2009 Annual Inspection and Status Report for the Hallam, Nebraska, Decommissioned Reactor Site

Summary

The annual inspection of the former Hallam Nuclear Power Facility (HNPF) was successfully conducted on April 29, 2009. The inspection determined the Site was in good condition.

The Intermediate Heat Exchanger (IHX) structure that entombs the decommissioned reactor is in good condition. The IHX roof was replaced in 2007 and the building was painted in 2008. Some minor maintenance is required around the perimeter of the IHX and on the northwest and southwest corners of the upper roof. Specifically, grading around the foundation needs to be modified to direct water away from the building. This issue was identified last year and the efforts to remedy this condition will be conducted within the year. In addition to the grading, inspectors this year identified two corners of the upper roof that require attention. Areas in the northwest and southwest corners of the upper roof are bare of its rock covering. It is recommended that these bare spots be filled in by re-distributing the existing rock present on the roof or by adding additional rock. If possible, the bare spots will be taken care of at the same time that the grading is being corrected.

The grass-covered mound located over the old reactor foundation is in good condition. Turf on the mound is healthy and no erosion is present.

The nineteen groundwater monitor wells at the site are in good shape. Inspectors found all of the wells secured and locked. Improvements were made to several of the monitor wells in 2008. These improvements are identified in this inspection report.

Groundwater sampling was conducted in 2008 per the LTSP. Results are presented on the LM website and summarized in the Groundwater Monitoring Results section of this report. Gross alpha, gross beta, potassium-40, thorium-234, and nickel-63 were the only parameters in 2008 that were detected at concentrations exceeding their respective minimum detectable concentration (MDC). Detections of potassium-40, thorium-234, and nickel-63 are first time occurrences. It should be noted that the lab analyzing the 2008 samples achieved much lower MDCs than were achieved in previous years.

1.0 Introduction

This report presents the findings of the annual U.S. Department of Energy (DOE) inspection of the decommissioned Hallam, Nebraska, Reactor Site on April 29. 2009.

M. Miller (Inspector), and K. Broberg (Assistant Inspector), both with S.M. Stoller Corporation (the DOE Office of Legacy Management [LM] Contractor), conducted the inspection. Todd Chinn of the Nebraska Public Power District (NPPD) acted as an escort on NPPD property. Art Kleinrath, DOE–LM also participated in the inspection.

The inspection was conducted in accordance with the *Long-Term Surveillance Plan* [LTSP] *for the Hallam Nuclear Power Facility, Hallam, Nebraska* (DOE Grand Junction, Colorado, Revision 1, June 2008), and procedures established by DOE for site inspections. The purposes of

the inspection were to confirm the integrity of the IHX structure and the grass cover on the foundation of the former reactor building, examine the condition of DOE monitor wells, and meet with owner representatives.

2.0 Inspection Results

Features discussed in this report are shown on the attached drawing. Photographs to support specific observations are identified in the text and on the drawing by photograph location (PL) numbers.

The Hallam Decommissioned Reactor Site consists of:

1. The IHX cells, entombed in a waterproofed above-grade concrete structure.

2. A massive, below-grade, reinforced concrete structure, once the foundation of the reactor and now covered with a waterproof membrane, soil, and grass. Fixed radioactive materials remain at three principal locations within this structure.

3. Nineteen groundwater monitor wells. (1A, 1B, 2A, 2B, 2B2, 2C2, 3A, 3B, 4A, 4B, 4C, 5A, 5B, 7B, 6A, 6B, 7C, 8B, and 8C).

Both structures and all wells are located at the Sheldon Power Station, an active coal-fired power plant owned and operated by NPPD.

2.1 Intermediate Heat Exchanger (IHX) Building

The IHX building is a massive 40-feet-wide by 80-feet-long concrete sarcophagus located at the north end of the former HNPF. On the south side, the building is two stories high (about 25- to 30-feet). On the north side, the building is one-story high. Photograph PL–1 shows the two different roof levels of the building. The roof on the second story is slightly crowned. The roof on the first story is sloped to drain.

Inspectors view the roof of the IHX building from the roof of the Sheldon Power Plant, which is located north of the IHX building. The roof of the IHX building was replaced in 2007. The entire roof is covered by a layer of rock material. Roof rock has been removed from two areas on the upper roof since the 2008 inspection resulting in two bare spots. One bare spot is located in the northwest corner of the upper roof and one bare spot is located in the southwest corner of the upper roof (PL–2, PL–3, and PL–4***). It is recommended that existing roof rock be redistributed back over the bare spots and/or supplemented with some additional roof rock.***

It was noted during the 2008 inspection that grading around the base of the IHX building needs to be performed. The soil around the immediate base of the building (extending out about a foot from the building) is sloped toward the building. At a distance of about a foot from the building, the soil slopes away from the IHX and serves to drain water away from the building. Photo PL–5 illustrates how the soil along the immediate base of the south wall of the IHX building is sloped toward the base of the building. The small slope toward the building probably developed over the years from water dripping off the roof. The concern is that water will pond against the base of the building rather than move away from the building. Inspectors noted this year that the situation has not worsened since it was first noted in 2008. ***It is recommended that a small***

amount of soil be added around the perimeter of the IHX building to eliminate the existing depression, and that a one-foot- wide layer of small gravel be placed around the perimeter of the IHX building on top of the soil to absorb the impact of any water dripping off the edge of the roof in the future. The gravel will also aid in helping water drain away from the base of the IHX building.

2.2 Buried Concrete Structure, Once the Foundation of the Former Reactor

The old reactor foundation is buried beneath a waterproof membrane, soil, and grass. Today the buried structure appears as a low, flat-topped, grass-covered mound, 1.4 acres in extent, immediately south of the IHX building. Inspectors are concerned whether any areas of erosion are developing on the mound that require attention, and if the sprinkler system is operating adequately to maintain the grass on the mound.

The grass on the mound is well established and in good condition with the exception of an area of struggling grass growth on the northeast corner (PL–6). The area of struggling grass growth was noted last year during the 2008 inspection. It looks as if the area just needs a little more watering and attention. Conditions on the northeast corner appear to be about the same as they were in 2008 and do not appear to compromise the integrity of the mound. ***It is recommended that inspectors continue to monitor grass conditions on the northeast corner of the mound but unless conditions get worse and the integrity of the mound is questioned no action is required.*** No evidence of erosion was observed on the grass covered mound.

During the 2008 inspection it was observed that the east edge of the grass-covered mound, just beyond the toe of the slope, was bare of grass due to waterline work that was conducted in 2007, and the area needed to be re-seeded. Inspectors this year observed that the area has been successfully reseeded (PL–7).

DOE replaced the sprinkler system on the grass-covered mound in July 2005. The sprinkler system had been activated by plant personnel in 2009. Plant personnel indicate that the sprinkler system is operating satisfactorily.

2.3 Groundwater Monitoring Program

DOE monitors groundwater at this site in response to a request from the Nebraska Department of Health. There are 19 wells in the monitoring network. During the inspection all 19 wells were properly secured with locks. Prior to 2008, DOE sampled the wells annually, measuring water levels and collecting groundwater samples at all wells that produce sufficient water. Sampling is now conducted every two years. No sampling is scheduled for 2009. The next scheduled sampling event is scheduled for 2010.

During 2008, several of the wells were freshly painted and well identification numbers were applied to the outside of all of the protective casings (PL–8). ***It is recommended that during the next scheduled sampling event (2010) the protective casings be re-painted (if deemed necessary) and the well identifications be touched up (if required) to make sure they remain visible.***

During 2008, well cluster 1 (OBS1A and 1B) was converted to a flush mount installation (PL–9). No visible well identification numbers are present on wells OBS1A and OBS1B. ***It is recommended the well caps of these two flush mount wells be labeled with their well number the next time they are sampled. There is a small white triangle present on the cap of each flush mount where a 1A or 1B could be applied (PL–10). It is also recommended that the concrete well pads be painted a bright color (e.g. fluorescent orange or green) to aid in locating them should coal dust collect in the area and cover them.***

During 2008, the surface vaults of flush mount wells 6A and 6B were modified to a more durable design, identical to design used at wells 1A and 1B. Coal dust is prevalent at the location of wells 6A and 6B, and these two wells often become buried by coal dust making it hard to locate them (PL–11). Well OBS6B is located approximately 6 feet south of an existing orange pole (PL–12). A small insert map was added to this year's inspection report map showing the location of wells 6A and 6B in reference to this pole and to each other. ***It is recommended that the well caps of wells 6A and 6B be labeled with their well number when the wells are sampled next. It is also recommended that the concrete well pads be painted a bright color (e.g. fluorescent orange or green) to aid in locating them should coal dust collect in the area and cover them.***

In 2008 bollards were removed from around wells OBS2A, OBS2B, OBS2B2, and OBS2C2 and were replaced with concrete barriers. These wells are located in a high traffic area. Plant personnel indicate that the new barriers are working fine to offer protection to the wells (PL–13).

In 2008 bollards were removed from around wells OBS7B and OBS7C and replaced with concrete barriers. These wells are located in a very high traffic area (PL–14). Plant operations are impacted due to concern that heavy equipment operating in the area might accidently damage the wells. Options considered for the wells ranged from improving protection of the wells to plugging and abandoning the wells altogether. The decision was made to focus on improving protection of the wells first before plugging and abandonment is considered. During the inspection, plant personnel indicated that the new concrete barriers greatly improve the situation.

Groundwater Monitoring Results

It was recommended by DOE in 2006 that groundwater monitoring be discontinued because analytical results since 1970 demonstrate that there has been no impact to shallow perched groundwater and no current or anticipated unacceptable risk to human health and the environment. The state of Nebraska did not concur with this recommendation, but did agree to a reduction in sampling and analysis from once a year to once every 2 years. The new (once every two years) sampling frequency began in 2008. The next sampling event will take place in 2010.

Groundwater samples were collected from June 4 to June 7, 2008, in accordance with the LTSP. Seventeen monitoring wells were sampled in 2008 for gross alpha, gross beta, tritium, gamma spectrometry, and nickel-63, and water levels. Monitoring results are posted on the DOE–LM website http://www.lm.doe.gov/land/sites/ne/hallam/hallam.htm and summarized below.

Gross alpha, gross beta, potassium-40, thorium-234, and nickel-63 were the only parameters in 2008 that were detected at concentrations exceeding their respective minimum detectable concentration (MDC). Detections of potassium-40, thorium-234, and nickel-63 are first time occurrences. It should be noted though that the lab analyzing the 2008 samples achieved much lower MDCs then were achieved in previous years.

Gross alpha and gross beta

Gross alpha and gross beta activities continue to be detected in groundwater samples collected at the Hallam site. As discussed in previous site reports, because the gross alpha and gross beta activities have been low and consistent over time, the detected activities are attributed to naturally occurring radionuclides (e.g., uranium and uranium decay chain products) in the ground water.

Gross alpha exceeded the MDC in 2008 in monitor well 5B with a measured concentration (including uranium) of 10.6 picocuries per liter (pCi/L). The Uranium Mill Tailing Remedial Action (UMTRA) Maximum Concentration Limit (MCL) for gross alpha (excluding radon and uranium) is 15 pCi/L.

Gross beta exceeded the MDC in 2008 in monitor wells 1A, 2B, 2B2, 2C2, 5A, 5B, 7B, and 8C. The highest value for gross beta was reported at monitor well 7B (9.05 pCi/L).

Potassium-40

Potassium-40 exceeded the MDC in 2008 in monitor wells 1A, 2A, 4C, and 5A. Potassium-40 is a naturally occurring radionuclide that is expected to be present in background concentrations and contributes to the gross beta concentrations observed at the site. Potassium-40 is also a contaminant in most gamma spectrometry detectors so the detection limit for potassium-40 will vary widely from detector to detector. The MDC exceedances in 2008 are attributed to the achievement of lower MDCs than in previous years. All of the detected concentrations in 2008 are qualified through the data validation process as being estimated quantities.

Thorium-234

Thorium-234 exceeded the MDC in 2008 at monitor well 5B (estimated concentration was 88.7 pCi/L). The detection limit for the analysis was 54.2 pCi/L. Thorium-234 is a direct progeny of uranium-238 and is expected to be present in groundwater containing uranium. In 2006, uranium was measured in select wells at Hallam to determine if naturally occurring uranium accounts for the gross alpha concentrations observed. Monitor well 5B had the highest uranium concentration (45 µg/L).

Nickel-63

A nickel-63 concentration of 7.77 pCi/L was detected in 2008 at monitor well 8C. The detected concentration is very close to the MDC of 6.49 pCi/L and is qualified as an estimated value. Sampling results for nickel-63 at well 8C have been obtained since 1997. This is the first time that nickel-63 has been detected. Given that this is the first detect and that the estimated detected concentration is so close to the MDC, the detected concentration is considered suspect at this time. The well is scheduled to be sampled again in 2010. The result of the next sampling event will provide further insight into whether this first-time detect reflects environmental conditions or a false positive result.

3.0 Recommendations

1. Two spots on the upper roof of the IHX building are bare of rock material (page 2).

   Recommendation: Existing roof rock will be redistributed back over the bare spots and/or supplemented with some additional roof rock. If possible this work will be conducted in conjunction with the grading work planned for the base of the IHX building in FY2009.

2. Soil surrounding the base of the IHX structure is sloped toward the building (page 2).

   Recommendation: A small amount of soil will be added around the perimeter of the IHX building to eliminate the existing depression, and a one-foot-wide layer of small gravel will be placed around the perimeter of the IHX building on top of the soil to absorb the impact of any water dripping off the edge of the roof. The gravel will also aid in helping water drain away from the base of the IHX building.

3. An area of struggling grass growth is present in the northeast corner of the grass covered mound (page 3).

   Recommendation: Inspectors will continue to monitor grass conditions on the northeast corner of the mound, but unless conditions get worse and the integrity of the mound is questioned, no action is required.

4. During 2008, several of the wells were freshly painted and well identification numbers were applied to the outside of all of the protective casings (page 3).

   Recommendation: During the next scheduled sampling event (2010) the protective casing will be re-painted (if deemed necessary) and the well identifications will be touched up to make sure they remain visible.

5. No visible well identification numbers are present on wells OBS1A and OBS1B (page 3).

   Recommendation: The well caps of these two flush mount wells will be labeled with their well number the next time that they are sampled. There is a small white triangle present on the cap of each flush mount where a 1A or 1B could be applied (PL–10). It is also recommended that the concrete pads be painted a bright color (e.g., fluorescent orange or green) to aid in locating them should coal dust collect in the area and cover them.

6. No visible well identification numbers are present on wells OBS6A and OBS6B (page 4).

   Recommendation: The well caps of these two flush mount wells will be labeled with their well number the next time that they are sampled. There is a small white triangle present on the cap of each flush mount where a 6A or 6B could be applied. It is also recommended that the concrete pads be painted a bright color (e.g., fluorescent orange or green) to aid in locating them should coal dust collect in the area and cover them.

4.0 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL–1	220	Two different roof levels of IHX building.
PL–2	140	Two bare spots on the upper roof of the IHX building.
PL–3	140	Bare spot in northwest corner of upper roof of the IHX building.
PL–4	140	Bare spot in southwest corner of upper roof of IHX building.
PL–5	270	Soil at the base of the south wall of the IHX is sloped toward the building.
PL–6	180	Area of struggling grass growth on northeast corner of grass covered mound.
PL–7	360	Looking north along the edge of grass covered mound.
PL–8	90	Monitor well 4–A clearly labeled on outside of protective casing.
PL–9	Na	Newly installed flush mount wells 1A and 1B.
PL–10	NA	Well identification can be added to the white triangle on the well cap of the newly installed flush mount wells.
PL–11	NA	Newly installed flush mount at cluster 6.
PL–12	360	Can use existing pipe to help locate flush mount well at cluster 6. An insert map is provided on the inspection report map for 2009.
PL–13	205	New concrete barriers around well cluster 2.
PL–14	30	New concrete barriers around well cluster 7.

HAL 4/2009. PL–1. Two different roof levels of IHX building.

HAL 4/2009. PL–2. Two bare spots on the upper roof of the IHX building.

HAL 4/2009. PL–3. Bare spot in northwest corner of upper roof of the IHX building.

HAL 4/2009. PL–4. Bare spot in southwest corner of upper roof of IHX building.

HAL 4/2009. PL–5. Soil at the base of the south wall of the IHX is sloped toward the building.

HAL 4/2009. PL–6. Area of struggling grass growth on northeast corner of grass covered mound.

HAL 4/2009. PL–7. Looking north along the edge of grass covered mound.

HAL 4/2009. PL–8. Monitor well 4–A clearly labeled on outside of protective casing.

HAL 4/2009. PL–9. Newly installed flush mount wells 1A and 1B.

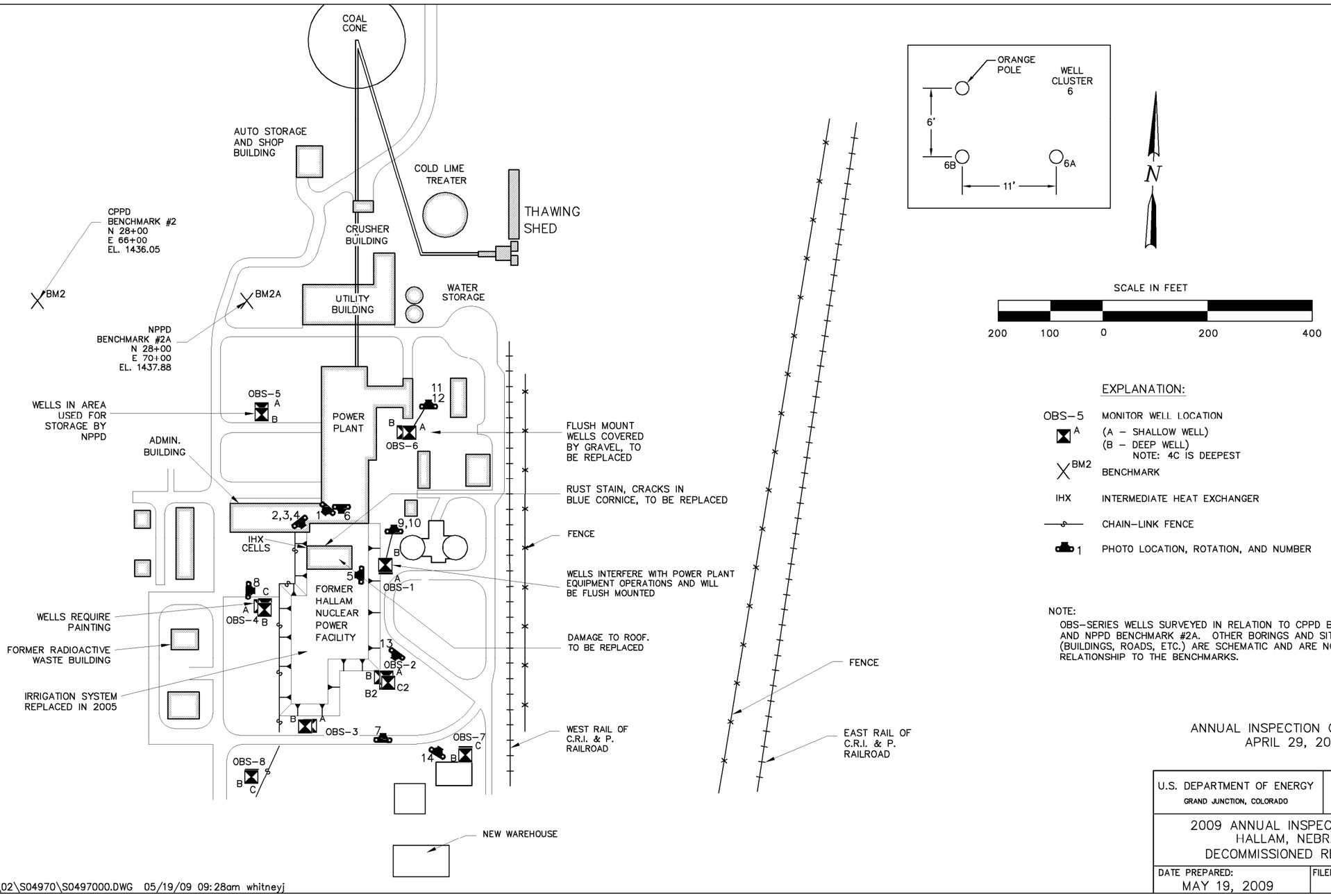
HAL 4/2009. PL–10. Well identification can be added to the white triangle on the well cap of the newly installed flush mount wells.

HAL 4/2009. PL–11. Newly installed flush mount at cluster 6.

HAL 4/2009. PL–12. Can use existing pipe to help locate flush mount well at cluster 6. An insert map is provided on the inspection report map for 2009.

HAL 4/2009. PL–13. New concrete barriers around well cluster 2.

HAL 4/2009. PL–14. New concrete barriers around well cluster 7.



EXPLANATION:

OBS-5	MONITOR WELL LOCATION
A	(A – SHALLOW WELL) (B – DEEP WELL) NOTE: 4C IS DEEPEST
BM2	BENCHMARK
IHX	INTERMEDIATE HEAT EXCHANGER
	CHAIN-LINK FENCE
1	PHOTO LOCATION, ROTATION, AND NUMBER

NOTE:

OBS-SERIES WELLS SURVEYED IN RELATION TO CPPD BENCHMARK #2 AND NPPD BENCHMARK #2A. OTHER BORINGS AND SITE FEATURES (BUILDINGS, ROADS, ETC.) ARE SCHEMATIC AND ARE NOT SHOWN IN RELATIONSHIP TO THE BENCHMARKS.

ANNUAL INSPECTION CONDUCTED
APRIL 29, 2009

U.S. DEPARTMENT OF ENERGY GRAND JUNCTION, COLORADO	Work Performed by S.M. Stoller Corporation Under DOE Contract No. DE-AC01-07LM00060
2009 ANNUAL INSPECTION DRAWING HALLAM, NEBRASKA DECOMMISSIONED REACTOR SITE	
DATE PREPARED: MAY 19, 2009	FILENAME: S0497000

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