use

The Lube Oil Storage Tank is an 8,000-gallon single-walled steel tank located in the Turbine Building (Figure 2, Grid C7). The 8,000 AST provides Lube Oil Storage for the numerous SSCs in the Turbine Building. No record of a release from this tank has been found.

Known and Potential Contaminants

The non-radiological contaminants are Lubricating Oil and Petroleum Constituents. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Based on the location within the Turbine Building and the volume of Lube Oil that could be released from the AST, a preliminary classification of NR Isolated is assigned to tank.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.5.9 TSC Diesel Storage FO-32

Description and Historical Use

The TSC Diesel Storage Tank (FO-32, Capacity 4,000 gallons) is single-walled steel UST with no internal tank protection. The associated piping is of bare steel (no cathodic protection) [24]. This UST is located adjacent to the south side of the New Warehouse (Figure 2, Grid Location B6). No record of a release of diesel fuel from the UST has been found.

Known and Potential Contaminants

The non-radiological contaminant is Diesel Fuel.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the underground burial and the amount of Diesel Fuel Oil stored in the UST, a preliminary Classification of NR Class 1 is assigned to the UST.

Recommended Future Investigation Activities

- Visual inspection of the UST fill pipe and surrounding area for indications of a release of the potential contaminants to the environment.
- Chemical analysis for diesel fuel constituents in soil samples from the tank grave when the tank is removed.

6.3.5.10 Turbine Main Oil Tank

Description and Historical Use

The Turbine Main Oil Tank is a 5,450-gallon single-walled steel tank located in the Turbine Building (Figure 2, Grid C7). The 5,450 AST provides Lube Oil Storage for the numerous SSCs in the Turbine Building. No record of a release from this tank has been found.

Known and Potential Contaminants

The non-radiological contaminants are Lubricating Oil and Lubricating Oil Constituents. If handled properly, these materials are not expected to pose a risk of contamination to environmental media such as soil or groundwater.

Potentially Contaminated Media

- Building Materials (Floor)

Preliminary Classification

Based on the location within the Turbine Building and the volume of Lube Oil that could be released from the AST, a preliminary classification of NR Isolated is assigned to tank.

Recommended Future Investigation Activities

- Visual inspection of the concrete floor and surrounding area for indications of staining, cracks or openings that could release the potential contaminants to the environment.

6.3.5.11 Vehicle and Equipment Fuel Storage FO-43

Description and Historical Use

The Vehicle and Equipment Fuel Storage (FO-43) is a steel double-walled AST with a total capacity of 1000 gallons. The AST is split into two 500-gallon storage tanks with 500 gallons for both diesel fuel and gasoline [24]. The tank is located adjacent to the east end of the New Warehouse (Figure 2, Grid B7). No record of a release of diesel fuel or gasoline from the tanks has been found.

Known and Potential Fuel

The non-radiological contaminants are Diesel Fuel, Gasoline Constituents, Volatile Organic Compounds, and RCRA Metals.

Potentially Contaminated Media

- Soil

Preliminary Classification

Based on the double wall protection of the AST, a preliminary Classification of NR Class 3 is assigned to the AST.

Recommended Future Investigation Activities

- Visual inspection of the AST fill pipe and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6 Transformers

The original transformers at the station prior to 1979 were most likely filled with PCB-containing dielectric fluid. Fort Calhoun currently has both non-PCB transformers and retrofilled (formerly filled with PCB oil that has been refilled with non-PCB oil) transformers. Retrofilled transformers still have limited PCB's in them which leach out of the transformer internals into the oil. FCS should characterize the on-site transformers as either non-PCB or retrofilled, and conduct sampling and PCB analysis for all retrofilled transformers.

Supporting Documents

08-21-2012 RA 57477 DEQ Notification RELEASE.pdf
CR-FCS-2003-04954-T1 Transformer Oil Cooling Pump leaking oil 1 gal Switchyard .pdf
SPCC Plan Final 05187B00.pdf

6.3.6.1 345kV Shunt Reactor including radiators

Description and Historical Use

The 345kV Shunt Reactor Transformer is located in the northeast portion of the Switchyard (Figure 2, Grid B5). In the event of a rupture in the 345kV Shunt Reactor Transformer, which contains 7,334 gallons of dielectric oil, the retaining structure will collect the leaking oil in the containment berm surrounding the transformer [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the 345kV Shunt Reactor Transformer, a preliminary classification of NR Class 1 is assigned to the 345kV Shunt Reactor.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.2 3PM13S166X Transformer

Description and Historical Use

The 3PM13S166X Transformer is a relatively small unit located directly south of the eastern portion of the Switchyard (Figure 2, Grid C5). The transformer is pad-mounted with no containment berm. In the event of a rupture in the 3PM13S166X Transformer, which contains 102 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the 3PM13S166X Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the 3PM13S166X transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.3 Administration Building Transformer

Description and Historical Use

The Administration Building Transformer includes two small units located directly south and southeast of the Administration Building (Figure 2, Grid D6). The transformers are pad-mounted with no containment berm. In the event of a rupture in the Administration Building Transformers, which contain 360 gallons each of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Administration Building Transformers and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the Administration Building Transformers.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.4 Auxiliary Transformers T1A1 and T1A2

Description and Historical Use

The Auxiliary Transformers (T1A1 and T1A2) include two units located south of the Turbine Building in a small switchyard located in that area (Figure 2, Grid C7). The transformers are pad-mounted and are located within a curbed area. In the event of a rupture in the Auxiliary Transformers, which contain 1560 gallons each of dielectric oil, the retaining curbed area will collect the leaking oil [24]. This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Auxiliary Transformers, a preliminary classification of NR Class 1 is assigned to the Auxiliary Transformers.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.5 Control Building Service Transformer 1

Description and Historical Use

The Control Building Service Transformer includes two small units (one of two, see Section 6.3.6.6) that are located in southwestern portion of the Switchyard (Figure 2, Grid C4). The transformers are pad-mounted with no containment berm. In the event of a rupture in the Control Building Service Transformers, which contain 250 gallons each of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Control Building Service Transformers and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the Control Building Service Transformers.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.6 Control Building Service Transformer 2

Description and Historical Use

A second Control Building Service Transformer is located western portion of the Switchyard (Figure 2, Grid B4). The transformer is pad-mounted with no containment berm. In the event of a rupture in the Control Building Service Transformer, which contain 500 gallons of dielectric oil, active spill response is designed to contain the release [25]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the second Control Building Service Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the Control Building Service Transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.7 EE-95 Transformer

Description and Historical Use

The EE-95 Transformer is located south of the Turbine Building in a small switchyard located in that area (Figure 2, Grid C7). The transformer is pad-mounted and is located within a curbed area. In the event of a rupture in the EE-95 Transformer, which contains 634 gallons each of dielectric oil, the retaining curbed area will collect the leaking oil [24]. This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the EE-95 Transformer, a preliminary classification of NR Class 1 is assigned to the EE-95 Transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.8 Emergency Power Transformer

Description and Historical Use

The Emergency Power Transformer is located south of the Turbine Building in a small switchyard located in that area (Figure 2, Grid C7). The transformer is pad-mounted and is located within a curbed area. In the event of a rupture in the Emergency Power Transformer, which contains 120 gallons of dielectric oil, the retaining curbed area will collect the leaking oil [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Emergency Power Transformer, a preliminary classification of NR Class 1 is assigned to the Emergency Power Transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.9 ILRT Compressor Transformer

Description and Historical Use

The ILRT Compressor Transformer is located adjacent to the northwest corner of the Rad Waste Building (Figure 2, Grid C6). The transformer is pad-mounted with no containment berm. In the event of a rupture in the ILRT Compressor Transformer, which contain 678 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the ILRT Compressor Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the ILRT Compressor Transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.10 Main Transformer

Description and Historical Use

The Main Transformer is located south of the Turbine Building in a small switchyard located in that area (Figure 2, Grid Location C7). The transformer is pad-mounted and is located within a curbed area. In the event of a rupture in the Main Transformer, which contains 17,223 gallons each of dielectric oil, the retaining curbed area will collect the leaking oil [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Main Transformer, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.11 New Spare Transformer

Description and Historical Use

The New Spare Transformer is located directly south of the eastern portion of the Switchyard (Figure 2, Grid C4). The transformer is pad-mounted with no containment berm. In the event of a rupture in the New Spare Transformer, which contains 1955 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the New Spare Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.12 New Warehouse Transformer

Description and Historical Use

The New Warehouse Transformer is located directly south of the New Warehouse (Figure 2, Grid C6). The transformer is pad-mounted with no containment berm. In the event of a rupture in the New Warehouse Transformer, which contains 670 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil

Preliminary Classification

Based on the volume of mineral oil that could be released from the New Warehouse Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.13 Old Warehouse Transformer

Description and Historical Use

The Old Warehouse Transformer is located on the north end of the of the former Old Warehouse location outside of the PA (Old Warehouse has been removed) (Figure 2, Grid C6). The transformer is pad-mounted with no containment berm. In the event of a rupture in the Old Warehouse Transformer, which contains 327 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Old Warehouse Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.14 PM13UP768X Transformer

Description and Historical Use

The PM13UP768X Transformer is a small unit located adjacent to the Flex Building near US 75 (Figure 2, Grid C1). The transformer is pad-mounted with no containment berm. In the event of a rupture in the PM13UP768X Transformer, which contain 162 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the PM13UP768X Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.15 Rad Waste Building Transformer

Description and Historical Use

The Rad Waste Building Transformer is located on the west side of the Rad Waste Building (Figure 2, Grid C6). The transformer is pad-mounted with no containment berm. In the event of a rupture in the Rad Waste Building Transformer, which contains 430 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Rad Waste Building Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.16 Service Building Maintenance Shop Transformer

Description and Historical Use

The Service Building Maintenance Shop Transformer is located on the north side of the Service Building/Maintenance Shop (Figure 2, Grid C7). The transformer is pad-mounted with no containment berm. In the event of a rupture in the Service Building Maintenance Shop Transformer, which contains 350 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Service Building Maintenance Shop Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.17 Spare GSU Transformer

Description and Historical Use

The Spare GSU Transformer is located directly south of the eastern portion of the Switchyard (Figure 2, Grid C5). The transformer is pad-mounted with no containment berm. In the event of a rupture in the Spare GSU Transformer, which contains 27,800 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from this transformer has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Spare GSU Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.18 Spare Transformer T1

Description and Historical Use

The Spare Transformer T1 is located directly south of the eastern portion of the Switchyard (Figure 2, Grid C5). The transformer is pad-mounted with no containment berm. In the event of a rupture in the Spare Transformer T1, which contains 4,692 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. During transportation of the Spare Transformer T1, it has been reported that the load was dropped, potentially causing a minor release of non-PCB oils [1]. The area was cleaned up and stained soils removed, but no confirmation soil samples were collected. During a site walk down in September 2016, it was noted that the Spare Transformer T1 was visibly leaking oil onto the pad/ground [1].

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Transformer bushings and gaskets commonly develop small releases with age due to thermal fatigue as the temperature of the dielectric fluid varies between periods of operation and periods of outage. Based on the volume of mineral oil that could be released from the Spare Transformer T1 Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.19 Station Service Transformers T1A3 and T1A4

Description and Historical Use

The two Station Service Transformers (T1A3 and T1A4) are located south of the Turbine Building in a small switchyard located in that area (Figure 2, Grid C7). The transformers are pad-mounted and are located within a curbed area. In the event of a rupture in the Station Service Transformers, which contains 4,482 gallons each of dielectric oil, the retaining curbed area will collect the leaking oil [25]. This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Station Service Transformers, a preliminary classification of NR Class 1 is assigned to the transformers.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.20 T1 Transformer

Description and Historical Use

The T1 Transformer is located in the western portion of the Switchyard (Figure 2, Grid C4). In the event of a rupture in the T1 Transformer, which contains 6,845 gallons of dielectric oil, the retaining structure will collect the leaking oil in the containment berm surrounding the transformer [24]. This will prevent oil from reaching any waterway. Minor oil leaks from this transformer have been reported, but no significant releases to the environment have been identified.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Transformer bushings and gaskets commonly develop small releases with age due to thermal fatigue as the temperature of the dielectric fluid varies between periods of operation and periods of outage. Based on the volume of mineral oil that could be released from the T1 Transformer, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.21 T2 Transformer

Description and Historical Use

The T2 Transformer is located in the southwestern portion of the Switchyard (Figure 2, Grid C4). In the event of a rupture in the T2 Transformer, which contains 5,520 gallons of dielectric oil, the retaining structure will collect the leaking oil in the containment berm surrounding the transformer [25] This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the T2 Transformer, a preliminary classification of NR Class 1 is assigned to the transformers.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.22 T3 Auto Transformer

Description and Historical Use

The T3 Auto Transformer is located in the central portion of the Switchyard (Figure 2, Grid C5). In the event of a rupture in the T3 Auto Transformer, which contains 24,900 gallons of dielectric oil, the retaining structure will collect the leaking oil in the containment berm surrounding the transformer [24]. This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the T3 Auto Transformer, a preliminary classification of NR Class 1 is assigned to the transformers.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.23 T4 Auto Transformer

Description and Historical Use

The T4 Auto Transformer is located in the northwestern portion of the Switchyard (Figure 2, Grid B5). In the event of a rupture in the T4 Auto Transformer, which contains 24,900 gallons of dielectric oil, the retaining structure will collect the leaking oil in the containment berm surrounding the transformer [24]. This will prevent oil from reaching any waterway. Minor oil leaks from this transformer have been reported, but no significant releases to the environment have been identified.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Transformer bushings and gaskets commonly develop small releases with age due to thermal fatigue as the temperature of the dielectric fluid varies between periods of operation and periods of outage. Based on the volume of mineral oil that could be released from the T4 Auto Transformer, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.24 Training Center Transformer

Description and Historical Use

The Training Center Transformer is located on the east side of the Training Center (Figure 2, Grid D5). The transformer is pad-mounted with no containment berm. In the event of a rupture in the Training Center Transformer, which contain 350 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Training Center Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.25 Transformer Outside 6-Bay Maintenance Garage

Description and Historical Use

The Transformer Outside 6-Bay Maintenance Garage is located adjacent to the west side of the 6-Bay Maintenance Garage (Figure 2, Grid C5). The transformer is pad-mounted with no containment berm. In the event of a rupture in the Transformer Outside 6-Bay Maintenance Garage, which contain 350 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the Transformer Outside 6-Bay Maintenance Garage and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.3.6.26 TSC Transformer

Description and Historical Use

The TSC Transformer is located on the north side of the Chemical and Radiation Protection Facility (Figure 2, Grid C6/7). The transformer is pad-mounted with no containment berm. In the event of a rupture in the TSC Transformer, which contain 280 gallons of dielectric oil, active spill response is designed to contain the release [24]. This will prevent oil from reaching any waterway. No record of a release from these transformers has been found.

Known and Potential Contaminants

The non-radiological contaminants are PCB-Containing Dielectric Oil and Mineral Oil.

Potentially Contaminated Media

- Soil
- Groundwater

Preliminary Classification

Based on the volume of mineral oil that could be released from the TSC Transformer and the lack of a containment berm, a preliminary classification of NR Class 1 is assigned to the transformer.

Recommended Future Investigation Activities

- Visual inspection of the transformer and surrounding area for indications of a release of the potential contaminants to the environment.

6.4 Radiological Impacts

6.4.1 Radionuclides of Concern

Radionuclides of Concern

The following waste characterization analyses (which were performed to demonstrate compliance with 10 CFR Part 61) were reviewed to determine the primary Radionuclides of Concern (ROCs):

- SFP Smears (2016)
- Primary Resin Sample (2016)
- Process Resin Sample (2013)
- Process Charcoal Sample (2016)
- Resin Sample 2018-1A (2018)
- Tri-Nuke filters (2010)
- Tri-Nuke filter smears (2010, 2014)
- AC-6 Filter and Smears (2009, 2012)
- CH-17A Smears (2011, 2016)
- CH-17B Smears (2012, 2016)

In addition, a review of the Annual Radiological Effluent Release Reports (ARERRs) for 2017 and 2018 was performed. A composite list of radionuclides identified as "positive" by the laboratory reports of the 10 CFR Part 61 analyses and ARERRs was produced and is included in Table 6 as a master list of ROCs. If the fraction remaining after any time period listed was less than 1.0E-6, the value at that time period was replaced with 0.0E+00.

Table 6: Composite List of Positively Identified Radionuclides

Radionuclide	Half-Life (yrs)[a]	Nuclide Fraction Remaining After[b]			
		2 yrs	5 yrs	10 yrs	50 yrs
H-3	1.2E+01	8.9E-01	7.5E-01	5.7E-01	6.0E-02
C-14	5.7E+03	1.0E+00	1.0E+00	1.0E+00	9.9E-01
Mn-54	8.5E-01	2.0E-01	1.7E-02	3.0E-04	0.0E+00
Fe-55	2.7E+00	6.0E-01	2.8E-01	7.9E-02	3.2E-06
Co-57	7.4E-01	1.6E-01	9.5E-03	9.0E-05	0.0E+00
Co-58	1.9E-01	7.9E-04	0.0E+00	0.0E+00	0.0E+00
Co-60	5.3E+00	7.7E-01	5.2E-01	2.7E-01	1.4E-03
Ni-59	1.0E+05	1.0E+00	1.0E+00	1.0E+00	1.0E+00
Ni-63	1.0E+02	9.9E-01	9.7E-01	9.3E-01	7.1E-01
Zn-65	6.7E-01	1.3E-01	5.6E-03	3.1E-05	0.0E+00
Sr-90	2.9E+01	9.5E-01	8.9E-01	7.9E-01	3.0E-01
Nb-94	2.0E+04	1.0E+00	1.0E+00	1.0E+00	1.0E+00
Tc-99	2.1E+05	1.0E+00	1.0E+00	1.0E+00	1.0E+00
Ag-110m	6.8E-01	1.3E-01	6.3E-03	4.0E-05	0.0E+00

Radionuclide	Half-Life (yrs)[a]	Nuclide Fraction Remaining After[b]			
		2 yrs	5 yrs	10 yrs	50 yrs
Sb-125	2.8E+00	6.0E-01	2.8E-01	8.1E-02	3.5E-06
Cs-134	2.1E+00	5.1E-01	1.9E-01	3.5E-02	0.0E+00
Cs-137	3.0E+01	9.6E-01	8.9E-01	7.9E-01	3.2E-01
Ce-144	7.8E-01	1.7E-01	1.2E-02	1.4E-04	0.0E+00
Pu-238	8.8E+01	9.8E-01	9.6E-01	9.2E-01	6.7E-01
Pu-239	2.4E+04	1.0E+00	1.0E+00	1.0E+00	1.0E+00
Pu-240	6.6E+03	1.0E+00	1.0E+00	1.0E+00	9.9E-01
Pu-241	1.4E+01	9.1E-01	7.9E-01	6.2E-01	8.9E-02
Am-241	4.3E+02	1.0E+00	9.9E-01	9.8E-01	9.2E-01
Cm-242	4.5E-01	4.5E-02	4.2E-04	0.0E+00	0.0E+00
Cm-243	2.9E+01	9.5E-01	8.9E-01	7.9E-01	3.0E-01
Cm-244	1.8E+01	9.3E-01	8.3E-01	6.8E-01	1.5E-01

[a] *Where available, half-life data obtained from NRC Radiological Toolbox Version 3.0.0 (5/1/14)*
[b] *Reflects individual nuclides' survival fraction independent of aggregate mix*

This composite list was subsequently modified (via process knowledge and a realistic analysis of each ROC's respective half-life) and the ROCs were categorized into four distinct groups. These groups are the gamma emitters (Gammas), the Hard to Detect (HTD) and low energy beta emitters (HTD&Betas), tritium, and Transuranics (TRUs). Additionally, one ROC was added because it is a required analyte by 10CFR20 App. G (I-129). The results are listed in Table 7.

Table 7: Categorized Radionuclides of Concern

Radionuclide	Radionuclide	Category	Half-Life (yrs)
Mn-54	Manganese-54	Gammas	8.5E-01
Co-57	Cobalt-57	Gammas	7.4E-01
Co-58	Cobalt-58	Gammas	1.9E-01
Co-60	Cobalt-60	Gammas	5.3E+00
Nb-94	Niobium-94	Gammas	2.0E+04
Ag-110m	Silver-110m	Gammas	6.8E-01
Sb-125	Antimony-125	Gammas	2.8E+00
Cs-134	Cesium-134	Gammas	2.1E+00
Cs-137	Cesium-137	Gammas	3.0E+01
Ce-144	Cerium-144	Gammas	7.8E-01
Eu-152	Europium-152[b]	Gammas	1.4E+01
Eu-154	Europium-154[b]	Gammas	8.6E+00
Eu-155	Europium-155[b]	Gammas	4.8E+00
C-14	Carbon-14	HTD & Betas	5.7E+03

Radionuclide	Radionuclide	Category	Half-Life (yrs)
Fe-55	Iron-55	HTD & Betas	2.7E+00
Ni-59	Nickel-59	HTD & Betas	1.0E+05
Ni-63	Nickel-63	HTD & Betas	1.0E+02
Zn-65	Zinc-65	HTD & Betas	6.7E-01
Sr-90	Strontium-90	HTD & Betas	2.9E+01
Tc-99	Technetium-99	HTD & Betas	2.1E+05
I-129	Iodine-129[a]	HTD & Betas	1.6E+07
H-3	Hydrogen-3	Tritium	1.2E+01
Pu-238	Plutonium-238	TRUs	8.8E+01
Pu-239	Plutonium-239	TRUs	2.4E+04
Pu-240	Plutonium-240	TRUs	6.6E+03
Pu-241	Plutonium-241	TRUs	1.4E+01
Am-241	Americium-241	TRUs	4.3E+02
Cm-242	Curium-242	TRUs	4.5E-01
Cm-243	Curium-243	TRUs	2.9E+01
Cm-244	Curium-244	TRUs	1.8E+01

[a] *I-129 was not identified in site samples but is a required 10CFR20 App. G waste stream analyte*
[b] *Eu-152,154 & 155 were not identified in site samples but are typically identified in activated concrete*

In summary, when analyzing samples for the presence of radioactivity, the ROCs listed in Table 7, should be requested analytes, based on the origin of the samples unless they can be eliminated based on relative abundance and potential dose consequence. Given that there may be a lengthy period between the time of completion of this HSA and initiation of decommissioning activities, the ultimate list of ROCs for the facility will be impacted by radionuclide half-life. This list should be modified to eliminate those radionuclides that would have decayed to negligible quantities.

The potential presence of any of these ROCs will be denoted by their respective assigned category for the remainder of the HSA.

Supporting Documents

2017 Annual RETS REMP.pdf
2018 Annual RETS REMP.pdf
FCS-17-001 R0 Plant Rad Mix.pdf
FCS-18-002 R0 - Potential Radionuclides of Concern During the Decommissioning of FCS.pdf
Gamma Spectroscopy for Sand Samples from Sandbags circa 2011.pdf
OPPD-FCS 2016 Post Shutdown Waste Stream - Part 61.pdf
OPPD-FCS HSA Report Final 10-14-2016.pdf
OPPD-FCS L71393 2017 Primary Resin Sample.pdf

OPPD-FCS L71393 2017 Resin and Charcoal Waste Stream.pdf
OPPD-FCS L76829 (10) 2018 Filter Waste Stream Data.pdf
OPPD-FCS L76829 (10) Filter Waste Stream Data.pdf
OPPD-FCS RS 011018 L76329 2018 Resin.pdf

6.4.2 Building or Structure

6.4.2.1 Access Road Security Guardhouse

Description and Historical Use

The Access Road Security Guardhouse (Figure 2, Grid D2) is a steel on slab building housing security personnel and equipment for control and monitoring of site vehicle access.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Building materials

Preliminary Classification

Though no radiological work was performed in this building, its occupancy by personnel and equipment from the plant presents a low probability of cross contamination. Based on this condition, this building is preliminarily classified MARSSIM Class 3, with the presumption that if residual radioactivity is present, its concentration will not exceed a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the interior and exterior surfaces of building material

6.4.2.2 Administration Building

Description and Historical Use

The Administration Building (Figure 2, Grid D6) is constructed of various building materials including concrete, brick, and steel and is located south of the plant outside the PA. This building houses office space for plant support personnel and is not attached to any other site building. Radiation Protection related activities in this building consisted of management of the dosimetry program and operation of the whole body counter (WBC) system for measurement and characterization of radiation worker internal contamination. There is no evidence of radiation source control events in this building, however, the operation of the WBC necessitates that internally/externally contaminated workers could have introduced low levels of contamination into this structure.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Building Materials

Preliminary Classification

The conduct of the dosimetry program management and operation and calibration of the WBC system in the Administration Building introduce potential for contamination from worker transit and use of detector calibration radiation sources within this building. Based on these considerations, this structure is preliminarily classified as MARSSIM Class 3, with the presumption that if residual radioactivity is present, its concentration will not exceed a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the interior and exterior building materials

Supporting Documents

RS-FCS-M-20130416-7.pdf
RS-FCS-M-20151012-7.pdf

6.4.2.3 Auxiliary Building

Description and Historical Use

The Auxiliary Building (Figure 2, Grid C6/7) is adjacent to the Containment Building. The Auxiliary Building contains all support systems for reactor operations that are not located in the Containment Building. In addition to reactor support systems typical of a PWR Auxiliary Building, the structure also contains the spent fuel pool, spent fuel support systems, emergency diesel generators, emergency core cooling and shutdown cooling systems. The Auxiliary Building is a large and complex structure with a wide range of radiological conditions within the structure. Because of this complexity an Auxiliary Building Gamma Survey Summary is provided below in Table 8.

Table 8: Auxiliary Building Gamma Survey Summary

Location	Area or Component	Gen Area (mR/hr)	Max (mR/hr)
Room 5	Spent Fuel Pool Heat Exchanger	2 - 8	*140/15
Room 6	Charging Pumps	0.5 – 2	2
Room 7	Charging Pump Valve Area	2 – 10	*1240/80
Room 8	Waste Disposal Tank Vault	2 -4	*90/15
Room 9	Waste Concentrator Tank	1.5 – 20	20
Room 9A	Waste Concentrator Pump	2 – 4	5
Room 9B	Neutralization Tank	1.5 - 2	2
Room 10	Radwaste Monitor Tank	1 – 2	2
Room 11	Purification Filters	0.5 – 8	8
Room 11A	Waste Filters	0.5 – 5	10
Room 12	Letdown Hx	1 – 18	70
Room 13	Blowdown Tank	0.5 – 4	*300/23
Room 14	Shutdown Cooling Hx A	0.5 - 3	4
Room 15	Shutdown Cooling Hx B	0.5 – 4	4
Room 15 A	Shutdown Cooling Hx Valves	3 – 18	18
Room 16	Waste Gas Compressors	0.5 – 1	1
Room 18	CCW Hx	< 0.5	-
Room 19	Air Compressor	< 0.1	-
Room 20	Electrical Penetration Area	< 0.1	-
Room 21	SI Pump Room West	1 - 3	*1320/25
Room 22	SI Pump Room East	1 – 4	*685/12
Room 24	SFP Transfer Canal Pumps	0.5 – 3	*700/33
Room 25 A	New Fuel Inspection Area	< 0.5	-
Room 27	Decontamination Room	1 - 4	4
Room 28	Spent Resin Storage Tank	10 – 40	40
Room 29	Volume Control Tank	0.5 – 4	4
Room 30	Waste Evaporator	4 – 7	60

Location	Area or Component	Gen Area (mR/hr)	Max (mR/hr)
Room 407	Chemistry Count Room	0.5 – 1	*70/4
Room 56, 57	Switchgear	< 0.1	-
Room 59	Piping Penetration	1 – 5	*135/14
Room 60	Sample Room	0.5 – 2	*120/3
Room 61	CVCS Ion Exchange Valves	< 0.5	-
Room 62	CVCS Ion Exchangers	0.5 – 30	200
Room 66	Containment Equipment Hatch	< 0.5	-
Room 67	Hot Shop	< 0.5	-
Room 71	I&C Hot Shop	< 0.5	-
Room 81	Emergency Feedwater Tank	< 0.1	-
Room 82	Fan Room	< 0.1	-
* *Contact/30 cm Dose Rates*			

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, Tritium, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Sumps
- Building Materials
- SSCs
- Tank Interior
- Concrete
- Drainpipes

Preliminary Classification

The Auxiliary Building and all SSCs within it are preliminarily classified as a MARSSIM Class 1 structure due to the fact that the majority of the building has been an RCA throughout the station operating years, has a high potential for containing residual radioactive material, and the presumption that if residual radioactivity is present, its concentration could exceed the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior
- Direct measurements and contamination surveys of the building exterior walls and roof
- Radiological analysis of concrete samples to assess volumetric contamination
- Radiological analysis of sediment samples of building sumps and drain piping
- Radiological analysis of tank interior surfaces

- Radiological analysis of roofing material samples to determine volumetric contamination

Supporting Documents

CR-FCS-1996-00600-Resin Spill in Room 61.pdf
CR-FCS-1996-01469-SI Pump Room 22 Flooded to Half Inch from SIRWT Overflow.pdf
CR-FCS-1996-01470-Contamination Detected in Truck Bay Rm 66 Clean Area.pdf
CR-FCS-1997-00442-20 mL RCS Leak During PASS Sampling.pdf
CR-FCS-1997-00545-RCS Spill in Corridor 26.pdf
CR-FCS-1997-00545-Spill from RCP Seal in Corridor 26.pdf
CR-FCS-1997-00999-Contamination on Railroad Siding and DRPs in Various Aux Building Rooms.pdf
CR-FCS-1998-01406-Leaking Radiation Source.pdf
CR-FCS-1999-02385-Water Leaking out Room 13 into Corridor 4.pdf
CR-FCS-2002-00693-Room 7 Contaminated During Work to Unplug Vent Header Drains.pdf
CR-FCS-2002-01050-Room 6 Floor Contamination and Airborne Condition in Aux Building During Tank Cleaning.pdf
CR-FCS-2002-01797-Aux Building Sump Tank Backed up to Room 6 via Equipment Drain Header.pdf
CR-FCS-2002-02871-Room 7 Floor Contaminated from Backed up Floor Drains.pdf
CR-FCS-2003-02024-Floor Drain Backup Contaminated Corridor 4 and Room 5.pdf
CR-FCS-2003-02038-Room 24 Floor Contamination Detected during Daily Survey.pdf
CR-FCS-2003-02060-Room 24A Floor Contamination up to 31k Detected during Survey.pdf
CR-FCS-2003-02198-Floors Drains Backing up in Corridor 4 and Rooms 5, 6, 24 and 24A Result in Contamination up to 36k.pdf
CR-FCS-2004-02024-Clogged Drain Results in Liquid Radwaste Overflow of Drain Trough into Rm 7 in WD.pdf
CR-FCS-2004-02036-Contaminated Water on Floor in Aux Building Room 21.pdf
CR-FCS-2005-00641-Primary System Filter Gasket Leak Results in 1-2 Gallon Spill in Room 11A.pdf
CR-FCS-2005-00661-Floor Contamination in Room 23 Detected during Daily Survey.pdf
CR-FCS-2005-00669-Contaminated Water Spilled on Floor of Room 7 during Operation of Wd-6 Pump.pdf
CR-FCS-2005-01339-Aux Building Floor Contamination.pdf
CR-FCS-2005-01503-Contamination During Work in Room 13.pdf
CR-FCS-2005-02712-Floor Contamination Found in Room 23.pdf
CR-FCS-2005-04019-Floor Contamination Found in Room 60.pdf
CR-FCS-2005-04961-Contamination Found in Clean Area of Room 23.pdf
CR-FCS-2005-05512-SFP Liner Leak Rate Increased Significantly.pdf
CR-FCS-2005-05606-Contamination Found in Room 15.pdf
CR-FCS-2007-00607-SFP Sample Spill in Room 5.pdf
CR-FCS-2007-02008-Water Intrusion Through Crack in East Wall of Room 24.pdf
CR-FCS-2007-5078-Cs137 Sealed Source Leak Causes Personnel Contamination.pdf
CR-FCS-2008-0389-Boric Acid Buildup in Room 30.pdf

CR-FCS-2008-0706-SI Water Leak in Room 13.pdf
CR-FCS-2008-3332-Neolube Tube Used in Room 15 Contaminated with Co60.pdf
CR-FCS-2008-3717_Percon While Working in Clean Area of Rm 13.pdf
CR-FCS-2008-6679-Contaminated Water Leak in Room 26.pdf
CR-FCS-2008-6740-Water from Room 69 Continues to Drip into Corridor 26.pdf
CR-FCS-2009-1747-Aux Building Room 23 Sump Rising Sump Level.pdf
CR-FCS-2009-2641-Water Leak into Room 5 through Pipe Chase.pdf
CR-FCS-2009-3891-10 to 20 Gallon Water Spill in Room 6 during Charging Pump Venting.pdf
CR-FCS-2009-5634-Personnel Contamination Results from Work in Room 12.pdf
CR-FCS-2010-1706-Contminated Water Spilled in Clean Area of Room 60 in Aux Building.pdf
CR-FCS-2010-2485-Spill from Catch Container while Working in Room 61.pdf
CR-FCS-2011-4159-Boric Acid Residue Identified from Leakage into Room 62.pdf
CR-FCS-2013-14240-Boric Acid Spills Evident in Room 69.pdf
CR-FCS-2013-14472-Contamination Found in Clean Controlled Area Rail Siding Outside Room 25.pdf
CR-FCS-2014-03427-Alpha Level 3 Contamination Found in Rooms 9 and 9A.pdf
CR-FCS-2014-07379-Ground Water Intrusion through Room 16 Floor.pdf
CR-FCS-2014-11308-Water Intrusion through Crack in Floor of Waste Gas Compressor Pump Room.pdf
CR-FCS-2015-00107-Water Spill in Room 6.pdf
CR-FCS-2015-09724-Active Water Leak in Room 7 Leaking into Room 21 Contaminating Clean Area.pdf
CR-FCS-2016-05044-Floor Drain Area of Room 18 Found to be Contaminated.pdf
IR-FCS-1982-1555-Waste Evaporator Tube Leak Event.pdf
IR-FCS-1989-0359-Floor Drains Backed up into Room 18 and Corridor 4.pdf
IR-FCS-1990-0134-SFP Overflow While Filling Refuel Cavity.pdf
RS-FCS-M-20150713-2.pdf
RS-FCS-M-20160512-4.pdf
RS-FCS-M-20160512-5.pdf
RS-FCS-M-20160520-1.pdf
RS-FCS-M-20161212-6.pdf
RS-FCS-M-20161212-7.pdf
RS-FCS-M-20171011-3.pdf
RS-FCS-M-20180605-1.pdf
RS-FCS-M-20190121-3.pdf
RS-FCS-M-20190521-7.pdf
RS-FCS-M-20190609-2.pdf
RS-FCS-M-20191117-1.pdf
RS-FCS-M-20191125-3.pdf
RS-FCS-M-20191207-8.pdf
RS-FCS-M-20191209-3.pdf
RS-FCS-M-20191209-7.pdf

6.4.2.4 Chemical and Radiation Protection Facility

Description and Historical Use

The Chemistry and Radiation Protection, CARP, Building (Figure 2, Grid C6/7), is located on the north side of the Auxiliary Building. This building contains a clean (non-radioactive) Chemistry laboratory, office spaces, and personnel locker rooms. A controlled personnel access point to the primary Radiologically Controlled Area, RCA, comprised of the Auxiliary, Radwaste and Containment Buildings, as well as the Spent Fuel Pit is accessed from the CARP. An additional personnel access point from this building provides access to and egress from a Chemistry Hot (radiological) Lab.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Building Materials (Floor)
- Concrete
- Floor Drains
- Roofing Materials

Preliminary Classification

The Chemistry/RP Building serves as the primary means of access and egress to the primary RCA, introducing likelihood of contamination via personnel and equipment transit from the RCA. In addition, the likelihood of cross-contamination exists from boundary airborne radioactivity events. The building is located in close proximity to the plant vent stack, presenting likelihood of exterior surface contamination from deposition of plant radiological effluents. Based on these considerations this building is preliminarily classified as MARSSIM Class 2, with the presumption that if localized radioactivity is present, its concentrations could approach or exceed the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior.
- Radiological analysis of sediment samples of building sumps and drains.
- Radiological analysis of concrete samples to assess volumetric contamination
- Direct measurements and contamination surveys of the building exterior and roof

Supporting Documents

CR-FCS-2007-5078-Cs137 Sealed Source Leak Causes Personnel Contamination.pdf
CR-FCS-2008-2461-30 ml Reactor Coolant Sample Spilled in Chemistry Hot Lab.pdf
RS-FCS-M-20130211-4.pdf
RS-FCS-M-20130211-6.pdf
RS-FCS-M-20140212-1.pdf

RS-FCS-M-20150811-1.pdf
RS-FCS-M-20150812-2.pdf
RS-FCS-M-20160816-1.pdf
RS-FCS-M-20160816-2.pdf

6.4.2.5 Containment Building

Description and Historical Use

The Containment Building (Figure 2, Grid C6) is a reinforced concrete structure in the form of a vertical cylinder with domed roof and a flat base designed to prevent radiological material release under normal operating and accident conditions. All penetrations through the steel-lined concrete structure for electrical conductors, pipe, ducts, air locks and hatch doors are of the double barrier design. The structure contains the reactor vessel, control rod elements, reactor coolant pumps, steam generators and pressurizer and system piping supporting reactor operation. A polar bridge crane is installed above the operating floor to handle the reactor vessel head and reactor internals during refueling and for maintenance operations within the reactor containment. Based on their proximity to the operating reactor, system piping, components and structures exposed to neutron fluence are subject to neutron activation. No documented releases have been identified for the Containment Building. The gamma dose rates for selected areas within the Containment Building are included in Table 9.

Table 9: Containment Building Gamma Dose Rates

Location	Area or Component	Gen Area (mR/hr)	Max (mR/hr)
A S/G Bay 994'	RCP-3A / RCP-3B	25	*1500/285
B S/G Bay 994'	RCP-3C / RCP-3D	25	*1500/105
A S/G Walkway	'A' S/G	3	*350/20
B S/G Walkway	'B' S/G	4	*50/25
Pressurizer Shed	Pressurizer	4	*80/30
Elevation 994'	General Area	1	*1100/60
Elevation 1045'	General Area	2	4
Elevation 1060'	HEPA/Charcoal Filters	0.5	3
Under Vessel	Vessel Bottom	230	300
Sump	General Area	30	155/70

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, Tritium, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Steel
- Concrete
- SSCs
- Drain Pipes
- Floor Drains

Preliminary Classification

The Containment Building contents and processes entailed significant radioactivity levels and cross-communication amongst all areas and elevations of the building. In addition, the neutron activation of components and materials within this building is an expected outcome from over 30 years of reactor operation within. These factors support a preliminary classification of MARRSIM Class 1 with the presumption that radioactivity if present, could exist at concentration levels that exceed the release criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior
- Direct measurements and contamination surveys of the building exterior surfaces
- Radiological analysis of concrete samples to assess volumetric contamination
- Radiological analysis of sediment samples of building sumps and drain lines

Supporting Documents

CR-FCS-2005-00938-Small Volume Spill of Primary Coolant while Transporting RCP Seal in Containment.pdf
CR-FCS-2008-3637-RCDT Overfill Spills Contaminated Water onto Containment Floor.pdf
CR-FCS-2009-5510-Boric Acid Identified in Steam Generator Basement in Containment.pdf
RS-FCS-M-20130114-12.pdf
RS-FCS-M-20130114-13.pdf
RS-FCS-M-20130114-14.pdf
RS-FCS-M-20130114-15.pdf
RS-FCS-M-20160512-3.pdf
RS-FCS-M-20161024-9.pdf
RS-FCS-M-20180905-1.pdf
RS-FCS-M-20190727-8.pdf
RS-FCS-M-20191209-1.pdf
RS-FCS-M-20191209-5.pdf

6.4.2.6 Fire Protection Equipment

Description and Historical Use

The Fire Protection Equipment storage (Figure 2, Grid C5) is located outside the protected area in a multi-stall garage building also employed for the service and maintenance of site vehicles. Some equipment stored in this area was deployed for training, drills, and actual fire-fighting evolutions inside the protected area, and potentially, within the RCA.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete

Preliminary Classification

Based on the deployment of equipment stored within this facility into and from the protected area, potentially including RCAs, there is likelihood of cross-contamination on equipment surveyed for release and storage. This area is preliminarily classified as MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the release criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior

6.4.2.7 Flex Equipment Storage Building

Description and Historical Use

The Flex Equipment Storage Building contains equipment stored for deployment under beyond design basis accident conditions. Limited personnel access is attained in this building located in the outer western perimeter of the Owner Controlled Area. Though built late in the plant's life cycle, it is used to contain spare firefighting equipment previously free-released from the RCA following use in drills and potentially, live-fire fighting evolutions.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete

Preliminary Classification

This building contains material free released from the FCS RCA. The aggregation of this equipment presents the likelihood that some radioactive material was present on the stored equipment. Based on this condition, this building is preliminarily classified as MARSSIM Class 3 with the presumption if radioactivity is present, its concentration is a small fraction of the release criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior

6.4.2.8 Hazardous Material Storage Building

Description and Historical Use

This building known as the Hazardous Material Storage Building (also known as Hazmat Shed) is located adjacent to and west of the former Old Warehouse (Figure 2, Grid C5). A second Storage Building was built at a later date (see Section 6.3.1.12). This building housed both chemicals and hazardous materials. Access to this building for delivery and removal of packages often employed forklifts and other handling equipment previously employed in the Protected Area following performance of radiation surveys for release.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete

Preliminary Classification

The transit of plant equipment through the PA vehicle access gate for access into the Hazardous Waste Storage Building introduces a risk of contamination of this building interior. Based on this consideration, this building is classified MARSSIM Class 3, with the presumption that any radioactivity present is a small fraction of the release criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior

6.4.2.9 Intake Structure

Description and Historical Use

The Intake Structure (Figure 2, Grid C7) is located on the east perimeter of the plant protected area along the bank of the Missouri River. The building houses circulating water, fire water and raw water system pumps which draw and filter water from the Missouri River. The building consists of a structural steel frame enclosed by resin wall panels. The intake structure is made of heavily reinforced concrete below the 1,014-foot elevation and extends over the Missouri River.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Roofing Materials

Preliminary Classification

Only non-radioactive fluid systems are contained within this building. However, based on the building's close proximity to the plant vent stack, and the frequency of personnel access to this building, it is assumed that the building roof and inner surfaces contain trace levels of plant radioactivity. Based on these conditions, this building is preliminarily classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is only a small fraction of the release criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior.
- Direct measurements and contamination surveys of the building exterior and roof.

Supporting Documents

RS-FCS-M-20120520-2.pdf
RS-FCS-M-20151112-3.pdf
RS-FCS-M-20160512-2.pdf

6.4.2.10 Maintenance Garage

Description and Historical Use

The maintenance Garage (Figure 2, Grid C5) is a steel and concrete structure located outside the plant Protected Area due west of the Containment Building. Plant vehicle storage, and maintenance is conducted in this multi-stall garage facility. A portion of this facility was also used to store spare fire protection equipment, some of which was potentially surveyed for free-release from the RCA. During the 2011 flood, the 6-Bay Maintenance Garage building was submerged in water.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Roofing Materials

Preliminary Classification

Travel of vehicles, equipment, and personnel from within the protected area into this building present likely contamination travel paths. Based on these conditions, this building is preliminarily classified as MARSSIM Class 3, with the presumption that if radioactivity is present, its concentrations are a small fraction of the release criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior.
- Direct measurements and contamination surveys of the building exterior and roof.
- Inspection of concrete floor for cracks that would introduce potential out-leakage of radioactivity

6.4.2.11 Maintenance Shop

Description and Historical Use

The Maintenance Shop (Figure 2, Grid C7) is located immediately northeast of the containment building and houses maintenance equipment and tooling as well as work space for plant maintenance evolutions. Periodically, temporary RCAs were established within this area as required for plant work. The Maintenance Shop was originally built in 1978 and adjoins the Service and Turbine Buildings to the south in the PA. The original building was a rectangular-shaped structure and included an overhang under which were bays for vehicle maintenance. A rectangular-shaped addition was made to the northern portion of the Maintenance Shop in 1987.

The Maintenance Shop also includes two lube oil storage areas, one for new lube oil (360 gallons) and a second for used lube oil (155 gallons) [24]. The lube oil is stored in 55-gallon drums (used lube oil) or 60-gallon drums (new lube oil). No leaks or releases are known to have occurred in the lube oil storage areas.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Steel
- Roofing Materials
- Building Materials

Preliminary Classification

The conduct of radiological work within this area, as well as frequent plant radiation worker access, present likely sources of contamination within this building. Additionally, the close proximity of this building to the plant vent stack makes deposition of plant radioactivity a likely outcome of over thirty years of operation. Based on these conditions, this building is preliminarily classified MARSSIM Class 2 with the presumption that if radioactivity is present, its concentrations would not likely exceed the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior
- Direct measurements and contamination surveys of the building exterior walls and roof
- Radiological analysis of concrete samples to assess volumetric contamination
- Radiological analysis of roofing material samples to determine volumetric contamination

Supporting Documents

RS-FCS-M-20130116-6.pdf
RS-FCS-M-20130707-5.pdf
RS-FCS-M-20131008-2.pdf
RS-FCS-M-20140717-3.pdf
RS-FCS-M-20140717-5.pdf
RS-FCS-M-20150709-5.pdf
RS-FCS-M-20150716-6.pdf
RS-FCS-M-20150716-7.pdf
RS-FCS-M-20160116-3.pdf

6.4.2.12 Neutralization Chemical Pumphouse

Description and Historical Use

The Neutralization Chemical Pumphouse, (Figure 2, Grid D7) was used to treat water stored in the chemical lagoons prior to discharge to the river.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Roofing Materials
- Building Materials

Preliminary Classification

This building presents minimal internal surface and system contamination risk based on limited personnel access and function. However, the building is subject to deposition from plant radiological effluents from the plant vent stack onto exterior surfaces. Based on these considerations, this building is classified as MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration will be a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building exterior materials and roofing

6.4.2.13 New Security Building

Description and Historical Use

The New Security Building (Figure 2, Grid C/D6 – not shown) is located on the northwest corner of the protected area. This building is the sole personnel access and egress point to the protected area, excluding drivers of vehicles passing through the vehicle gate. It was constructed late in plant operating life, deployed for site use starting in 2016. The building contains personnel exit radiation monitors periodically calibrated and source checked using sealed radiation sources within this building.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Roofing material

Preliminary Classification

The short duration of building use during plant operation limits the magnitude of potential contamination from personnel foot traffic exiting the plant. Based on this limited use, it is expected that any contamination in this building would be a small fraction of the plant release criteria and little deposition on external surfaces would have accumulated from plant stack releases. Based on these conditions, the building is preliminarily classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentrations would be a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior
- Direct measurements and contamination surveys of the building exterior and roof

Supporting Documents

RS-FCS-M-20160914-9.pdf
RS-FCS-M-20180315-2.pdf

6.4.2.14 New Warehouse

Description and Historical Use

The New Warehouse (Figure 2, Grid B6), is constructed of steel and building materials on a concrete pad. The building houses two levels of new plant supplies and equipment and includes a storage area for lube oil and hydraulic oil that accommodates up to 70 55-gallon drums [24]. This building also houses decontamination showers used in the event of radiological contamination of personnel.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Roofing Materials
- Drain Pipes

Preliminary Classification

Although no radioactive material was regularly stored in this building, the presence of personnel decontamination showers introduces the likelihood of some radiological cross-contamination within this building. This building's close proximity to the plant vent stack makes deposition of stack radioactive effluents onto the building exterior a likely outcome of plant operations. Based on these conditions, this building is classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration would be a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior
- Radiological analysis of sediment and internal surfaces in shower drain lines
- Direct measurements and contamination surveys of the building exterior and roof

Supporting Documents

RS-FCS-M-20140310-13.pdf
RS-FCS-M-20140310-5.pdf
RS-FCS-M-20140310-9.pdf
RS-FCS-M-20150318-6.pdf
RS-FCS-M-20150915-7.pdf
RS-FCS-M-20150915-8.pdf

6.4.2.15 Old Security Building

Description and Historical Use

The Old Security Building (Figure 2, Grid D7) was originally the primary security building for screening employees into and out of the Protected Area of the station. A new security access facility has been constructed and the Old Guard House has been replaced by a new structure on the southwest perimeter of the protected area. The building contains personnel exit radiation monitors periodically calibrated and source checked using sealed radiation sources within this building.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Building Materials
- Roofing Materials

Preliminary Classification

The historical use, work practices and controls for this structure result in a low risk of significant radiological impact. Primarily all foot traffic into and out of the PA traversed this building. Based on this use and its proximity to the plant vent stack, some radioactivity deposition on flooring and outer building roofing is expected to have occurred during over 30 years of plant operation. Based on these factors this structure is preliminarily classified MARSSIM Class 3, with the presumption that if residual radioactivity is present, its concentration will not exceed a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior
- Direct measurements and contamination surveys of the building roof

Supporting Documents

RS-FCS-M-20130913-1.pdf
RS-FCS-M-20140312-4.pdf
RS-FCS-M-20150313-2.pdf

6.4.2.16 Old Warehouse

Description and Historical Use

The Old Warehouse (Figure 2, Grid C6) was located immediately outside the west perimeter of the protected area. This slab-on-grade building constructed of steel and concrete was demolished in 2018. It was used to house low level radioactive waste packaged for shipment for disposal and contaminated plant equipment (e.g. RCP motors) stored for re-deployment post maintenance. The building was the site of numerous flooding events associated with operation of the nearby (north) reverse osmosis (RO) water purification unit. During the 2011 flood the northern portion of the Old Warehouse was encased in an Aqua Dam to keep the flood waters from impacting the RO system and sea-lands which contained radioactive waste. This building area (since demolition) is now represented within the land area designated as Survey Unit 8107 per Reference [10]

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Asphalt
- Concrete

Preliminary Classification

Based on its history of flooding while containing radioactive material, it is likely that low level contamination is present on the surface formerly housed within this building structure. Given the building history, including the high volume of washout from site flooding, this yard area formerly contained by this building is preliminarily classified as MARSSIM Class 3, with the presumption that if residual radioactivity is present, its concentration will not exceed a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurement and soil and concrete samples in areas where RMAs were situated in building and along building perimeter prior to demolition.

Supporting Documents

CR-FCS-2002-04256-Old Warehouse Flooded in Posted Contaminated Area from Reverse Osmosis Unit Leak.pdf
CR-FCS-2004-02476-Reverse Osmosis Unit Leak Floods Old Warehouse up to 2 Inches Deep.pdf
CR-FCS-2016-05876-Water Intrusion into Old Warehouse Radiologically Controlled Area.pdf
RS-FCS-M-20121215-3.pdf
RS-FCS-M-20130425-4.pdf
RS-FCS-M-20150430-4.pdf

RS-FCS-M-20170528-3.pdf

6.4.2.17 OSGS Building

Description and Historical Use

The Original Steam Generator Storage (OSGS) building (Figure 2, Grid C3) is constructed of a poured concrete floor with concrete block walls. The building is located near the west perimeter of the OCA and has been used to house plant primary system components including steam generators, a reactor head, and a pressurizer prepared for off-site shipment following removal from the plant. This structure is located in Survey Unit 8405 of Reference [10].

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Structural steel

Preliminary Classification

Based on the historical use of this structure, it is likely that residual contamination is present on building interior surfaces at more than a small fraction of the release criteria. This building is preliminarily classified as a MARSSIM Class 2 structure based on the discussion above, and the presumption that if localized residual radioactivity is present, its concentration is not likely to exceed the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and surface contamination surveys of building interior.
- Radiological analysis of concrete samples to assess volumetric contamination

Supporting Documents

RS-FCS-M-20120619-3.pdf
RS-FCS-M-20131218-2.pdf
RS-FCS-M-20160705-4.pdf

6.4.2.18 Radwaste Building

Description and Historical Use

The Radwaste Building (Figure 2, Grid C6), contains storage tanks, pumps, compressors and other equipment to process and store plant radioactive waste. The building is access through rollup doors on south and west walls of the building and through personnel entry from the Auxiliary Building. The yard surface below this building is depicted within Survey Units 7201 and 7202 of Reference [10]. The gamma dose rates for various areas within the Containment Building are included in Table 10.

Table 10: Radwaste Building Gamma Dose Rates

Location	Area or Component	Gen Area (mR/hr)	Max (mR/hr)
Radwaste	Radwaste Upper Level (RCA)	< 0.5	*160/30
Radwaste	Radwaste Lower Level	< 0.5	*3/1
Room 502	General Area	< 0.5	*3/1
Room 504	Magna-Tech Machine	2	*9/3
Room 506	Storage	2	150
Room 507	HEPA / Tri-nuke Hose Storage	1	*105/40
Room 508	Storage	1	*33/6
Room 509	OSSC / HOSS Area	2	7
Room 510	DAW Storage	< 0.5	*10/1

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, Tritium, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Building Materials
- Roofing Materials
- SSCs
- Drain Pipes
- Sumps

Preliminary Classification

The Radioactive Waste Building and all SSCs within it are preliminarily classified as a MARSSIM Class 1 structure due to the fact that the majority of the building has been an RCA throughout the station operating years, has a high potential for containing residual radioactive material, and the presumption that if residual radioactivity is present, its concentration could exceed the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior
- Direct measurements and contamination surveys of the building exterior walls and roof
- Radiological analysis of roofing material samples to determine volumetric contamination
- Radiological analysis of concrete samples to assess volumetric contamination
- Radiological analysis of sediment samples of building sumps and drain lines

Supporting Documents

CR-FCS-1996-01470-Contamination Detected in Truck Bay Rm 66 Clean Area.pdf
CR-FCS-2004-02024-Clogged Drain Results in Liquid Radwaste Overflow of Drain Trough into Rm 7 in WD.pdf
CR-FCS-2014-11308-Water Intrusion through Crack in Floor of Waste Gas Compressor Pump Room.pdf
CR-FCS-2015-05944-Rad Waste Building Roof Leak.pdf
IR-FCS-1990-0134-SFP Overflow While Filling Refuel Cavity.pdf
RS-FCS-M-20131220-3.pdf
RS-FCS-M-20140922-1.pdf
RS-FCS-M-20150531-2.pdf
RS-FCS-M-20151223-1.pdf
RS-FCS-M-20160229-1.pdf
RS-FCS-M-20170805-4.pdf
RS-FCS-M-20171220-1.pdf
RS-FCS-M-20191118-2.pdf
RS-FCS-M-20191207-1.pdf
RS-FCS-M-20191207-2.pdf
RS-FCS-M-20191207-3.pdf
RS-FCS-M-20191207-4.pdf
RS-FCS-M-20191207-5.pdf

6.4.2.19 RO Unit

Description and Historical Use

The Reverse Osmosis Unit (Figure 2, Grid C6), is located outside the western Protected Area Boundary northwest of the Containment Building. The system produced water for use in plant primary and secondary systems.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Building Materials

Preliminary Classification

Based on the function of this building and its distance from the plant, and location outside the protected area, any contamination in this area would be of low probability and the result of personnel access during operation. Based on these factors this structure is preliminarily classified MARSSIM Class 3, with the presumption that if residual radioactivity is present, its concentration will not exceed a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior

6.4.2.20 Service Building

Description and Historical Use

The Service Building (Figure 2, Grid C7), housed the water treatment facility and personnel office space. The water treatment system generated purified river water for in-plant use. Water transferred from the river to a settlement tank within the Service Building was treated with caustics, acids, and other water treatment chemicals and processed through ion exchange resins to purify and control the pH, for in-plant use [1]. The water treatment system was retired-in-place when the Reverse Osmosis system was deployed.

In addition to the water treatment activities, the Service Building contained the Auxiliary (diesel) boiler, diesel fuel transfer pumps and piping, and lead acid batteries.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Drain Pipes
- Roofing Materials

Preliminary Classification

Radioactive material was not used or stored in this building but because of its proximity to the power block, there is the potential that trace levels of contamination may have accumulated in this building, primarily from airborne deposition on the roof and from the routine movement of personnel and equipment between buildings. Based on these factors this structure is preliminarily classified MARSSIM Class 3, with the presumption that if residual radioactivity is present, its concentration will not exceed a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior and floor drain piping.
- Direct measurements and contamination surveys of the building exterior and roof.

Supporting Documents

RS-FCS-M-20110913-7.pdf
RS-FCS-M-20130114-10.pdf
RS-FCS-M-20130114-9.pdf
RS-FCS-M-20140916-6.pdf
RS-FCS-M-20150713-1.pdf
RS-FCS-M-20160816-6.pdf

RS-FCS-M-20160914-2.pdf

6.4.2.21 Storage Building

Description and Historical Use

The Storage Building (Figure 2, Grid B5) is located outside the northwest boundary of the PA, north of the Switchyard and northeast of the former Old Warehouse. The building is used to store chemicals in a remote location of the site. Transport of material into this building was often conducted using site forklifts and equipment transiting the PA.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Concrete
- Roofing Materials

Preliminary Classification

The access of plant personnel and transport equipment which also accessed the PA presents a cross contamination path for this building. Based on this consideration, this building is classified MARSSIM Class 3, with the presumption that any radioactivity in this building would be a small fraction of the release criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior
- Direct measurements and contamination surveys of building exterior and roof

6.4.2.22 Training Center

Description and Historical Use

This building, (Figure 2, Grid D5) containing classrooms, simulation facilities, and office space supporting all disciplines of plant worker training. A radiation protection lab, including radiation counters and a personnel contamination monitor is housed within this facility. Plant workers and equipment to be used for training presented a transient radioactivity contamination hazard within this building.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Building Materials

Preliminary Classification

Based on the transient nature of personnel and equipment throughout the history of this building, presenting a low probability of cross contamination, this building is preliminarily classified MARSSIM Class 3, with the presumption that if residual radioactivity is present, its concentration is likely to be a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior
- Direct measurements and contamination survey of exterior surfaces and roof.

6.4.2.23 Turbine Building

Description and Historical Use

The Turbine Building (Figure 2, Grid C7) is a large concrete and steel building housing the turbine, generator, condenser, feedwater heaters, and other secondary plant support systems and components. Two historical events and the floor drain system configuration have posed radiological contamination hazards within the Turbine Building. A steam generator tube rupture event occurred in 1984 due to intergranular stress corrosion cracking (IGSCC) in the B steam generator during a hot-hydro evolution. Because the plant was not generating power at the time of this tube rupture, the radiological impact was far less than would be expected during power operations. Nonetheless, contamination in secondary systems was evident following this event, as evidenced by a 30 mR/hr contact reading on sludge removed from the component cooling/raw water interface in 1990, and fixed contamination periodically identified on the secondary side of the affected loop. A waste evaporator tube leak event also occurred early in plant operating history (approximately 1978), posing a contamination risk to auxiliary steam system piping. There was, however, no evidence of radioactivity in this system signifying cross-contamination. Additionally, the floor drain configuration permits communication between the floor drains within the Auxiliary Building (RCA) and rooms 81, 19, and 20 within the (non-RCA) Turbine Building during times of high volume spills. Such events occurred on several occasions, leaving residual contamination in the Turbine Building floor drain systems. While floor drains, B main steam line and raw water system piping have been historically cross-contaminated as a result of these events and conditions, the bulk of the building interior houses secondary, non-radioactive plant systems and components.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, Tritium, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Sumps
- Drain Pipes
- Sediment
- SSCs

Preliminary Classification

Historical plant events have resulted in evidence of primary to secondary system cross contamination, including sludge removed from the component cooling and raw water system interface piping with significant radiological dose rates. Evaluation of floor drains have also identified radioactivity levels above background. While this building houses these systems containing radioactivity, the turbine building structure itself presents a lesser radiological contamination risk. Based on these conditions a distinction of MARSSIM

Classifications is warranted between the Turbine Building structure and select system piping therein. Based on its history and its proximity to plant vent stack, the preliminary classification of the internal and external building structure is MARSSIM Class 3 with the presumption that if residual radioactivity is present, its concentration is likely to be a small fraction of the acceptance criteria. The floor drains and sumps, raw water piping and B steam line piping within the Turbine Building, however, are classified separately as MARSSIM Class 2 based on known residual contamination from plant events described above.

Recommended Future Investigation Activities

- Direct measurement and contamination surveys of building interior
- Direct measurement and contamination surveys of system piping and components
- Direct measurement and contamination surveys of building exterior and roof surface
- Radiological analysis of sediments in building sumps and system drain lines.

Supporting Documents

IR-FCS-1982-1555-Waste Evaporator Tube Leak Event.pdf
IR-FCS-1989-0359-Floor Drains Backed up into Room 18 and Corridor 4.pdf
LER-FCS-84-08 SGTR.pdf
Rad Analysis for Turbine Building Drains - 14-002 - Rm 19 81 diesel floor drain R1.pdf
RS-FCS-I-20140313-1.pdf
RS-FCS-M-20160816-5.pdf
RS-FCS-M-20161212-2.pdf
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RS-FCS-M-20171213-2.pdf
RS-FCS-M-20171213-3.pdf
RS-FCS-M-20171213-4.pdf
RS-FCS-M-20191207-7.pdf
RS-FCS-M-20191209-6.pdf
SG Rupture_SIRWT Overflow.pdf

6.4.2.24 Utility Building

Description and Historical Use

The utility building (Figure 2, Grid A6) supports security training and firing range operation. This building was occupied by personnel and equipment from the plant site.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Building materials

Preliminary Classification

Based on the transient nature of personnel and equipment throughout the history of this building, presenting a low probability of cross contamination, this building is preliminarily classified MARSSIM Class 3, with the presumption that if residual radioactivity is present, its concentration is likely to be a small fraction of the acceptance criteria.

Recommended Future Investigation Activities

- Direct measurements and contamination surveys of the building interior

6.4.3 Exterior Area

6.4.3.1 Agricultural Land

Description and Historical Use

The agricultural land leased by OPPD for farming is located in the southwest region of the site, remote from the PA, however, adjacent to the new sanitary wastewater land application area. Positive activity has been identified in the soil in this waste water deposition area, adjacent to the agricultural land. [1]

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Soil
- Sediment

Preliminary Classification

While no plant process involving radioactivity was conducted in this land area, the impacts of flooding in transport of loose surface contamination from the plant and the adjacent wastewater application area presents a likelihood of contamination of this area. Based on this condition, the preliminary classification of this area is MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the acceptance criteria. This area is located within the Survey Units 8304, 8305 and 8306 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radiological analysis of soil and sediment samples.

Supporting Documents

HSA Combined.pdf

6.4.3.2 Equipment Storage Area

Description and Historical Use

This area, located in the northwest corner of the site switchyard, (Figure 2, Grid B4) was used for storage of plant tool and equipment for outage work activities.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Gravel
- Soil

Preliminary Classification

Equipment storage and transport into this area at times involved the use of material handling equipment and sealand containers and contents surveyed and released from the PA. These practices introduce the probability of surface contamination deposited within this storage area. Additionally, at least one soil sample in the vicinity to the immediate north of this storage area has revealed positive activity at a small fraction of the acceptance criteria [1]. Based on these conditions, this area is preliminarily classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the release criteria. This area is located within the Survey Unit 8108 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radiological analysis of gravel, soil and sediment samples.

6.4.3.3 Fire Training Area

Description and Historical Use

This outdoor area provides a means for hands on fire training (Figure 2,Grid B3/4). Currently, the area consists of a concrete pad with a central drain that discharges directly to Fish Creek. The area also contains two sealand containers, a propane tank, a cross pan, and other fire training equipment (fire extinguishers, rest area, etc.) [1]. At times, when training was provided in this area, fire fighting equipment that had been free release surveyed from the primary RCA was employed.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Gravel
- Soil

Preliminary Classification

Fire training employed fire extinguishers and protective equipment which at times had been released via free-release survey from the primary RCA. The use of this equipment presents a potential path for contamination of this outdoor training area. Based on this historical practice, this area is preliminarily classified as MARSSIM Class 3, with the presumption that any radioactivity present would be a small fraction of the release criteria. This area is located within the Survey Unit 8108 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radioactivity analyses of soil (and in some cases gravel) samples of this area

6.4.3.4 Firing Range

Description and Historical Use

The firing range is located north of the PA, on the north side of Fish Creek (Figure 2, Grid A6). The firing range consists of three berms and a shelter area. On the south corner of the firing range is a tower used for rifle practice, and there is a simulated indoor or obstructed view scenario practice area in the northeast corner.

Routine access of personnel from the plant and use of security equipment released from the RCA for conduct of training and firing drills in this exterior area introduce some likelihood of radiological contamination.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Gravel
- Soil

Preliminary Classification

Based on the historical use of this area for security training, this area is preliminarily classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the release criteria. This area is located within the Survey Unit 8106 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radioactivity analyses of soil (and in some cases gravel) samples of this area

6.4.3.5 Fish Creek and Wetlands

Description and Historical Use

Fish Creek flows along the north side of the PA discharging to wetlands and the Missouri River (Figure 2, A/B 3/4/5). The creek drains the farmland to the north and receives stormwater water runoff from the Fire Training Area, Switchyard, Firing Range, and the Plant.

This region of the OCA establishes a geographical boundary along the north perimeters of the Fire Training and Switchyard areas and south of the Firing Range area. No plant processes are conducted in this region however, historical soil sampling has revealed radioactivity at a small fraction (<1%) of the acceptance criteria.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Sediment
- Soil

Preliminary Classification

Though no processes involving plant radioactivity were conducted in this region of the OCA, storage of RAM in the vicinity and the extreme instances of site flooding introduce potential for contamination in this area. In at least one case, [1] soil sampling has revealed low level plant radioactivity in this area. Based on these conditions, this area is classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the acceptance criteria. This area is contained within Survey Units 8105, 8104, and 8106 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radioactivity analyses of soil and creek sediment samples of this area

6.4.3.6 Former Chemical Treatment Lagoons

Description and Historical Use

The chemical lagoons (Figure 2, Grid D7) have been retired in place and filled with stone. These lagoons previously contained byproducts from re-generation of plant water treatment demineralizer resins, a process which was non-radiological in nature. After abandonment, the ion exchange resin residuals from the lagoons were placed in the landfill (See Section 6.3.2.6). This outdoor yard area is located in the vicinity of the plant stack and the PA boundary.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Trap Rock

Preliminary Classification

The proximity to the plant stack and the PA boundary presents a likelihood of contamination from deposition of stack effluent and redistribution from site flooding events. Based on these considerations, this area is preliminarily classified as MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the acceptance criteria. This area is contained within Survey Unit 8301 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radiological volumetric analyses of trap rock covering of lagoon area.

6.4.3.7 Former Sanitary Lagoons

Description and Historical Use

The former sanitary lagoons (Figure 2, Grid E 5/6) are located immediately south of the administration building. Early in plant operations, process waste streams into the site sewage system included sanitary waste from facilities inside and outside the primary RCA, as well as personnel showers from within the RCA. These processes and these original sanitary lagoons were terminated, and the lagoons backfilled.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Sediment
- Sludge

Preliminary Classification

The waste streams to the sewage system introduced likelihood of contamination in this process stream from worker external contamination removed during worker decontamination showering. Samples of soil in the former west lagoon [1] have identified plant radioactivity at a small fraction of the acceptance criteria. Similarity of processes introduce similar probability of radioactivity in both the former east and west sanitary lagoons. Based on these considerations, these areas are classified MARSSIM Class 3, with the presumption that any radioactivity present exists at concentrations that are a small fraction of the acceptance criteria. This area is contained within Survey Units 8303 and 8302 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radioactivity analyses of sediment and sludge samples of this area

Supporting Documents

CR-FCS-1996-00125-Co58 Detected in West Lagoon Sewage Sludge.pdf

6.4.3.8 Landfill

Description and Historical Use

This land area, (Figure 2, Grid E6/7) located southeast of the Administration Building consists of buried material from pre-operation construction activities. There has been no historical evidence of radioactivity identified within this area and the landfill is monitored in compliance with NDEE Landfill closure criteria (Permit Number NE0054712).

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Soil

Preliminary Classification

Though no plant processes introduced sources of radioactivity contamination in this area, the probability of plant stack radioactivity deposition and transport of surface radioactivity as a result of plant flooding history present a probability of contamination of this area. Based on these considerations, this area is preliminarily classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the acceptance criteria. This area is contained within Survey Unit 8303 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radiological analyses of soil samples

6.4.3.9 North Slough

Description and Historical Use

This land area is located to the extreme northeast of the owner controlled area (Figure 2, Grid A6/7) along the west bank of the Missouri River. No plant processes take place in this area.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Soil

Preliminary Classification

Though no plant processes introduced sources of radioactivity contamination in this area, the probability of plant stack radioactivity deposition and transport of surface radioactivity as a result of plant flooding history present a probability of contamination of this area. Based on these considerations, this area is preliminarily classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the acceptance criteria. This area is contained within Survey Units 8101 and 8102 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radiological analyses of soil samples

6.4.3.10 Protected Area Yard

Description and Historical Use

The protected yard area surrounds the entire containment, auxiliary building and support buildings including the intake structure and new warehouse. Various activities conducted within this area, including a temporary decontamination area and heavy equipment haul path established for steam generators, and other components removed from the primary systems during component replacement projects, and dry cask transfers to the ISFSI, introduce potential ground contamination sources. Additionally, plant spills early in plant life introduced radioactivity to the railroad siding outside the Auxiliary building and in the yard area now covered by the radioactive waste building, constructed after the spill events. Records of immediate remediation and disposal of contaminated rail siding soil and material were reviewed. Additionally, site personnel interview records were entered into the site's 50.75.g files to document details from personnel involved with the event.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Asphalt
- Soil
- Gravel

Preliminary Classification

The protected area yard presents a number of likely contamination paths including transport of equipment and personnel from the primary RCA to this area on a daily basis and deposition of stack radiological effluents. In addition, plant events resulting in spills in the yard area, particularly early in plant operation introduced soil contamination which was partly remediated at the time of events. Practices such as establishment of a decontamination facility in the southwest region of the PA yard during the SG replacement process elevated that probability of ground contamination within the area. Some limited historical sampling/analyses has revealed soil contamination results at small fractions of the acceptance criteria. Based on these considerations, and the history of the SFP overflow event spill onto the rail siding outside the Auxiliary Building, this area is preliminarily classified as MARSSIM Class 3, with the exception of this affected yard area, (MARSSIM Class 2) with the presumption that for the Class 3 area, if radioactivity is present, its concentrations are a small fraction of the acceptance criteria. For the Class 2 'island' Area, it is presumed that if radioactivity is present it will not exceed the acceptance criteria. The Yard area is contained within Survey Units 7100, 7200, 7300, 7400, and 7500 per [10], with 7203 encompassing the MARSSIM Class 2 island area.

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radiological analyses of soil, gravel, and asphalt samples

Supporting Documents

CR-FCS-1996-01470-Contamination Detected in Truck Bay Rm 66 Clean Area.pdf
CR-FCS-1997-00999-Contamination on Railroad Siding and DRPs in Various Aux Building Rooms.pdf
CR-FCS-2002-04256-Old Warehouse Flooded in Posted Contaminated Area from Reverse Osmosis Unit Leak.pdf
CR-FCS-2004-02476-Reverse Osmosis Unit Leak Floods Old Warehouse up to 2 Inches Deep.pdf
CR-FCS-2005-05512-SFP Liner Leak Rate Increased Significantly.pdf
CR-FCS-2007-00154-Sewage Waste Water Flowing from Manhole Cover.pdf
CR-FCS-2007-02008-Water Intrusion Through Crack in East Wall of Room 24.pdf
CR-FCS-2008-3557-Puntured Sealand Container with Internal Contamination.pdf
CR-FCS-2013-14472-Contamination Found in Clean Controlled Area Rail Siding Outside Room 25.pdf
CR-FCS-2014-07379-Ground Water Intrusion through Room 16 Floor.pdf
CR-FCS-2016-05876-Water Intrusion into Old Warehouse Radiologically Controlled Area.pdf
Supplemental Decon Facility - Temp RCA.pdf

6.4.3.11 Sanitary Lagoons

Description and Historical Use

The sanitary lagoons contain the site wastewater for processing. The new lagoons were deployed upon retirement of the original lagoons which were later backfilled with trap rock. The new sanitary lagoons are located in the extreme southern section of the owner controlled area. Historical sampling and analysis of the lagoons has identified radioactivity in the sludge from the lagoons, at small fractions of the acceptance criteria.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, Tritium, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Sediment
- Sludge

Preliminary Classification

Based on historical data regarding radioactivity in the Sanitary Lagoons, this area is preliminarily classified MARSSIM Class 2, with the presumption that any radioactivity present exists will not exceed the acceptance criteria. This area is defined as Survey Unit 8700 per [10].

Recommended Future Investigation Activities

- Radioactivity analyses of lagoon water, sediment and sludge.

Supporting Documents

CR-FCS-1996-00125-Co58 Detected in West Lagoon Sewage Sludge.pdf
IR-FCS-1991-0323-Radioactivity Detected in West Sewage Lagoon.pdf

6.4.3.12 Sanitary Wastewater Land Application Area

Description and Historical Use

This tract of land, immediately to the west of the new wastewater lagoons is the site of periodic deposition from the wastewater lagoons. The process of collection of waste water from the site in these lagoons subjects the site to transfer of personnel internal and external radioactivity deposition into this waste stream. Historical sampling [1] has identified radioactivity in this area at a small fraction (<4%) of the Cs-137 acceptance criteria.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Soil

Preliminary Classification

Based on historical use of this land area, and the identification of radioactivity in the soil in this area, [1] the Sanitary Wastewater Land Application Area is preliminarily classified as MARSSIM Class 3, with the presumption that the concentration of any radioactivity present is a small fraction of the release criteria. This area is contained within Survey Unit 8310 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radiological analyses of soil samples

6.4.3.13 South Slough

Description and Historical Use

This land area is located to the immediate south east of the plant area, (Figure 2, Grid D/E7) along the west bank of the Missouri River. No plant processes take place in this area, though it does abut the Landfill area.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Soil

Preliminary Classification

Though no plant processes introduced sources of radioactivity contamination in this area, the probability of plant stack radioactivity deposition and transport of surface radioactivity as a result of plant flooding history present a probability of contamination of this area. Based on these considerations, this area is preliminarily classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the acceptance criteria. This area is defined as Survey Unit 8307 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated soil activity

6.4.3.14 Switchyard

Description and Historical Use

This area (Figure 2, Grid B/C4/5 located outside the west perimeter of the plant PA, contains switchgear providing offsite electrical power to the station and connecting site electrical generation lines to the grid. Though no radiological operations take place in this area, personnel and vehicle access to the area present potential cross contamination sources. Additionally, Sea Land containers housing outage equipment and materials were staged in the northwest corner of the switchyard area, introducing another potential contamination pathway.

Known and Potential Contaminants

The ROCs are those categorized as Gammas, HTD&Betas, and TRUs. The ROCs may be revised based upon more definitive data collected during site characterization activities.

Potentially Contaminated Media

- Soil
- Gravel

Preliminary Classification

Though no plant operating processes introduced radioactivity into the switchyard area, the likelihood of cross contamination from personnel and equipment released from the PA accessing the switchyard, and plant vent stack deposition of radioactive material drive classification of this area. Based on these considerations, this area is classified MARSSIM Class 3, with the presumption that if radioactivity is present, its concentration is a small fraction of the acceptance criteria. This area is contained within Survey Unit 8108 per [10].

Recommended Future Investigation Activities

- Gamma walk-over survey to identify areas with elevated activity
- Radiological analyses of soil and gravel samples

7 Conclusions

This HSA has been completed in accordance with guidance provided in MARSSIM. As expected, operational activities at FCS from initial power generation in September 1973 to the present have resulted in areas that have been impacted with radiological and/or non-radiological contaminants. A general conclusion that can be drawn from the record reviews, personnel interviews, and site walk-downs that were part of HSA development is that FCS had an excellent operating history in that operations have resulted in very low radiological and non-radiological potential impacts to the environment beyond the PA. No identified areas of contamination are a current or expected threat to human health or the environment that would warrant immediate corrective action.

The information developed by this HSA indicates that the areas and SSCs with a high probability of requiring remediation (Class 1) are located within RCAs. Migration of surface contamination from the RCA appears to be limited, as has been determined from frequent site surveys conducted inside the PA.

Ordinarily, historic events that resulted in contamination were remediated immediately at the time of their discovery. In these instances, the remediation was accomplished to the point of no significant measured radioactivity above background, within the counting capabilities of field and lab instrumentation available at the time. These instances and impacted areas were appropriately documented in historical files and are cited within this report. It is presumed that modern detection and counting capabilities would either corroborate those results, or further identify residual radioactivity.

It should be noted that the HSA reflects the current radiological and non-radiological status of the site. Because decommissioning may be a lengthy and iterative process, information in the HSA should be evaluated with respect to the impact of the elapsed time between the completion of this report and decommissioning (due to radioactive decay or natural attenuation) on the intended use of the information. The following conclusions are presented for consideration and to clearly state important observations.

- Known incidents of contamination have been remediated and none of the impacted areas or SSCs are an imminent threat to human health or the environment.
- Historic releases at the station have been managed in accordance with applicable radiological and non-radiological regulations.
- Each area identified as potentially impacted will require further characterization as it becomes more accessible during decommissioning to determine the extent to which it may have been impacted, if at all.
- No new impacted areas that were not previously known have been identified by this HSA.
- Where lead-based paint, ACM, or components containing mercury or PCBs are present, the areas are located within buildings, are not exposed to the environment and are being managed in accordance with site procedures. The current management practices for these areas are sufficient to ensure the safety of site workers until the materials of concern are permanently removed from the station.

- FCS has implemented the guidance prescribed by NEI 07-07 (the Industry Groundwater Protection Initiative) and has established an on-going groundwater monitoring program.
- Groundwater is not used as a source of drinking water on or near the station.
- Groundwater flow beneath the station is primarily easterly towards the Missouri River, however, bank flow conditions give rise to seasonal westerly flow near the river.
- The only radionuclide contaminants identified in groundwater are tritium and strontium-90.

8 Recommendations

With completion of this HSA, the next task in the process prescribed in MARSSIM and in regulatory systems applied here for non-radiological contaminants is to collect and more extensively analyze data in a strategic manner in the areas identified as potentially impacted. The characterization data will support design of the additional investigation, decommissioning or remediation activities, and subsequent final status surveys for each building, structure, and land area that has been classified as impacted. Planning for this characterization phase should include consideration of the preliminarily recommended future investigation activities identified in Section 6, recognizing that such recommendations do not yet have the benefit of the strategic characterization phase.

Depending on the decommissioning strategy that is chosen, the next phases of the MARSSIM process described in Section 5.1 may not be initiated for several years. These characterization activities will help to identify the extent of contamination in SSCs and the environs and will be useful in planning and estimating costs for decommissioning activities. An example of the benefits of strategic characterization activities in the near term is a more accurate estimate of the volume of contaminated soil and concrete that will require disposal as either radiological or non-radiological waste.

As decommissioning of the station advances and areas become accessible, areas of the site identified as potentially impacted should be evaluated to document current conditions and select appropriate remedial responses, if they are required. Characterization should include not only environmental media (soils, sediment and groundwater), but also building materials to determine whether radioactive or other contaminants are present and may potentially pose a risk to human health and safety or the environment during site-related activities. However, the extent of building characterization should depend on the anticipated end-state of the site at the time of license termination and site release. For example, if the buildings will be removed as waste prior to license termination, then the extent of their characterization need only be sufficient for waste disposal profiling rather than for the design of their final status survey(s).

To facilitate planning for decommissioning, FCS should consider obtaining concrete samples from selected concrete surfaces in the Class 1 structures. The samples should be taken following an appropriate engineering evaluation to identify the appropriate time and operating condition and/or configuration for the sampling. A sample from each of the Class 1 structures should be analyzed to determine its content of tritium, fission products, and activated concrete (Containment Structure only) radionuclides; and the depth to which these radionuclides have penetrated the concrete. This information will be useful in preparing an estimate of the volume of concrete that is contaminated and in estimating costs for waste disposal.

Subsurface soil and groundwater sampling should be conducted at Class 1 and NR Class 1 areas not contained within buildings. Several soil and groundwater samples from each area

should be analyzed for the contaminants of concern and the results compared to appropriate DCGLs (in the case of radiological contaminants) or regulatory criteria (in the case of non-radiological contaminants) to determine the need for remediation. Exterior areas where additional sampling is recommended for NR issues include the Fire Training Area (PFAs in groundwater), the Firing Range (lead in soils), and Fish Creek and associated wetlands (SVOCs and PFAs in sediment).

Screening of Class 2, NR Class 2, Class 3, NR Class 3 and NR Isolated areas to determine whether environmental contaminants are present should follow the same process as that used in Class 1 and NR Class 1 areas but may be less rigorous and require fewer sample analyses. The samples should be taken following an appropriate engineering evaluation to identify the appropriate time and operating condition and/or configuration for the sampling. In some areas, characterization may be limited to sampling of containment surfaces, surface soil or groundwater from nearby existing monitoring wells.

While the existing array of FCS groundwater monitoring wells is sampled quarterly and analyzed for radiological constituents in support of the station's Groundwater Protection Program [3], no analyses have been programmatically completed to characterize the groundwater quality pertaining to non-radiological contaminants. At least one round of groundwater samples from representative FCS monitoring wells in areas where non-radiological contamination has or may have occurred should be analyzed for non-radiological contaminants including petroleum constituents, volatile organic compounds, PCBs and RCRA metals.

At least one round of sampling of material accumulated within the sediment traps at the bottom of storm drains should be performed, and the samples analyzed for plant-related radionuclides and non-radiological contaminants such as petroleum constituents and RCRA metals.

No data were reviewed regarding the specific PCB status of on-site transformers. While FCS has both non-PCB and retrofilled transformers, no documentation of the PCB status of the transformers was identified. If the PCB status of the on-site transformers has not been completed, RSCS recommends either completing or conducting the characterization of the transformer's PCB status.

FCS should review existing data sources or consider additional sampling and analysis of sediment in the operating sanitary lagoons. Likewise, sediments along the stormwater discharge path and at the station stormwater outfalls should be sampled to determine whether radiological or non-radiological contamination of the sediments in these locations has occurred and to support planning for decommissioning of the station and license termination.

Monitoring of groundwater from plant monitoring wells currently required by the FCS Groundwater Protection Program should continue at its current frequency at least until all

fuel is removed from the Spent Fuel Pool and the pool and associated systems are drained. At that time, FCS can consider a reduction in the frequency of groundwater monitoring during SAFSTOR and active decommissioning of the station.

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RS-FCS-M-20191209-5.pdf
RS-FCS-M-20191209-6.pdf
RS-FCS-M-20191209-7.pdf

B. Summary Table of Potentially Impacted Non-Radiological Areas

Potentially Impacted Area	Figure Number	Potential Contaminants	Preliminary Classification
Building or Structure			
Auxiliary Building	9	Petroleum Products, Oil and Grease, PCB-Containing Dielectric Oil	NR Isolated
Chemical and Radiation Protection Facility	9	Mercury	NR Isolated
Containment Building	9	Lubricating Oil, Petroleum Products, Oil and Grease, PCB-Containing Dielectric Oil, Lead, Asbestos	NR Isolated
Flex Equipment Storage Building	9	Petroleum Products, Oil and Grease	NR Isolated
Hazardous Material Storage Building	9	Petroleum Constituents, Volatile Organic Compounds, PCB-Containing Dielectric Oil	NR Class 2
Intake Structure	9	Petroleum Constituents, Oil and Grease	NR Isolated
Maintenance Garage	9	Petroleum Constituents, Oil and Grease, Volatile Organic Compounds, Waste Oil	NR Class 3
Maintenance Shop	9	Petroleum Constituents, Volatile Organic Compounds, RCRA Metals	NR Class 3
New Warehouse	9	Lubricating Oil, Hydraulic Oil	NR Isolated
Old Warehouse	9	Petroleum Constituents, RCRA Metals	NR Class 3
Service Building	9	Sodium Hydroxide, Hydrochloric Acid, Chlorine, Diesel Fuel, Lead	NR Isolated
Storage Building	9	Petroleum Constituents, Volatile Organic Compounds, Semi-Volatile Organics, RCRA Metals	NR Class 2
Turbine Building	9	Petroleum Constituents, Oil and Grease, Dielectric Oil	NR Isolated
Chemical and Drum Storage Areas			
Oil Storage Room Drums 1	NA	Petroleum Constituents, Oil and Grease	NR Isolated
Oil Storage Room Drums 2	NA	Petroleum Constituents, Oil and Grease	NR Isolated
Warehouse Storage Oil Drums	NA	Petroleum Constituents, Oil and Grease	NR Isolated

Potentially Impacted Area	Figure Number	Potential Contaminants	Preliminary Classification
Exterior Area			
Agricultural Land	7	Diesel Fuel Constituents, Petroleum Constituents, Pesticides, RCRA Metals	NR Class 3
Fire Training Area	7	Semi-Volatile Organics, RCRA Metals, Perfluoroalkyl Surfactants	NR Class 1
Firing Range	7	Lead, RCRA Metals	NR Class 1
Fish Creek and Wetlands	7	Semi-Volatile Organics, RCRA Metals, Volatile Organic Compounds, Perfluoroalkyl Surfactants	NR Class 1
Former Chemical Treatment Lagoons	7	RCRA Metals	NR Class 3
Landfill	7	RCRA Metals	NR Class 3
Protected Area Yard	7	Dielectric Oil, Petroleum Constituents, Fuel Oil	NR Class 3
Switchyard	7	PCB-Containing Dielectric Oil, Dielectric Oil, Petroleum Constituents	NR Class 1
Oil-Filled Mechanical Equipment			
Electro Hydraulic Control Fluid System	NA	Electrohydraulic Control Fluid, Lubricating Oil Constituents, Lubricating Oil	NR Isolated
Elevator Hydraulic Oil Tank	NA	Hydraulic Oil	NR Isolated
Lube Oil Conditioning Unit	NA	Lubricating Oil, Lubricating Oil Constituents	NR Isolated
Primary Coolant Pump Motors	NA	Lubricating Oil, Lubricating Oil Constituents	NR Isolated
Seal Oil System	NA	Lubricating Oil, Lubricating Oil Constituents	NR Isolated
Training Center Generator	NA	Diesel Fuel, Petroleum Constituents	NR Class 3
Site-Wide Impacts			
Asbestos-Containing Material	NA	Asbestos	NR Isolated
Lead and Lead-Based Paint	NA	Lead, Batteries, Lead-Based Paint	NR Isolated
Mercury-Containing Components	NA	Mercury	NR Isolated

Potentially Impacted Area	Figure Number	Potential Contaminants	Preliminary Classification
PCB-Containing Components	NA	PCB-Containing Dielectric Oil, Capacitors, Light Ballasts	NR Isolated
Storm Drain System and Outfalls	NA	Petroleum Constituents, Oil and Grease, RCRA Metals	NR Class 3
Storage Tanks			
Administration Building Outdoor Diesel Fuel Storage Tank FO-56	8	Diesel Fuel	NR Class 3
Auxiliary Boiler Storage FO-10	8	Diesel Fuel	NR Class 1
Diesel Fire Pump Storage Tank	8	Diesel Fuel	NR Class 3
Emergency Diesel Generator Auxiliary Day Tank	8	Diesel Fuel	NR Isolated
Emergency Diesel Generator Day Tank	8	Diesel Fuel	NR Isolated
Emergency Diesel Storage FO-1	8	Diesel Fuel	NR Class 1
FW-54 Day Tank	8	Diesel Fuel	NR Isolated
Lube Oil Storage Tank	8	Lubricating Oil, Petroleum Constituents	NR Isolated
TSC Diesel Storage FO-32	8	Diesel Fuel	NR Class 1
Turbine Main Oil Tank	8	Lubricating Oil, Lubricating Oil Constituents	NR Isolated
Vehicle and Equipment Fuel Storage FO-43	8	Diesel Fuel, Gasoline Constituents, Volatile Organic Compounds, RCRA Metals	NR Class 3
Transformer			
345kV Shunt Reactor including radiators	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
3PM13S166X Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Administration Building Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Auxiliary Transformers T1A1 and T1A2	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Control Building Service Transformer 1	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1

Potentially Impacted Area	Figure Number	Potential Contaminants	Preliminary Classification
Control Building Service Transformer 2	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
EE-95 Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Emergency Power Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
ILRT Compressor Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Main Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
New Spare Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
New Warehouse Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Old Warehouse Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
PM13UP768X Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Rad Waste Building Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Service Building Maintenance Shop Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Spare GSU Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Spare Transformer T1	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Station Service Transformers T1A3 and T1A4	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
T1 Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
T2 Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
T3 Auto Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
T4 Auto Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
Training Center Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1

Potentially Impacted Area	Figure Number	Potential Contaminants	Preliminary Classification
Transformer Outside 6-Bay Maintenance Garage	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1
TSC Transformer	8	PCB-Containing Dielectric Oil, Mineral Oil	NR Class 1

C. Summary Table of Potentially Impacted Radiological Areas

Potentially Impacted Area	Figure Number	Potential Contaminants	Preliminary Classification
Building or Structure			
Access Road Security Guardhouse	10	Gammas, HTD&Betas, TRUs	Class 3
Administration Building	10	Gammas, HTD&Betas, TRUs	Class 3
Auxiliary Building	10	Gammas, HTD&Betas, Tritium, TRUs	Class 1
Chemical and Radiation Protection Facility	10	Gammas, HTD&Betas, TRUs	Class 2
Containment Building	10	Gammas, HTD&Betas, Tritium, TRUs	Class 1
Fire Protection Equipment	10	Gammas, HTD&Betas, TRUs	Class 3
Flex Equipment Storage Building	10	Gammas, HTD&Betas, TRUs	Class 3
Hazardous Material Storage Building	10	Gammas, HTD&Betas, TRUs	Class 3
Intake Structure	10	Gammas, HTD&Betas, TRUs	Class 3
Maintenance Garage	10	Gammas, HTD&Betas, TRUs	Class 3
Maintenance Shop	10	Gammas, HTD&Betas, TRUs	Class 2
Neutralization Chemical Pumphouse	10	Gammas, HTD&Betas, TRUs	Class 3
New Security Building	10	Gammas, HTD&Betas, TRUs	Class 3
New Warehouse	10	Gammas, HTD&Betas, TRUs	Class 3
Old Security Building	10	Gammas, HTD&Betas, TRUs	Class 3
Old Warehouse	10	Gammas, HTD&Betas, TRUs	Class 3
OSGSF Building	10	Gammas, HTD&Betas, TRUs	Class 2
Radwaste Building	10	Gammas, HTD&Betas, Tritium, TRUs	Class 1
RO Unit	10	Gammas, HTD&Betas, TRUs	Class 3
Service Building	10	Gammas, HTD&Betas, TRUs	Class 3

Storage Building	10	Gammas, HTD&Betas, TRUs	Class 3
Training Center	10	Gammas, HTD&Betas, TRUs	Class 3
Turbine Building	10	Gammas, HTD&Betas, Tritium, TRUs	Class 2/3
Utility Building	10	Gammas, HTD&Betas, TRUs	Class 3
Chemical and Drum Storage Areas			
Oil Storage Room Drums 1	NA	Gammas, HTD&Betas, TRUs	Class 3
Oil Storage Room Drums 2	NA	Gammas, HTD&Betas, TRUs	Class 3
Exterior Area			
Agricultural Land	7	Gammas, HTD&Betas, TRUs	Class 3
Equipment Storage Area	7	Gammas, HTD&Betas, TRUs	Class 3
Fire Training Area	7	Gammas, HTD&Betas, TRUs	Class 3
Firing Range	7	Gammas, HTD&Betas, TRUs	Class 3
Fish Creek and Wetlands	7	Gammas, HTD&Betas, TRUs	Class 3
Former Chemical Treatment Lagoons	7	Gammas, HTD&Betas, TRUs	Class 3
Former Sanitary Lagoons	7	Gammas, HTD&Betas, TRUs	Class 3
Landfill	7	Gammas, HTD&Betas, TRUs	Class 3
North Slough	7	Gammas, HTD&Betas, TRUs	Class 3
Protected Area Yard	7	Gammas, HTD&Betas, TRUs	Class 2/3
Sanitary Lagoons	7	Gammas, HTD&Betas, Tritium, TRUs	Class 2
Sanitary Wastewater Land Application Area	7	Gammas, HTD&Betas, TRUs	Class 3
South Slough	7	Gammas, HTD&Betas, TRUs	Class 3
Switchyard	7	Gammas, HTD&Betas, TRUs	Class 3
Oil-Filled Mechanical Equipment			
Elevator Hydraulic Oil Tank	NA	Gammas, HTD&Betas, TRUs	Class 3
Site-Wide Impacts			
Asbestos-Containing Material	NA	Gammas, HTD&Betas, TRUs	Class 1/2
Lead and Lead-Based Paint	NA	Gammas, HTD&Betas, TRUs	Class 1/2
Sewage Collection System	NA	Gammas, HTD&Betas, Tritium, TRUs	Class 3

Storm Drain System and Outfalls	NA	Gammas, HTD&Betas, Tritium, TRUs	Class 3

D. Document Figures

Figure 1: Location of FCS

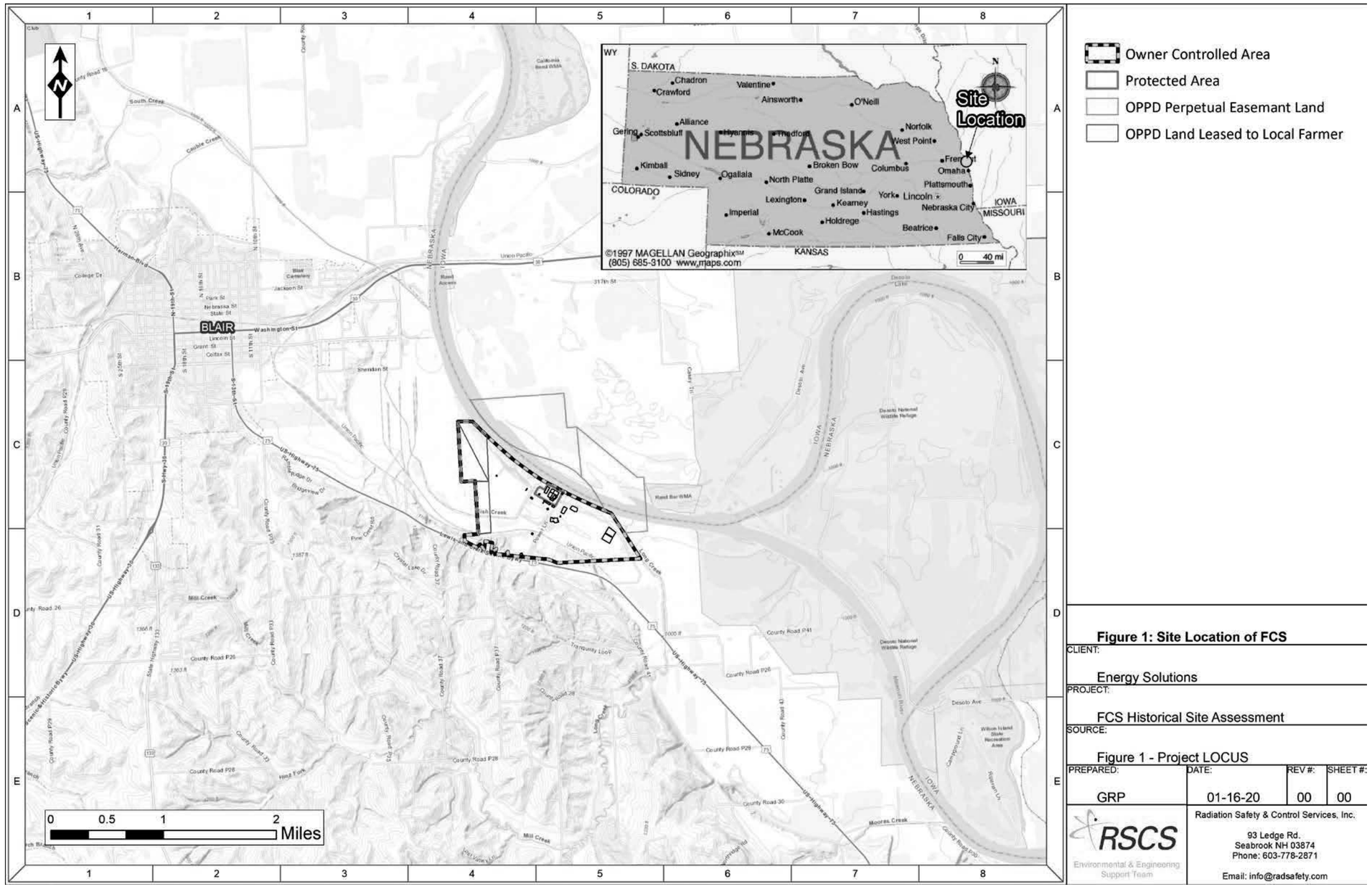

Figure 1: Site Location of FCS

CLIENT:	Energy Solutions
PROJECT:	FCS Historical Site Assessment
SOURCE:	Figure 1 - Project LOCUS

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Figure 2: Site Map of FCS

FACILITIES

1 Access Road Security Guardhouse
2 Administration Building
3 Auxiliary Building
4 Chemical and Radiation Protection Facility
5 Containment Building
6 Fire Protection Equipment
7 Flex Equipment Storage Building
8 Hazardous Material Storage Building
9 Intake Structure
10 Maintenance Garage
11 Maintenance Shop
12 Neutralization Chemical Pumphouse
13 New Security Building
14 New Warehouse
15 Old Security Building
16 Old Warehouse
17 OSGS Building
18 Radwaste Building
19 RO Unit
20 Service Building
21 Storage Building
22 Switchyard
23 Training Center
24 Turbine Building
25 Utility Building (Firing Range)

Figure 2: Site Map

CLIENT: Energy Solutions

PROJECT: FCS Historical Site Assessment

SOURCE: Figure #2: Site Diagram

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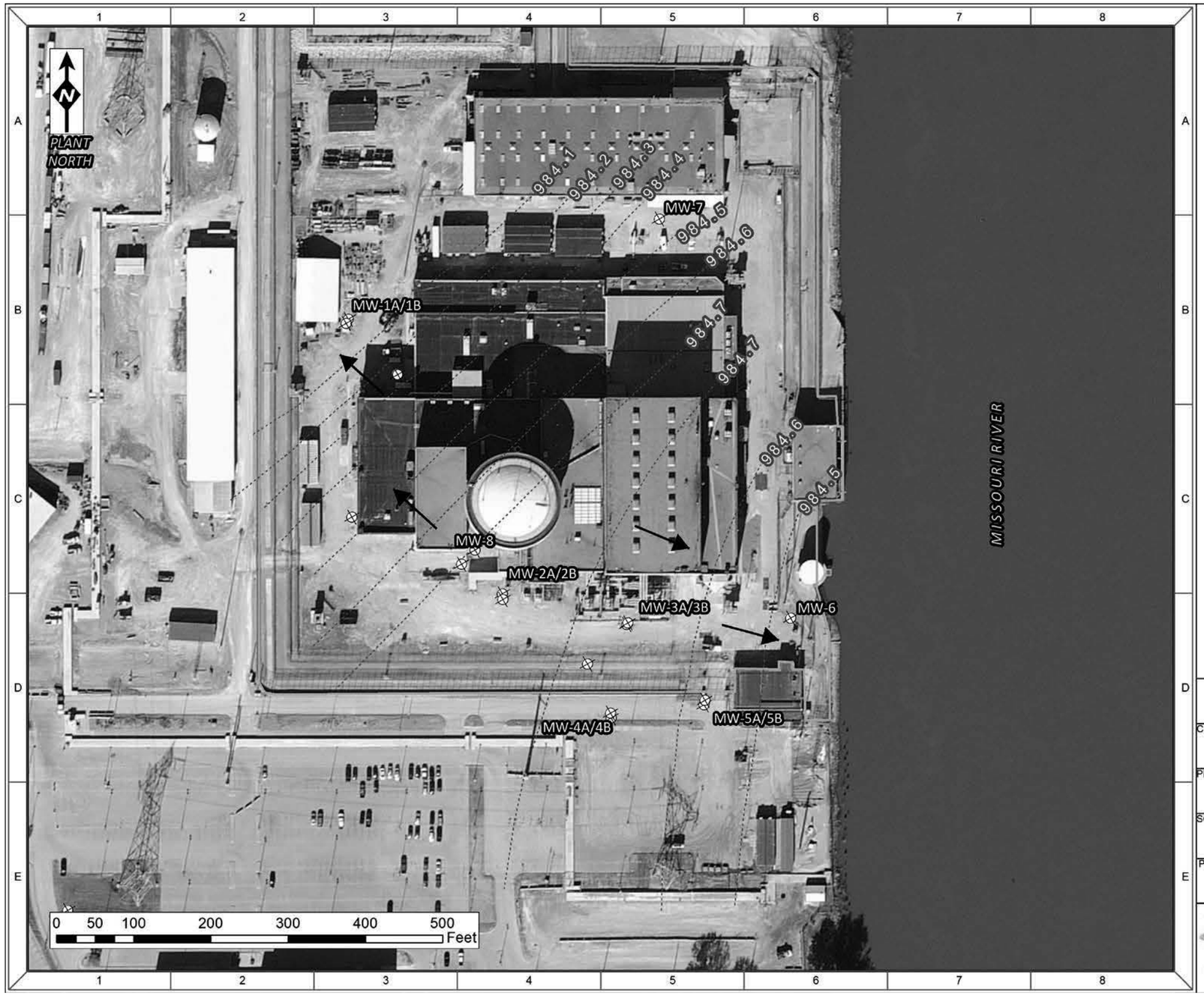
Figure 3: Groundwater Contours and Flow Direction in the Protected Area at FCS



Monitoring Wells
Groundwater Contour (ft MSL)
Protected Area
Flow Direction

Figure 3: Groundwater Contours and Flow Direction in the Protected Area at FCS

CLIENT: Energy Solutions

PROJECT: FCS Historical Site Assessment

SOURCE: Figure 6G Water Table Contour Map (Nov 30, 2007) Hydrogeologic Assessment

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Figure 4: Groundwater Contours and Flow Direction in the Landfill Area at FCS

Monitoring Wells
Groundwater Contour 2012 (ft)
Groundwater Contour 2013 (ft)
Landfill
Flow Direction

Figure 4: Groundwater Contours and Flow Direction in the Landfill Area at FCS

CLIENT: Energy Solutions

PROJECT: FCS Historical Site Assessment

SOURCE: Figure 1 Groundwater Contour Map Nov 28, 2012 & June 11, 2013

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Figure 5: Locations of Groundwater Monitoring Wells at FCS

⊕ Monitoring Wells

Protected Area

Figure 5: Locations of Groundwater Monitoring Wells at FCS

CLIENT: Energy Solutions

PROJECT: FCS Historical Site Assessment

SOURCE: AOI 16: Stormwater Outfalls

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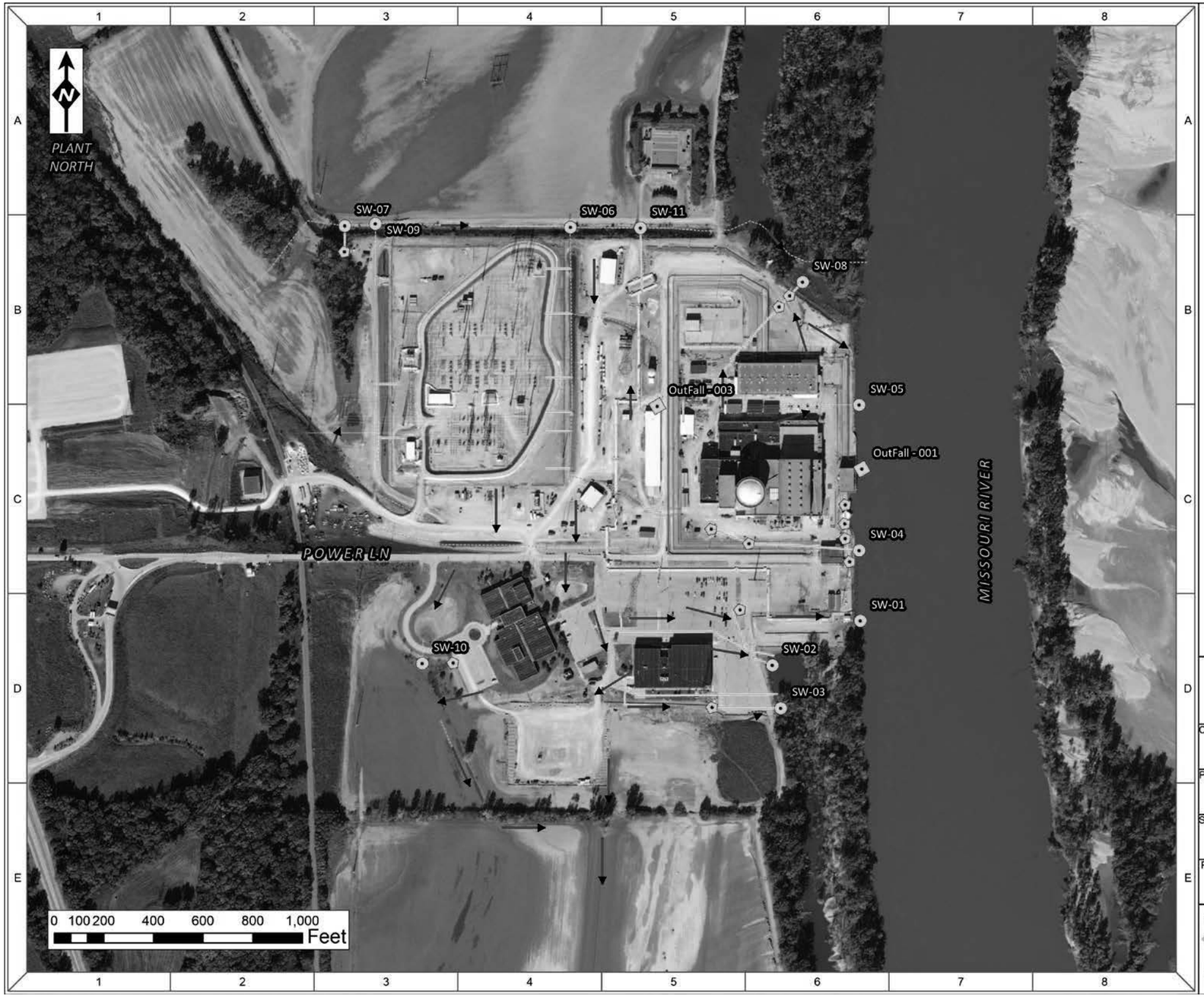
Figure 6: Location and Preliminary Radiological and Non-Radiological Classifications of the Storm Drain System at FCS



Stormdrain System (NR and Rad Class 3)

- NPDES Permitted Outfall
- Stormwater Outfall
- Stormdrain Inlet
- Stormdrain Pipe
- Drainage
- Flow Direction

Radiological and Non-Radiological Classification

- NR & Rad Non-Impacted
- NR Isolated
- NR & Rad Class 3
- NR & Rad Class 2
- NR & Rad Class 1

Figure 6: Location and Preliminary Radiological and Non-Radiological Classifications of the Storm Drain System at FCS

CLIENT: Energy Solutions

PROJECT: FCS Historical Site Assessment

SOURCE: Figure #3 - Stormwater Drainage & Controls

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Figure 7: Locations and Preliminary Non-Radiological Classifications of External Areas of Interest at FCS

External Areas of Interest

1 Agricultural Land
2 Equipment Storage Area
3 Fire Training Area
4 Firing Range
5 Fish Creek and Wetlands
6 Former Chemical Treatment Lagoons
7 Former Sanitary Lagoons
8 Landfill
9 North Slough
10 Protected Area Yard
11 Sanitary Lagoons
12 Sanitary Wastewater Land Application Area
13 South Slough
14 Switchyard

Protected Area

Owner Controlled Area

Non-Radiological Classifications	Radiological Classifications
NR Non-Impacted	Non-Impacted
NR Isolated	Class 3
NR Class 3	Class 2
NR Class 2	Class 1
NR Class 1	

Figure 7: Locations and Preliminary Classifications of External Areas of Interest at FCS

CLIENT: Energy Solutions

PROJECT: FCS Historical Site Assessment

SOURCE: Figure #5: Current Site Conditions

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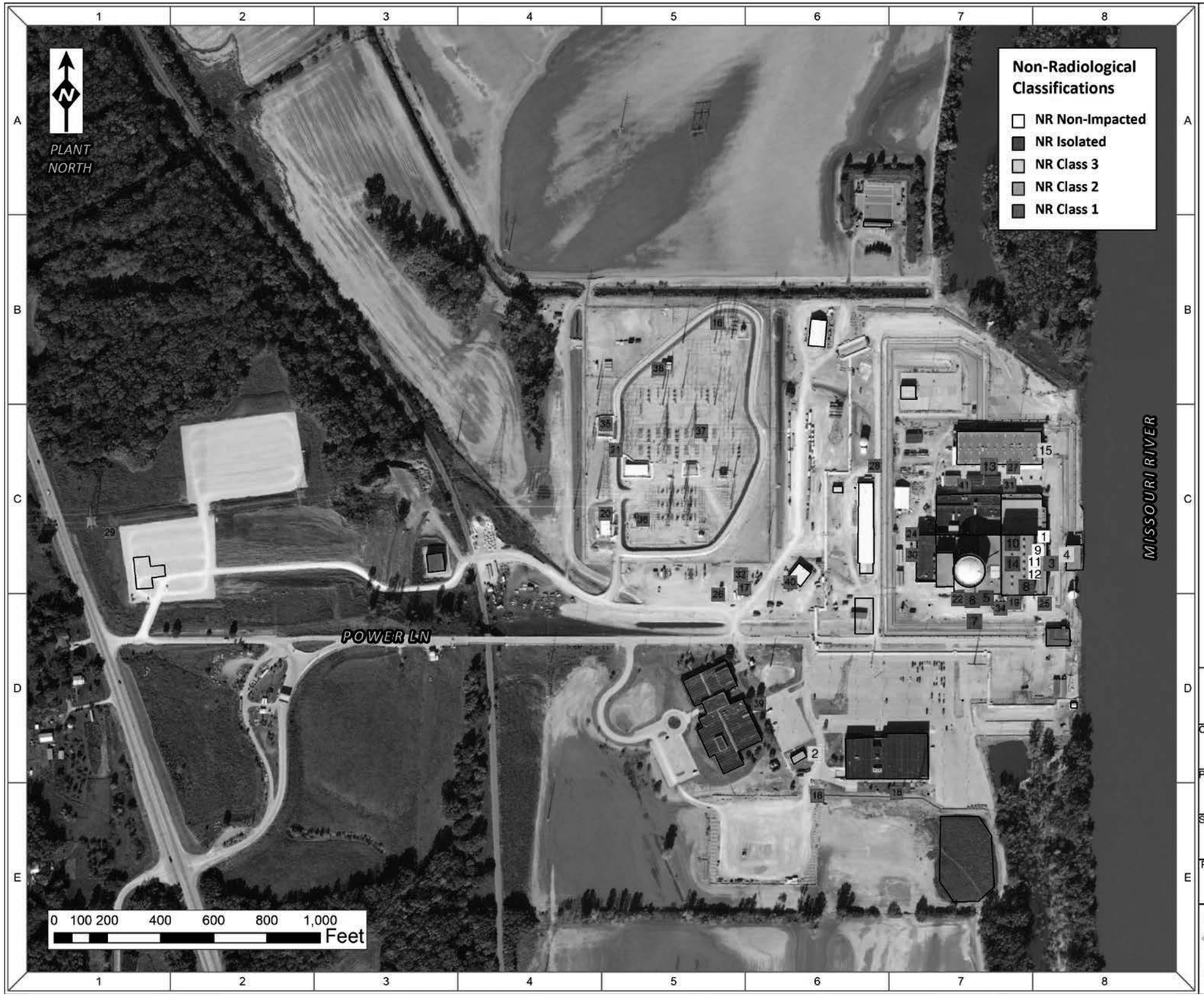
Figure 8: Locations and Preliminary Non-Radiological Classifications of Hazardous Material Storage Areas and Transformers at FCS



HAZARDOUS STORAGE AREAS

1 Acid Tank DW-30
2 Administration Building Outdoor Diesel Fuel Storage Tank FO-56
3 Auxiliary Boiler Storage FO-10
4 Diesel Fire Pump Storage Tank
5 Emergency Diesel Generator Auxiliary Day Tank
6 Emergency Diesel Generator Day Tank
7 Emergency Diesel Storage FO-1
8 FW-54 Day Tank
9 Hypochlorite Tank
10 Lube Oil Storage Tank
11 Sodium Hydroxide Tank
12 Sulphuric Acid Tank
13 TSC Diesel Storage FO-32
14 Turbine Main Oil Tank
15 Vehicle and Equipment Fuel Storage FO-43

TRANSFORMERS

16 345kV Shunt Reactor including radiators
17 3PM13S166X Transformer
18 Administration Building Transformer
19 Auxiliary Transformers T1A1 and T1A2
20 Control Building Service Transformer
21 Control Building Service Transformer
22 EE-95 Transformer
23 Emergency Power Transformer
24 ILRT Compressor Transformer
25 Main Transformer
26 New Spare Transformer
27 New Warehouse Transformer
28 Old Warehouse Transformer
29 PM13UP768X Transformer
30 Rad Waste Building Transformer
31 Service Building Maintenance Shop Transformer
32 Spare GSU Transformer
33 Spare Transformer T1
34 Station Service Transformers T1A3 and T1A4
35 T1 Transformer
36 T2 Transformer
37 T3 Auto Transformer
38 T4 Auto Transformer
39 Training Center Transformer
40 Transformer Outside 6-Bay Maintenance Garage
41 TSC Transformer

Figure 8: Locations and Preliminary Classifications of Hazardous Material Storage Areas and Transformers at FCS

CLIENT: Energy Solutions

PROJECT: FCS Historical Site Assessment

SOURCE: Figure #2: Site Diagram

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Figure 9: Preliminary Non-Radiological Classifications of Facilities at FCS

FACILITIES

1 Access Road Security Guardhouse
2 Administration Building
3 Auxiliary Building
4 Chemical and Radiation Protection Facility
5 Containment Building
6 Fire Protection Equipment
7 Flex Equipment Storage Building
8 Hazardous Material Storage Building
9 Intake Structure
10 Maintenance Garage
11 Maintenance Shop
12 Neutralization Chemical Pumphouse
13 New Security Building
14 New Warehouse
15 Old Security Building
16 Old Warehouse
17 OSGS Building
18 Radwaste Building
19 RO Unit
20 Service Building
21 Storage Building
22 Training Center
23 Turbine Building
24 Utility Building (Firing Range)

Non-Radiological Classifications

- NR Non-Impacted
- NR Isolated
- NR Class 3
- NR Class 2
- NR Class 1

Figure 9: Preliminary Non-Radiological Classifications of Facilities at FCS

CLIENT: Energy Solutions

PROJECT: FCS Historical Site Assessment

SOURCE: Figure #2: Site Diagram

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Figure 10: Preliminary Radiological Classifications of Facilities at FCS

FACILITIES

1 Access Road Security Guardhouse
2 Administration Building
3 Auxiliary Building
4 Chemical and Radiation Protection Facility
5 Containment Building
6 Fire Protection Equipment
7 Flex Equipment Storage Building
8 Hazardous Material Storage Building
9 Intake Structure
10 Maintenance Garage
11 Maintenance Shop
12 Neutralization Chemical Pumphouse
13 New Security Building
14 New Warehouse
15 Old Security Building
16 Old Warehouse
17 OSGS Building
18 Radwaste Building
19 RO Unit
20 Service Building
21 Storage Building
22 Training Center
23 Turbine Building
24 Utility Building (Firing Range)

Radiological Classifications

- Non-Impacted
- Class 3
- Class 2
- Class 1

Figure 10: Preliminary Radiological Classifications of Facilities at FCS

CLIENT: Energy Solutions

PROJECT: FCS Historical Site Assessment

SOURCE: Figure #2: Site Diagram

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Figure 11: 2011 Missouri River Flood at FCS

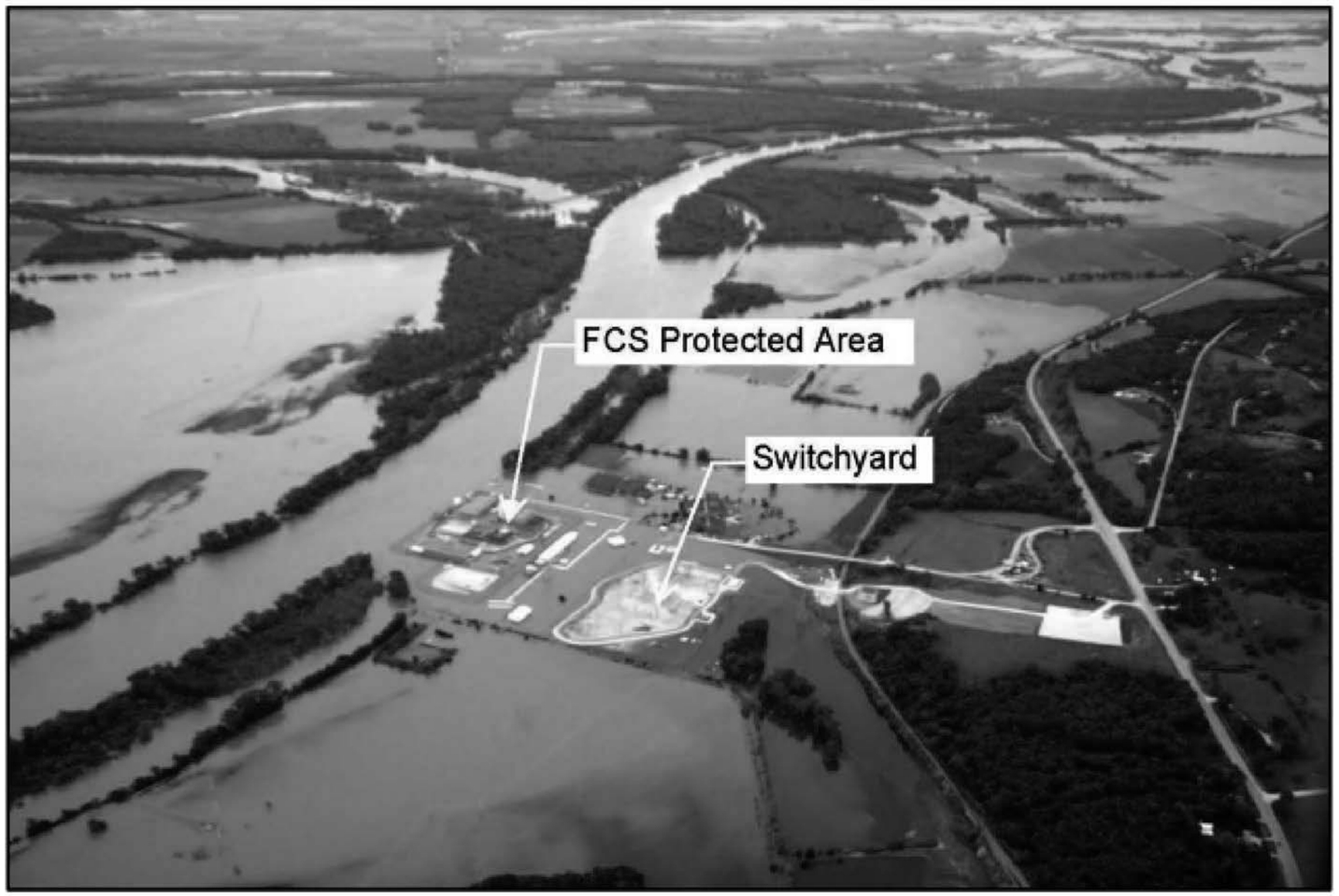

Figure 11: 2011 Missouri River Flood at FCS

CLIENT:
Energy Solutions

PROJECT:
FCS Historical Site Assessment

SOURCE:
Google Earth Imagery 7-2011
Figure 4,1-1. Impact of 2011 Flood

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