Black Hills Power

CIS Testing Importance to your TIMP Programs

And

Black Hills Power's Lessons Learned

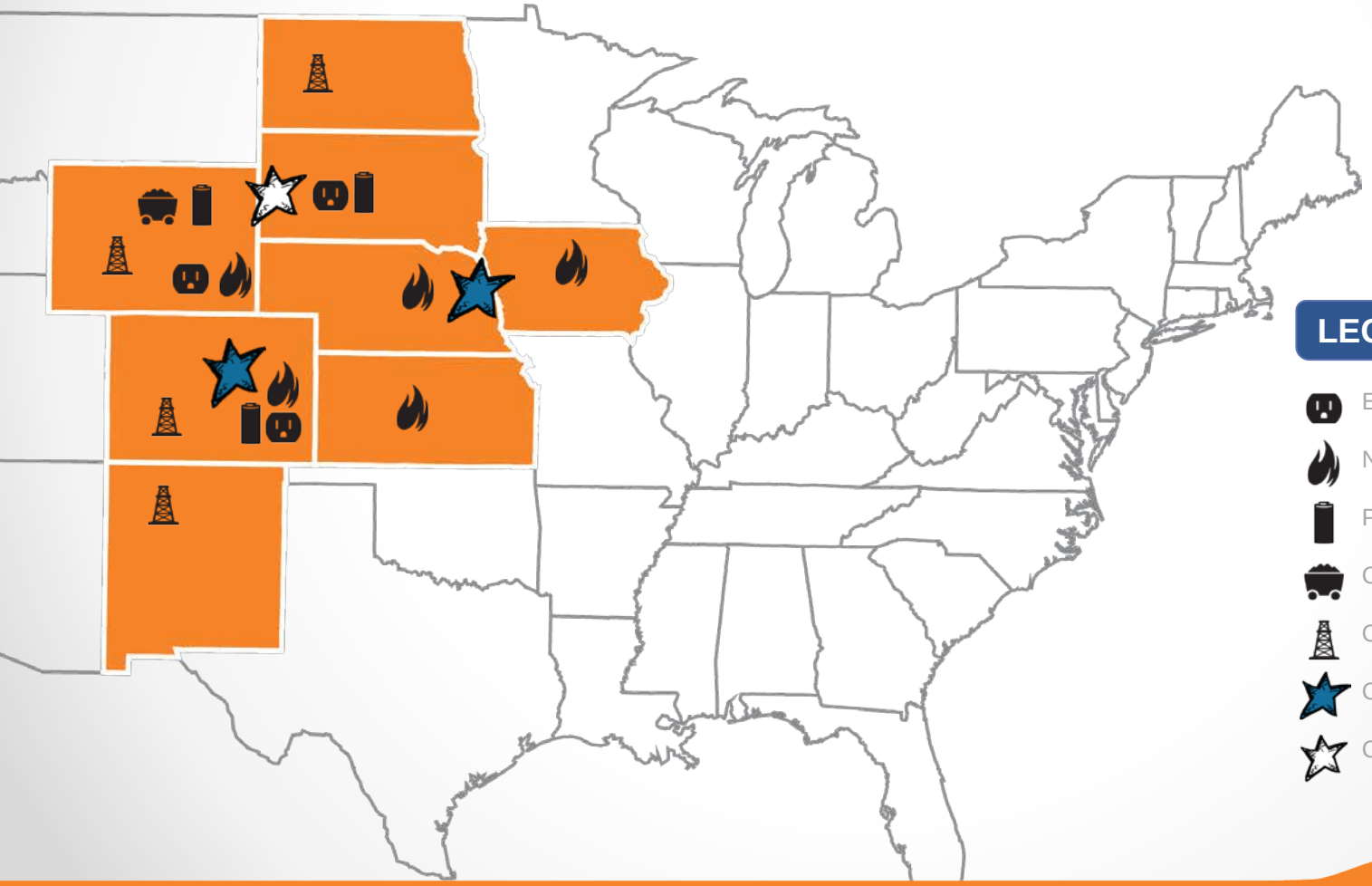
Black Hills Corporation
Improving life with energy

WHO WE ARE

Black Hills Corporation is a diversified energy service company operating in several western states.

- Corporate Offices
  - Rapid City, SD (Headquarters)
  - Denver, CO
  - Papillion, NE
- Electric and Gas Utility Group
  - 201,500 electric customers
  - 528,000 gas customers
- Non-regulated Energy Group
  - Natural Gas
  - Crude Oil
  - Coal
  - Electric Power

Black Hills Corporation



LEGEND

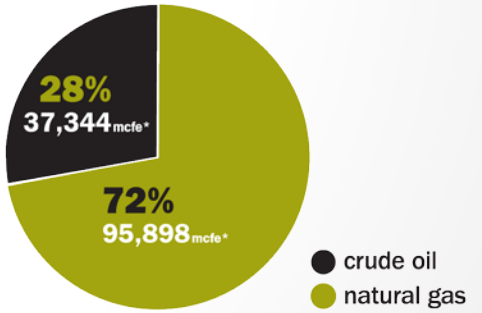
- Electric Utility
- Natural Gas Utility
- Power Generation
- Coal Mine
- Oil and Gas
- Corporate Office
- Company Headquarters

OIL AND GAS RESERVE BASINS

● current areas of continuing exploration of oil and gas reserves

We have 20,371 miles of gas transmission and distribution mains and service lines. That's enough pipeline to nearly circle the globe.

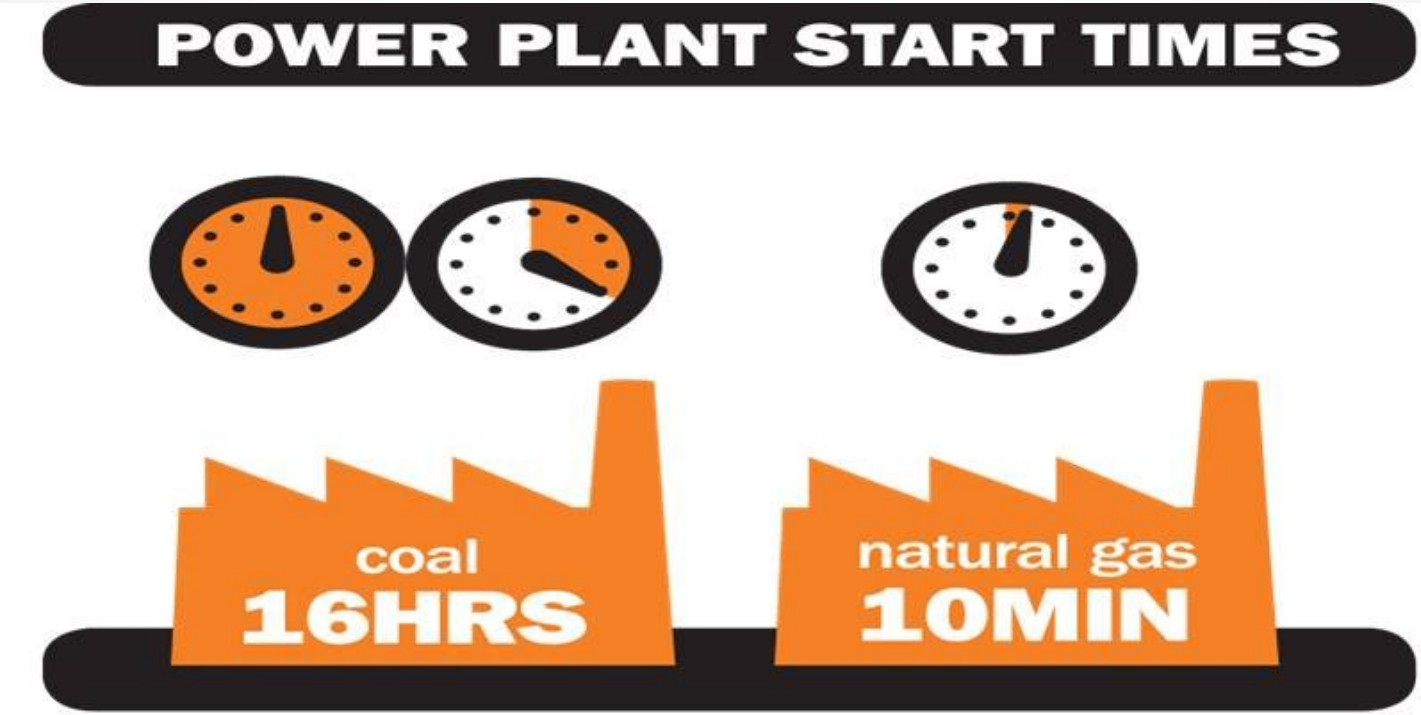
BLACK HILLS CORPORATION OIL AND GAS RESERVES



mcfe = measured in thousand cubic feet equivalent
*end of 2011

Black Hills Power is one of three BHC Electrical Utilities with Generation Facilities

- Black Hills Power Generation Facilities:
  - 4 in South Dakota
  - 5 in Wyoming (with plans for an additional facility going commercial in 2014)



The new plant has a quick 10-min. start time to back up wind generation and meet peak needs during hot summer and cold winter months.

Generation Facilities mean:

- Natural Gas Fuel Source
- Natural Gas Fuel = Pipelines
- Pipelines =
  - Transmission classification
- Transmission Pipelines =
  - PHMSA Regulations

BHPs Transmission Pipelines

- In the state of South Dakota, BHP owns 1.48 total miles of Class Location 3, Transmission Pipeline supplying Natural Gas to Combustion Turbine Generation
  - Ben French Pipeline Design (.51 miles)
    - OD size 10” carbon steel – with step down feeds at 4”
    - Operating Pressure 325 psig
    - MAOP 680 and 425 respectively
  - Lange Pipeline Design (.97 miles)
    - OD size 10” carbon steel
    - Operating Pressure 465 psig
    - MAOP 740

- For our Integrity Management Program – both were scheduled in 2011 to have Direct Assessment testing to meet our compliance commitment.

Transmission Pipelines

- 192 Subpart I – Corrosion Control
  - (a) Monitoring/Surveillance 192.459, .465, .467, .471, .475, .479, .481
  - (b) Prompt Remedial Action 192.465, .483, .485

- In accordance with 192.901 Integrity Management
  - The key elements of BHP's program include:
    - (a) identification of all high consequence areas, in accordance with 192.905
    - (b) baseline assessment plan meeting 192.919 and 192.921
    - (c) identification of threats to each covered pipeline segment, which shall include data integration and a risk assessment per 192.917 & 192.935

October 2011

- Up to this point, all of our Annual Inspections/Testing showed good reads, Pipe to Soils were consistently within compliance range
- No HCA's
- No leak history
- Build in 1991 and 2001 with modern materials
- Both pipelines are cathodic protected with galvanic anodes
- Black Hills Power obtained bids to do EDCA Testing for Integrity Management

External Corrosion Direct Assessment (ECDA) Testing

Close Interval Potential Survey (CIPS) and Current Voltage Gradient (ACVG)

TESTING RESULTS

Station#	Flag#	DOC	Direction	Current	Station#	Flag#	DOC	Direction	Current
0+50	1	4'3"	F	0.011	9+00	18	4'6"	F	0.052
1+00	2	3'8"	F	0.015	9+50	19	3'8"	F	0.05
1+50	3	3'9"	F	0.01	10+00	20	3'11"	F	0.058
2+00	4	3'2"	F	0.01	10+50	21	3'4"	F	0
2+50	5	3'3"	F	0.011	11+00	22	3'5"	F	0.06
3+00	6	3'5"	F	0.008	11+50	23	4'8"	F	0.1
3+50	7	3'10"	F	0.003	**12+00**	**24**	**3'11"**	**F**	**0.143**
4+00	8	2'7"	F	0.013	**12+50**	**25**	**3'11"**	**F**	**0.465**
4+50	9	3'3"	F	0.025	**13+00**	**26**	**3'8"**	**F**	**0.585**
5+00	10	3'1"	F	0.025	**13+50**	**27**	**3'7"**	**F**	**0.815**
5+50	11	3'6"	F	0.026	**14+00**	**28**	**3'11"**	**F**	**1.25**
6+00	12	3'3"	F	0	14+50	29	5'	F	1.31
6+50	13	3'2"	F	0.035	15+00	30	4'9"	F	1.25
7+00	14	3'4"	F	0.038	15+50	31	3'10"	F	1.4
7+50	15	2'10"	F	0.039	16+00	32	4'10"	F	1.35
8+00	16	3'10"	F	0.046	17+50	35	6'2"	F	2.42
8+50	17	3'11"	F	0.045	18+00	36	6'8"	F	1.37

CONCERN Caused Us to – Re-think the Project

- Readings clearly were showing we had a potential problem
- Knowing of this – Do we continue to investigate - -
  - Black Hills is committed to maintaining the integrity of our pipelines, thus Executive Management determine to move forward with our investigation and expose the pipeline section, between the primary concern areas – Flags #24 - #28

- Continuing Project (Phase II) –
  - Project Scope Update – additional costs – On site contractor available
  - Additional Tail Gate Sessions, with new contractor employyes
  - CHECK - Operator Qualifications additional contractors
  - **ALWAYS CALL 811 before digging**
  - Started at the field bends
    - and found what appeared to be a coating issue

Direct Examination
Disbonded coating

ADDITIONAL CONCERN:

Field bending of the yellow-jacketed coated pipe caused cracking of the outer coating

Polyethylene yellow - jacket removal

Pipeline built under a dry creek bed - - Not so in 2011

Ground Water & Wetlands

De-Watering

REGULATORY: Don't forget to get all the necessary permits needed for water-way involvement

Re-direct Creek Flow

Microbiological Bacteria

Holiday in Coating

Direct Examination:

Microbiological Influenced Corrosion (MIC)

After Sand Blasting

Additional MIC


60 cm
93
102
98
WT 1221
WL 105
WL 1.10


2,2 cm

Let the Repairs Begin

- Corrosion Tech determinations:
  - How best to repair?
    - Utilize Reinforcing Sleeves
  - Obtaining the correct sizing of reinforcing sleeves
  - Obtain Certified Welder
  - Obtain Welding Inspector
  - Coating type determination

Dresser Style 110 Reinforcing Sleeve

Re-coated with Denso 7125 Epoxy Coating

Brush & Roller Applied Coating

Sleeved & Recoated

INSPECTION

Continued Inspection

Backfilled to prevent pipe wash-out

Redirect Creek back to natural course

Additional Measure – Added Cathodic Protection Test Station

LESSONS LEARNED:

- Through out project – have your Safety & Environmental professionals involved to monitor work processes;
- **Expect the Unexpected**
- Our Ben French pipeline was built in 1991, up to testing always had good inspection readings, catholically protected, no high consequence areas, ECDA indirect survey indicated points of concern, and direct inspection showed disbonded coating, upon removal of coating and sandblasting found MIC with wall lose, but did not affect integrity or cause line pressure reduction
- Scope of Work changed - caused scrambling to find reinforcing sleeves, welder, inspector, coating, overnighting material busted the budget.

2012 Project Continuation

- Phase III: We still felt the entire pipeline had possible disbonded coating that needed remedial repairs;
- Found: Disbonded coating but NO more corrosion
  - Disbonded coating repaired
  - Added 300 feet of Rock Shield in two areas on the pipeline
  - 98% of pipeline is now recoated (only section remaining is cased)

In Conclusion

- If you are questioning the extra costs to do ECDA testing – Remember BHP and our findings
- Remedial Repairs, even unplanned, outweigh a leak or potential pipeline explosion
- Bitter / Sweet - We absolutely hated what we found, but on the other hand, absolutely loved what we found.

QUESTIONS