

SIoux FALLS REGIONAL SANITARY LANDFILL:

LANDFILL GAS PIPELINE

MARCH 15, 2011

**SOUTH DAKOTA/NORTH DAKOTA
PIPELINE OPERATOR SAFETY
TRAINING**



SUMMARY

- **WHAT IS LANDFILL GAS**
- **OVERVIEW OF LANDFILL AND STATISTICS, SERVICES OFFERED**
- **BACKGROUND OF LFG USAGE OPTIONS (LFG FEASIBILITY STUDY)**
- **LFG USER AGREEMENT**
- **LFG PIPELINE PROJECT SPECIFICS**
- **LFG PIPELINE SAFETY ISSUES**



LANDFILL GAS (LFG)

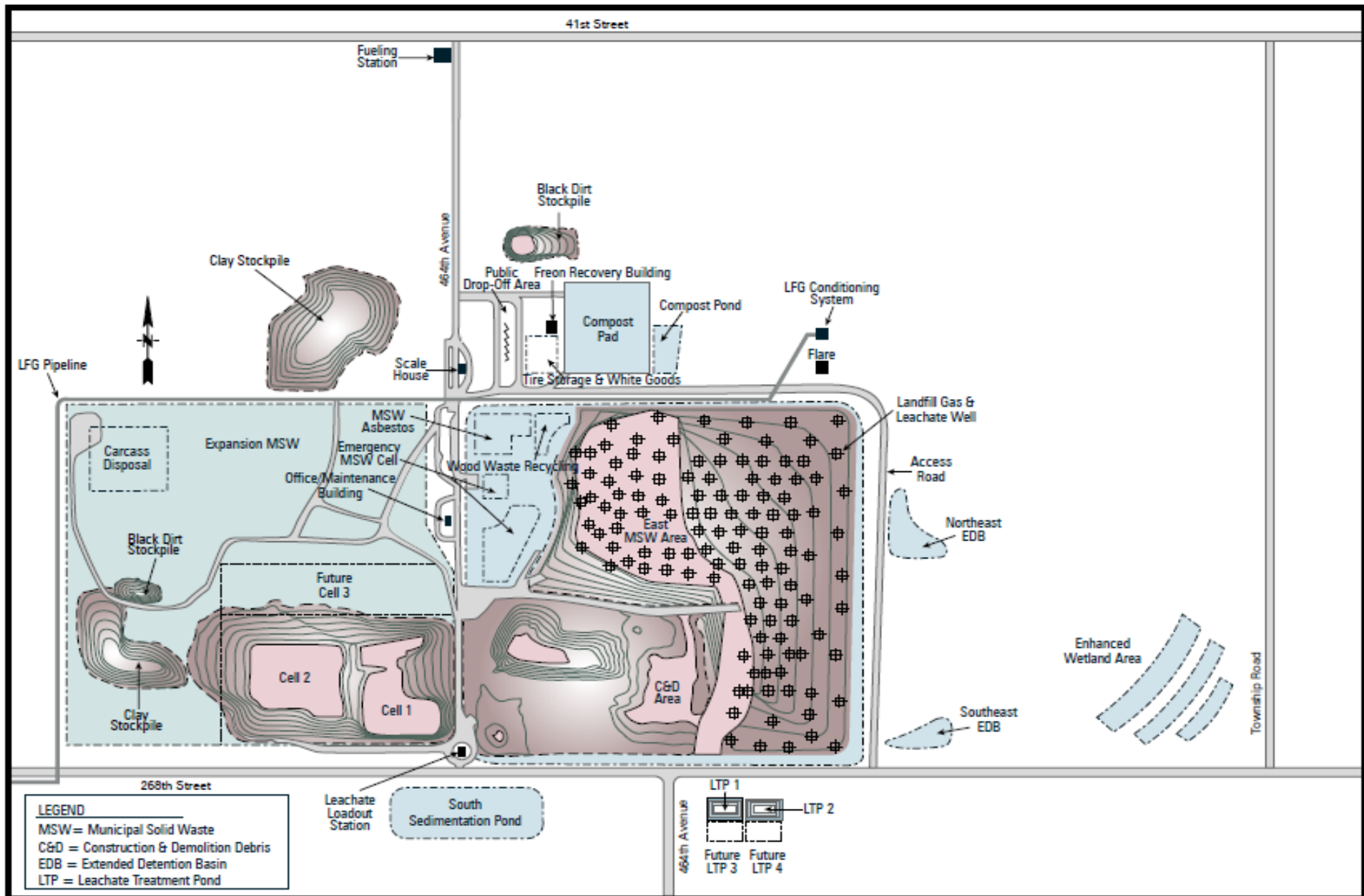
- **LFG IS 40 TO 60% METHANE**
- **METHANE IS 24 TIMES MORE POTENT GHG THAN CO2**
- **THE CITY VOLUNTARILY INSTALLED ITS LFG SYSTEM; WE ARE ACTIVELY COLLECTING LFG AND PUTTING IT TO BENEFICIAL USE**
- **LFG IS A RENEWABLE ENERGY SOURCE**
- **POET WANTS TO POWER THEIR ETHANOL PRODUCTION USING AS MUCH RENEWABLE POWER AS POSSIBLE**
- **SOLID WASTE TYPICALLY GENERATES METHANE FOR 30 TO 40 YEARS**



LANDFILL OVERVIEW

- **LANDFILL LOCATED APPROXIMATELY 5.5 MILES WEST OF SIOUX FALLS ON 41ST STREET**
- **LANDFILL SERVES 5 COUNTY REGION**
- **SERVICE POPULATION OF APPROXIMATELY 250,000 PEOPLE**
- **>100,000 VEHICLES CROSS THE SCALES EVERY YEAR (331 VEHICLES PER DAY AVERAGE BUT WEEKENDS >1200)**





WHERE DOES LFG COME FROM?

- **MUNICIPAL SOLID WASTE (FOOD WASTE, HOUSEHOLD WASTE, ETC.)**
 - **ANAEROBIC BACTERIA BREAKS DOWN ORGANIC MATERIALS GENERATING METHANE**
- **C&D (CONSTRUCTION & DEMOLITION DEBRIS)**
 - **MORE INERT MATERIALS DO NOT DEGRADE SO NO GAS COLLECTION**



BACKGROUND

- **IN EARLY 2000'S CITY EXPLORED SITING AN ETHANOL PLANT, BIODIESEL PLANT OR ASPHALT PLANT AT OR VERY NEAR TO THE LANDFILL TO HELP OFFSET COST OF INSTALLING A LEACHATE AND LANDFILL GAS COLLECTION SYSTEM. INCENTIVES (TAX &/OR CARBON CREDITS) ALSO LOOKED AT TO HELP JUSTIFY SYSTEM COSTS.**



BACKGROUND

- **THERE WERE NO TAKERS FOR LF SITE**
 - **LANDFILL LOCATION CONCERNS, RAILROAD NOT AVAILABLE**
 - **CITY CONTINUED TO LOOK FOR END USER**
- **2006-2007 CITY INSTALLED PHASE I AND PHASE II & FLARED GAS TO PROVE VIABILITY. CITY BEGAN ACCUMULATING CARBON CREDITS. HAVE SOLD CCX AND CCAR VERIFIED EMISSION REDUCTION CREDITS.**



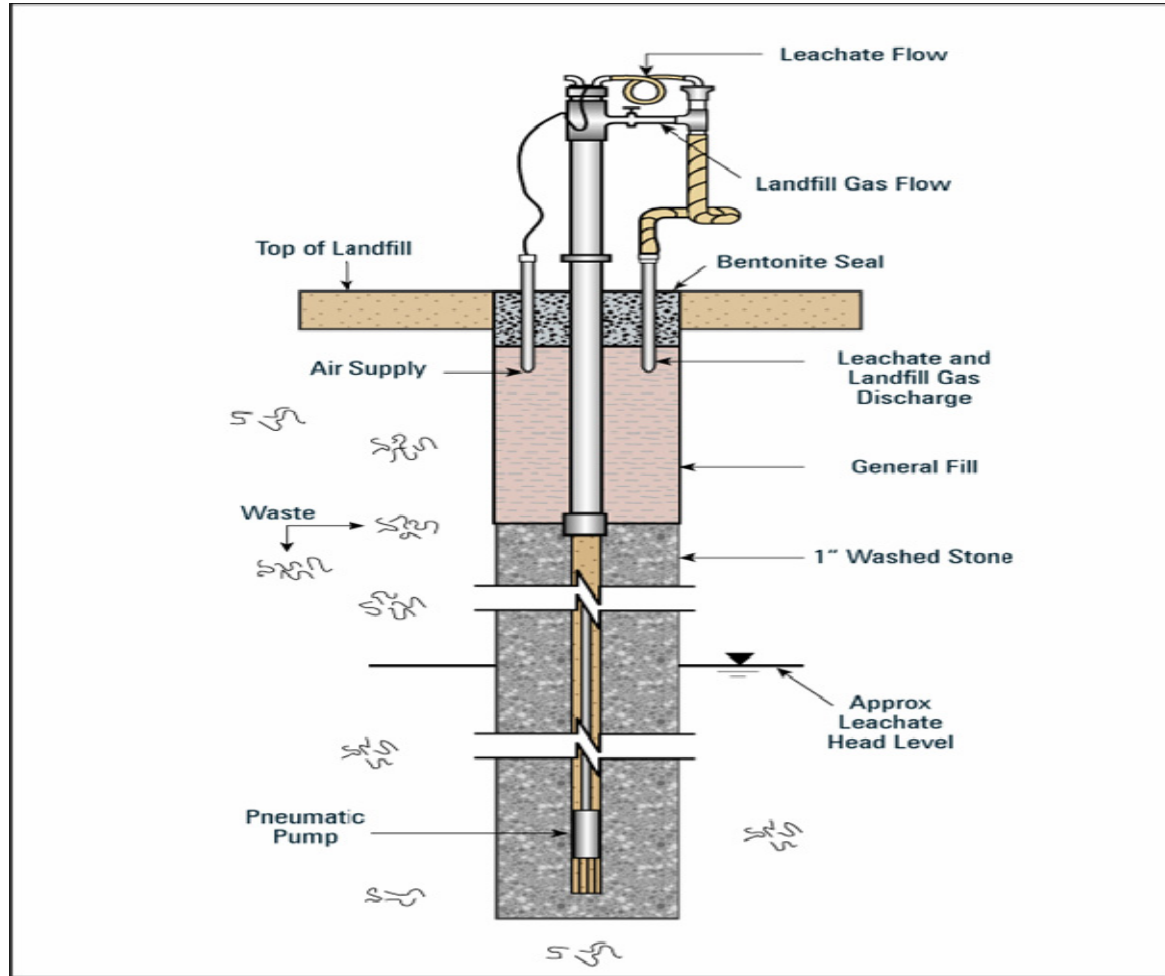
LANDFILL GAS WELLS (134 TOTAL)



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

SCHEMATIC OF DUAL PHASE WELL



LEACHATE AERATION POND



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LEACHATE LOADOUT STATION



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LANDFILL GAS WAS FLARED OFF INITIALLY & IS NOW A BACKUP



LANDFILL GAS FLARE AT NIGHT



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LFG END USER UPDATE

- **IN 2006 CITY HAD DISCUSSIONS WITH GREAT PLAINS ETHANOL (NOW KNOWN AS POET) ABOUT POSSIBILITY OF AN ENERGY USE FOR LFG**
- **IN 2006 CITY CONSULTANT (RW BECK) DID A FEASIBILITY STUDY ON ITS LFG GENERATION POTENTIAL AND LOOKED AT OPTIONS AND ALTERNATIVES FOR ITS LFG**



LFG FEASIBILITY STUDY

- **RW BECK FEASIBILITY STUDY LOOKED AT SEVERAL DIFFERENT OPTIONS AND ALTERNATIVES**
 - **DIRECT UTILIZATION PROJECT**
 - **GENERATION OF ELECTRICITY AND SELLING IT TO A LOCAL UTILITY**
 - **OTHER ENERGY ALTERNATIVES (E.G. LFG TO LIQUID METHANE; DIRECT CONVERSION TO RENEWABLE FUEL(?))**
 - **CITY OWNERSHIP OR THIRD PARTY OWNERSHIP OF LFG UTILIZATION PROJECT**
 - **9 DIFFERENT PRO FORMAS COMPLETED**



LFG FEASIBILITY STUDY

- **LFG GENERATION FORECAST**
 - 2006 ESTIMATED AVERAGING 900-1 000 SCFM
 - BY 2010 ESTIMATED TO BE 1 800 SCFM
- **DIRECT UTILIZATION DETERMINED TO BE MORE DESIRABLE (\$\$\$)**
- **ESTIMATED CAPITAL COSTS:**
 - DIRECT UTILIZATION: \$4.3 M
 - ELECTRICAL GENERATION & DISTRIBUTION: \$5.0 M



LFG FEASIBILITY STUDY

- **AVERAGE ANNUAL NET REVENUE**
 - **ELECTRICAL GENERATION**
 - **ESTIMATES RANGED FROM (-\$183,000 LOSS TO \$173,000 GAIN)**
 - **DIRECT UTILIZATION**
 - **THIRD PARTY OWNED DEVELOPER OPTION ESTIMATE WAS (\$170,000 TO \$340,000 GAIN)**
 - **CITY OWNED OPTION ESTIMATE WAS >\$850,000 GAIN**

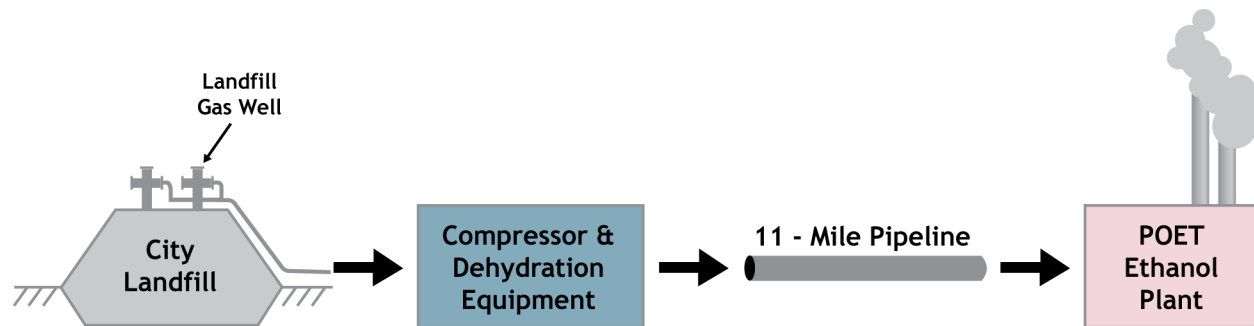


DIRECT UTILIZATION PROJECT PATH CHOSEN

- **POET BIOREFINING-CHANCELLOR WAS MOST VIABLE CANDIDATE**
 - **~ 10 MILES AWAY**
 - **365 DAYS / 24 HOUR OPERATION**
 - **CAN TAKE ALL LFG THAT WE CAN GENERATE**
- **NEGOTIATIONS CONTINUED WITH POET**
- **SPRING 2008 FINAL AGREEMENT WAS REACHED**



LFG PIPELINE TO POET BIOREFINING (CHANCELLOR)



LFG AGREEMENT

- **BILLING BASED ON MMBTU CONTENT (%METHANE X 970BTU / CUBIC FOOT)**
- **2 FLOW METERS**
- **COORDINATION BETWEEN LANDFILL AND POET (INTERRUPTIONS, SHUTDOWNS, ETC)**
- **PRICE: \$4.00 PER MMBTU**
- **LFG TESTING AND STANDARDS REQUIREMENTS**
- **LFG SCRUBBING OR TREATMENT IF NECESSARY WILL BE DONE BY POET**



LFG AGREEMENT

- **OPERATION RESPONSIBILITIES**
- **INVOICING, BILLING & TAXES**
- **PIPELINE CONSTRUCTION**
COMMENCEMENT DATE
 - **JUNE 2008 POET GAVE CITY NOTICE TO PROCEED**
- **ACCESS TO PROPERTY AND EQUIPMENT**

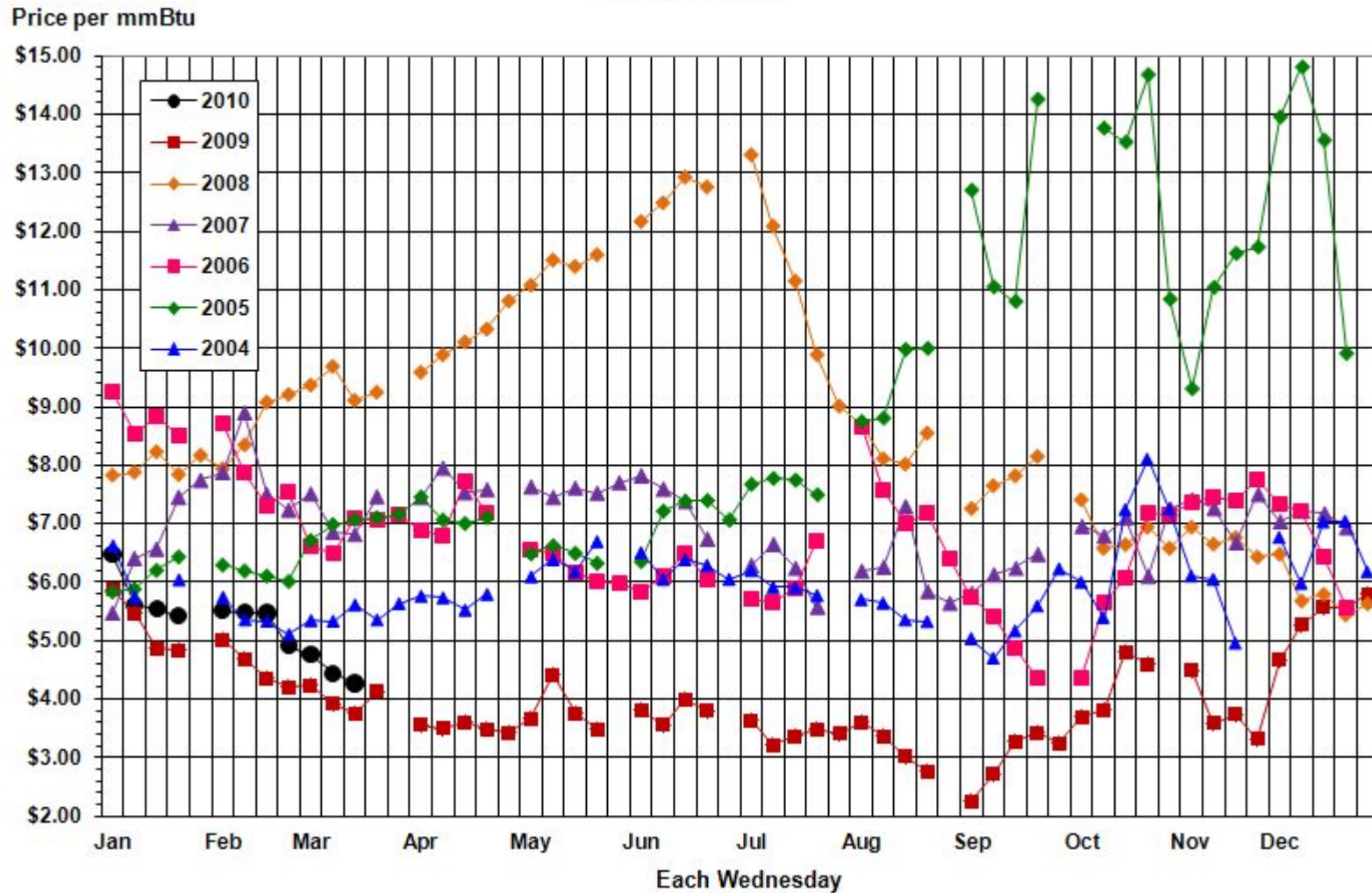


LFG AGREEMENT

- **ENVIRONMENTAL INCENTIVES (CREDITS)**
 - **VERY IMPORTANT TO BOTH PARTIES**
 - **POET: INCENTIVES FOR DISPLACEMENT OF FOSSIL FUELS**
 - **CITY: INCENTIVES FOR LFG COLLECTION SYSTEM AND DESTRUCTION OF METHANE CONTENT**



Natural Gas Spot Prices at the Henry Hub 2004 - 2010



PRICE COMPARISON

Landfill	\$/MMBtu	Type of Project
Private Michigan Landfill	\$0.29 to \$0.50	Electric
County Landfill in Florida	\$0.30	Electric
County Landfill in Florida	\$0.30	Electric
County Landfill in California	\$0.18	Electric
Private Michigan Landfill	\$0.14	Electric
County Landfill in California	\$1.20	High-BTU (Natural Gas)
Private Michigan Landfill	\$0.30	Electric
Private Michigan Landfill	\$0.05	Electric
Private Virginia Landfill	\$2.60	Pipeline
Private Virginia Landfill	\$0.10	Electric
Private Minnesota Landfill	\$0.40	Electric
Private Nebraska Landfill	\$3.75 to \$6.50	Pipeline
County Landfill in Indiana	\$1.00	High-BTU (Natural Gas)
City of Fargo	< \$2.00	Pipeline



PIPELINE PROJECT OVERVIEW

- **BROKEN DOWN INTO 5 PHASES**
 - **PIPE PROCUREMENT**
 - **PIPELINE INSTALLATION**
 - **LFG COMPRESSOR BUILDING**
 - **LFG COMPRESSOR SYSTEM**
 - **LFG TIE-IN FROM EXISTING FLARE**
- **PIPELINE CONSTRUCTION COMMENCEMENT DATE**
 - **JUNE 2008 POET GAVE CITY NOTICE TO PROCEED;
ACTUAL CONSTRUCTION DIDN'T START IN EARNEST UNTIL
SEPTEMBER 2008**
- **PIPELINE COMPLETION DATE**
 - **CITY WAS REQUIRED TO DELIVER GAS BY JULY 2009**
 - **FEBRUARY 2009 LFG SALES BEGAN WELL AHEAD OF
REQUIREMENT**



SIoux FALLS LANDFILL GAS PIPELINE

- **THE 12” DIAMETER PLASTIC HDPE PIPELINE IS APPROXIMATELY 1.1 MILES LONG AND RUNS THROUGH LANDFILL PROPERTY AND THEN WEST ALONG 268TH STREET TO 463RD AVENUE WHERE IT RUNS SOUTH TO 277TH STREET AND THEN WEST TO POET BIOREFINING – CHANCELLOR PROPERTY.**
- **THERE ARE VALVES AT THE LANDFILL, ALONG THE ROUTE AND IN THE DITCH AT 277TH STREET WHERE THE SERVICE LINE THEN RUNS TO THE BOILER. THERE IS ALSO A VALVE JUST OUTSIDE THE BOILER FACILITY THAT POET MAINTAINS.**
- **THE PIPELINE COMPRESSOR BUILDING IS TIED INTO A SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM. THIS ALLOWS FOR ALARM CALLS AND REMOTE START AND STOP OF THE PIPELINE COMPRESSOR.**
- **CONTINUOUS MONITORING FOR FLOW VOLUME (TYPICALLY 2400 SCFM), PRESSURE (TYPICALLY 30-35 PSIG), METHANE, OXYGEN AND CARBON DIOXIDE CONTENT IS PERFORMED.**



PIPELINE FUSION (WELDING)



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

PIPELINE PLACEMENT (PLOWING IN PIPE)



PIPELINE PLACEMENT (PLOWING IN PIPE)



LANDFILL GAS COMPRESSOR SYSTEM



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LANDFILL GAS COMPRESSOR SYSTEM



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LANDFILL GAS COMPRESSOR SYSTEM



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LANDFILL GAS COMPRESSOR SYSTEM



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LANDFILL GAS COMPRESSOR SYSTEM



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LANDFILL GAS COMPRESSOR SYSTEM



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LANDFILL GAS COMPRESSOR SYSTEM



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!

LANDFILL GAS COMPRESSOR SYSTEM



CITY OF SIOUX FALLS PUBLIC WORKS

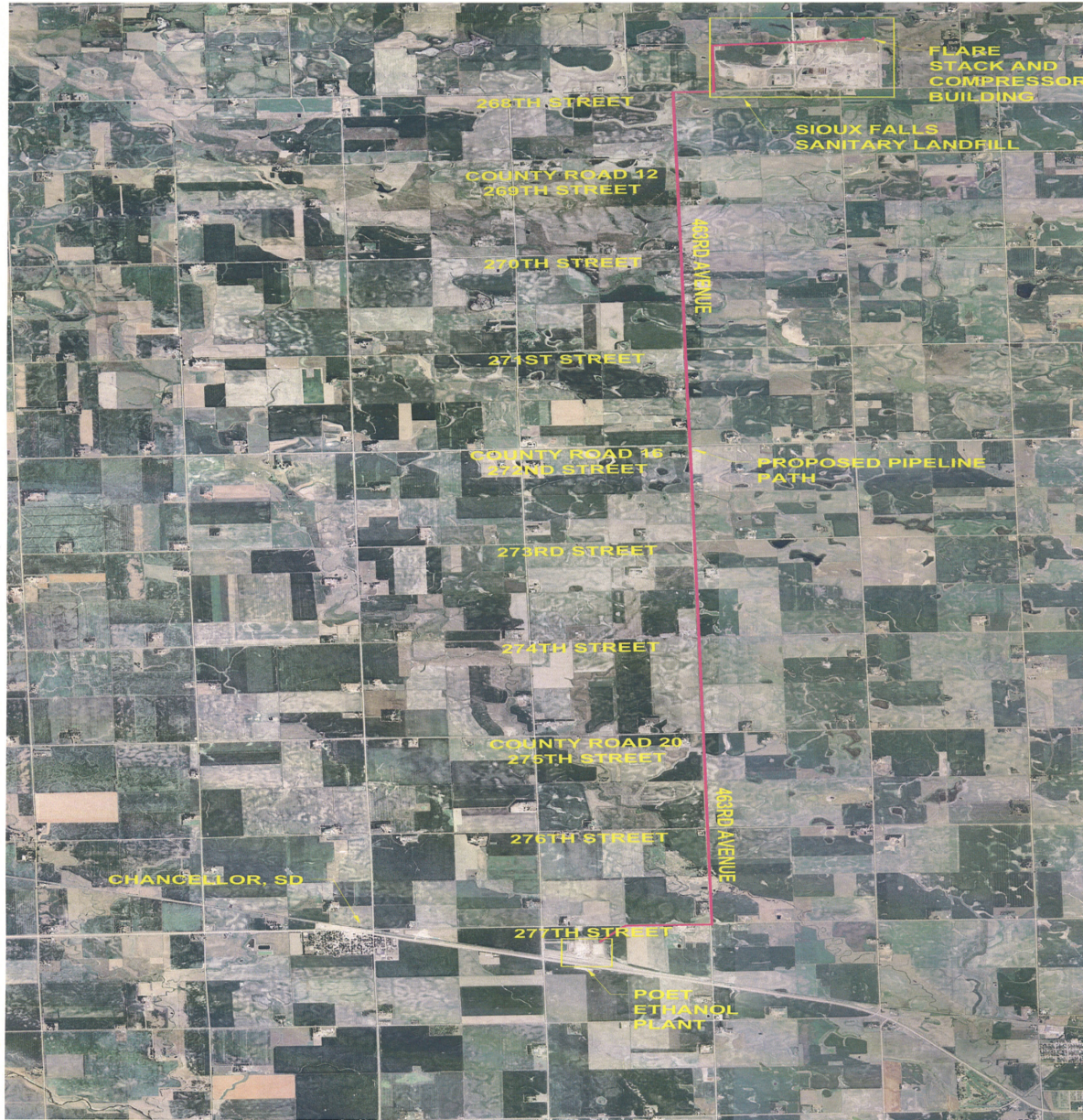
Providing a Better Quality of Life for You!

POET BIOREFINING- CHANCELLOR



CITY OF SIOUX FALLS PUBLIC WORKS

Providing a Better Quality of Life for You!



PIPELINE SAFETY ISSUES

- **CLASSIFIED AS AN INTRASTATE TRANSMISSION PIPELINE FROM FIRST VALVE OF PIPELINE TO SERVICE LINE**
- **GAS WELLS, COLLECTION PIPING AND LFG CONDITIONING SYSTEM (COMPRESSION, PARTICULATES & MOISTURE REMOVAL) IS CONSIDERED PART OF GATHER SYSTEM AND NOT REGULATED**
- **GAS ODORIZATION IS NOT REQUIRED BECAUSE WE ARE A TRANSMISSION PIPELINE WITH ONE END USER**
 - **LANDFILL GAS DOES HAVE ITS OWN UNIQUE SMELL**



PIPELINE SAFETY ISSUES

- **§192.743 B: (B) ARE CALCULATIONS USED TO DETERMINE CAPACITY AVAILABLE?**
 - **RELATED TO OVER PRESSURIZATION PROTECTION OF PIPELINE SO MAOP IS NOT EXCEEDED**
 - **RATHER THAN INSTALL A LARGER PRESSURE RELIEF VALVE AT SIGNIFICANT ADDITIONAL COST WE AGREED TO ESTABLISH A PRESSURE TRANSMITTER TESTING PROCEDURE.**
 - **PIPELINE CONDITIONING SYSTEM ALREADY HAD PRESSURE TRANSMITTERS WITH A CONTROL LOOP THAT WOULD SHUT THE SYSTEM DOWN IMMEDIATELY IF THE PRESSURE SETTING WAS REACHED**
 - **MAOP OF OUR PIPELINE IS 57 PSIG**
 - **1ST PRESSURE TRANSMITTER IS SET TO 50 PSIG. SYSTEM WILL SHUT DOWN IMMEDIATELY IF 50 PSIG IS REACHED.**
 - **2ND PRESSURE TRANSMITTER FOR REDUNDANT PROTECTION IS SET TO 57 PSIG (MAOP). SYSTEM WILL SHUT DOWN IMMEDIATELY IF 57 PSIG IS REACHED AT THIS POINT.**



PIPELINE SAFETY ISSUES

- **PROTECTION & PUBLIC AWARENESS:**
 - ONLY 11 MILES LONG IN A RURAL SETTING SO WE PHYSICALLY STOP AT EVERY RESIDENCE ALONG THE ROUTE AT LEAST ONCE A YEAR WITH A HANDOUT
 - SINCE LANDFILL HAS BEEN ISSUING A FREE LANDFILL PASS TO ALL HOME OWNERS IN SIOUX FALLS ANYWAY WE INCLUDE A SECTION WITH INFORMATION ON PIPELINE SAFETY AND A REMINDER TO CALL BEFORE YOU DIG (811 IS A FREE CALL)
 - LANDFILL WEBSITE HAS PIPELINE INFO:
[HTTP://WWW.SIOUXFALLS.ORG/~MEDIA/DOCUMENTS/PUBLICWORKS/SOLIDWASTE/2010/LANDFILL_GAS_PIPELINE_INFORMATIONAL_HANDOUT.ASHX](http://www.siouxfalls.org/~media/documents/publicworks/solidwaste/2010/landfill_gas_pipeline_informational_handout.ashx)
 - LFG PIPELINE TABLETOP SCENARIO WITH POET & EMERGENCY RESPONSE PROVIDERS DONE RECENTLY



QUESTIONS???

**DAVE MCELROY
LANDFILL SUPERINTENDENT
(605) 367-8162
DMCELROY@SIOUXFALLS.ORG**

