Nuts and Bolts – Design, Construction and Operation of LFGTE Projects

Mississippi LFG Energy Workshop
S. EPA Landfill Methane Outreach Program
April 25, 2002

Regulatory Framework

LFG Regulatory Framework

- RCRA Subtitle D
- NSPS
- Title V
- Other Clean Air Act Provisions
- State Rules
- Local Air District Rules

Landfills Applicable under NSPS

- MSW Landfills
- Received Waste on or after 11/08/87
- Waste Design Capacity >= 2.5 million Mg
- Annual NMOC Emissions >= 50 Mg

Title V Permits

- “Major Sources” require permit.
- Facilities subject to NSPS/EG require permit (despite being a minor source based on estimated emissions).
- Permit Components:
  - Emissions inventory
  - Review of applicable regulations
  - Application
  - Certification of compliance
  - Monitoring, reporting, and record keeping

Design

Landfill Gas Collection Systems

- Landfill gas extraction wells
  - Horizontal
  - Vertical
- Landfill gas blower stations
- Landfill gas condensate management
- Landfill gas safety issues

Vertical Extraction Wells Design Criteria

Extraction Wells

- Layout
- Spacing
- Borehole Depth
- Borehole Diameter
- Drilling Method
- Presence of Water
- Dual Extraction with Leachate
- Pipe Material
- Pipe Depth
- Well Screen
- Backfill

Vertical Extraction Wells Design Criteria (cont.)

- Well Head / Lateral
  - Material
  - Above vs. Below Grade
  - Cover
  - Valve
  - Access for Monitoring

Vertical Extraction Wells Design Criteria (cont.)

- Header Lines
  - General Layout
  - Depth
  - Material
  - Bedding / Backfill
  - Slope
  - Diameter
  - Protection

Vertical Extraction Wells Design Criteria (cont.)

- Condensate Management
  - Vacuum Trap / Seal
  - Re-injection
  - Collection
  - Number / Location
  - Construction
  - Access
  - Maintenance

Horizontal Collectors Design Criteria

- Layout
- Spacing
- Depth
- Material / Construction
- Bedding / Backfill
- Temporary / Sacrificial
- Permanent / final Cap
- Condensate Management

GENERAL\STEVE\BD\HEADER

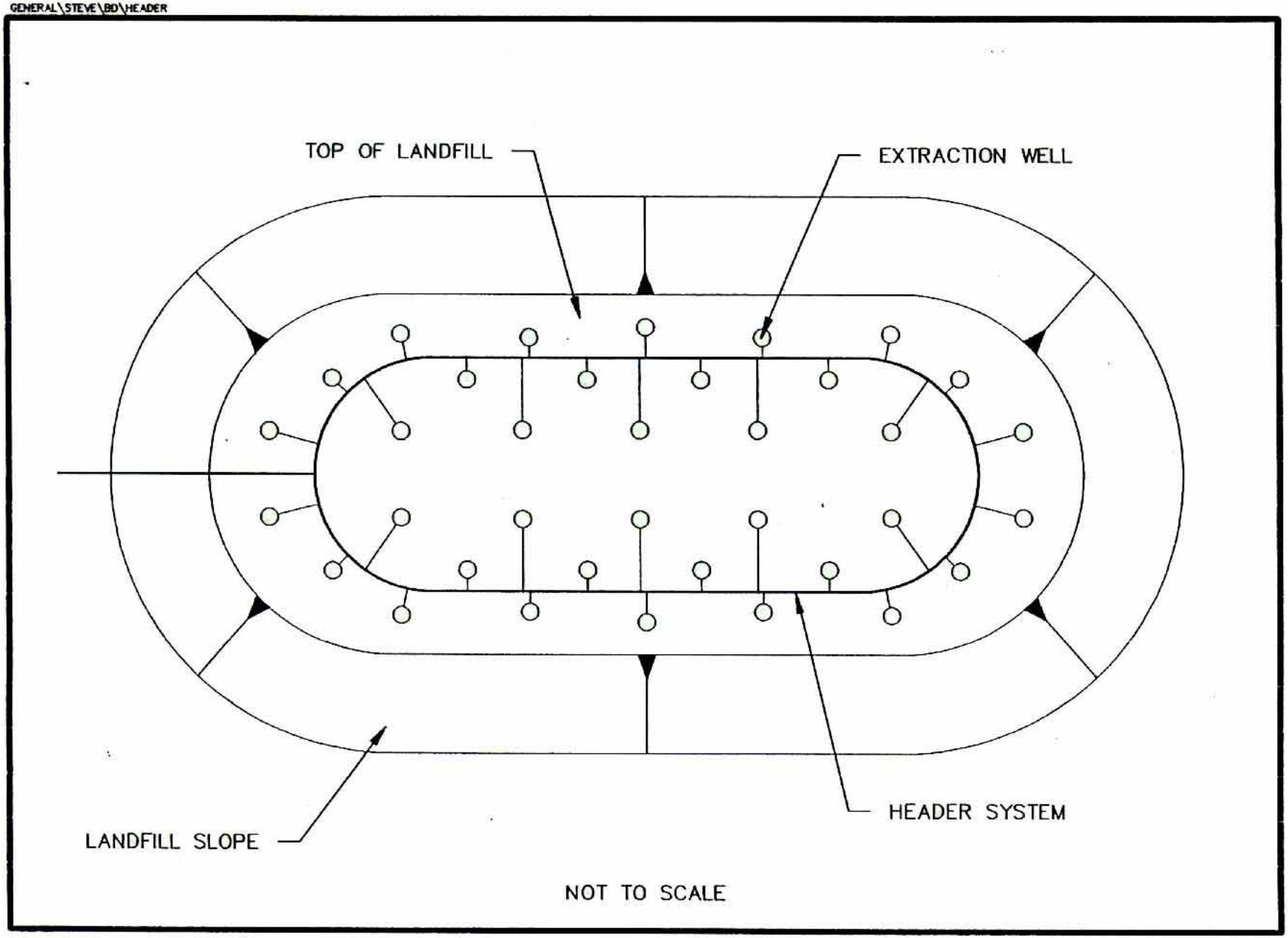
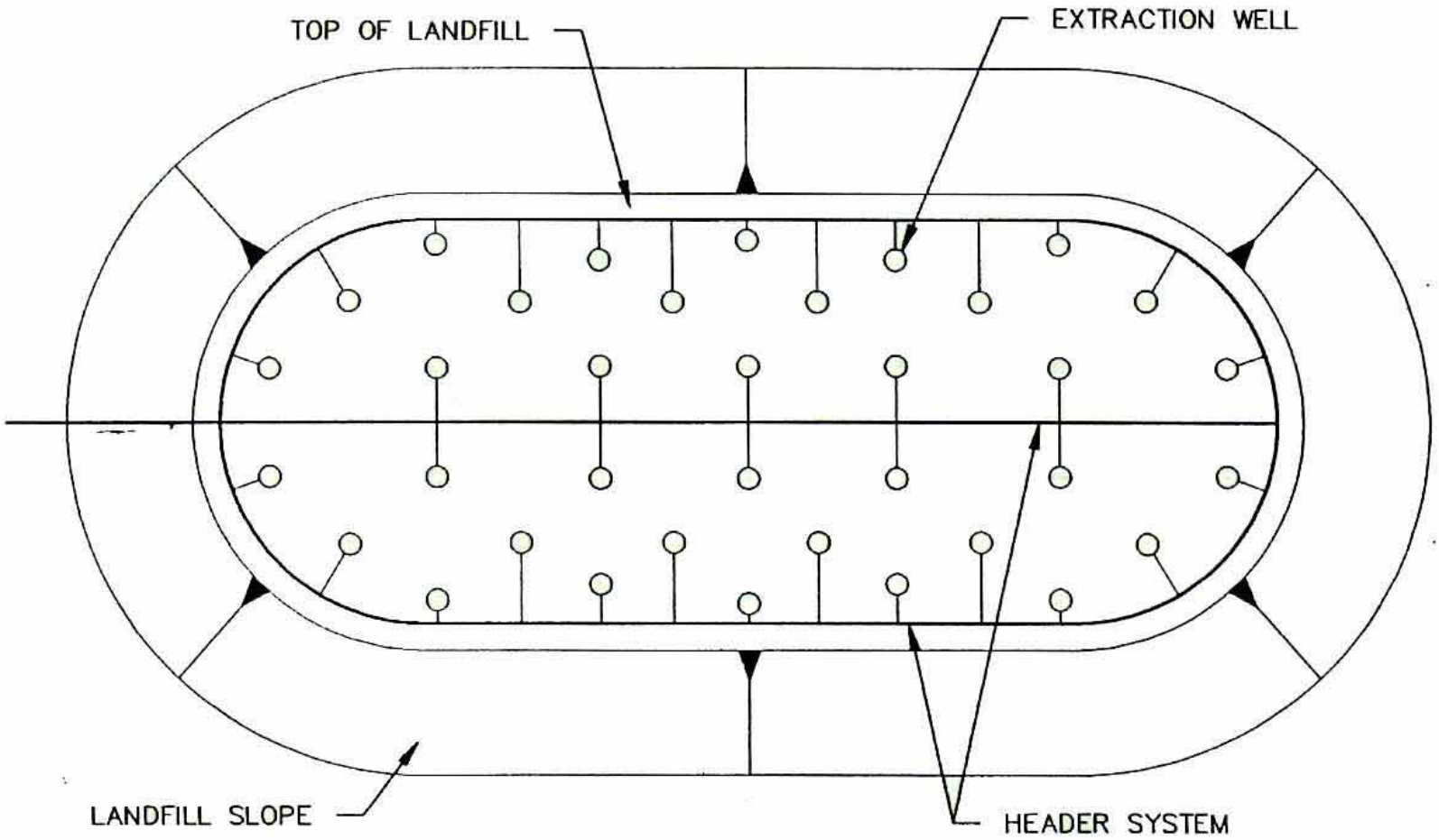


Exhibit 5-4. Single Loop System.

GENERAL\STEVE\BD\HEADER



NOT TO SCALE

Exhibit 5–5. Dual Loop System.

GENERAL\STEVE\BD\HEADER

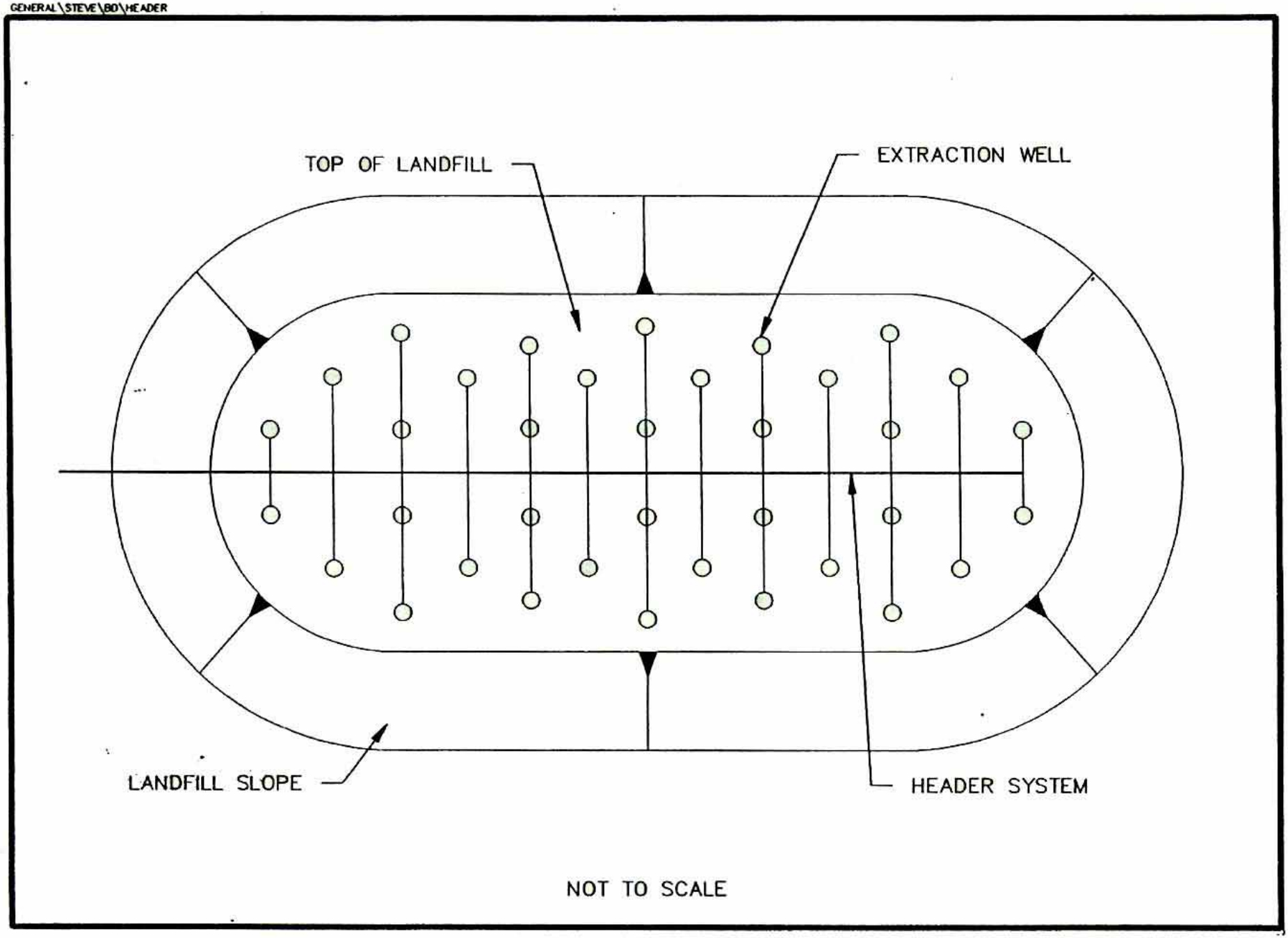
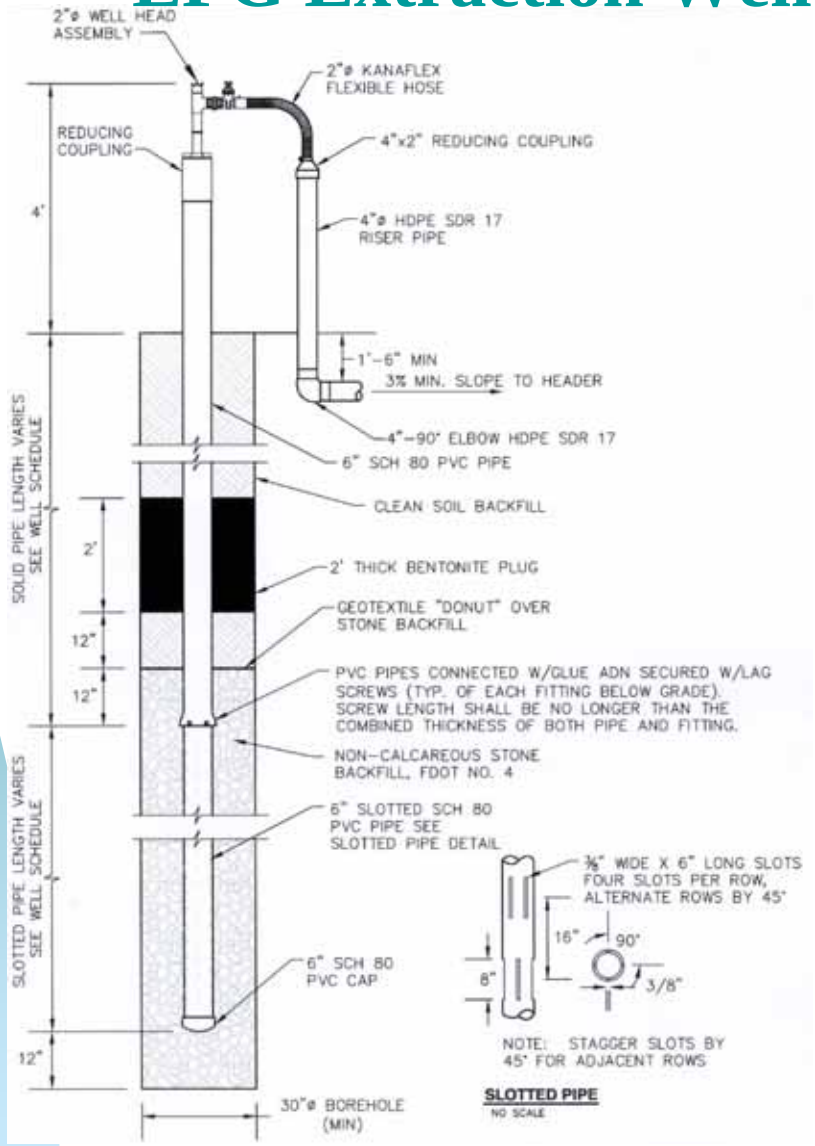
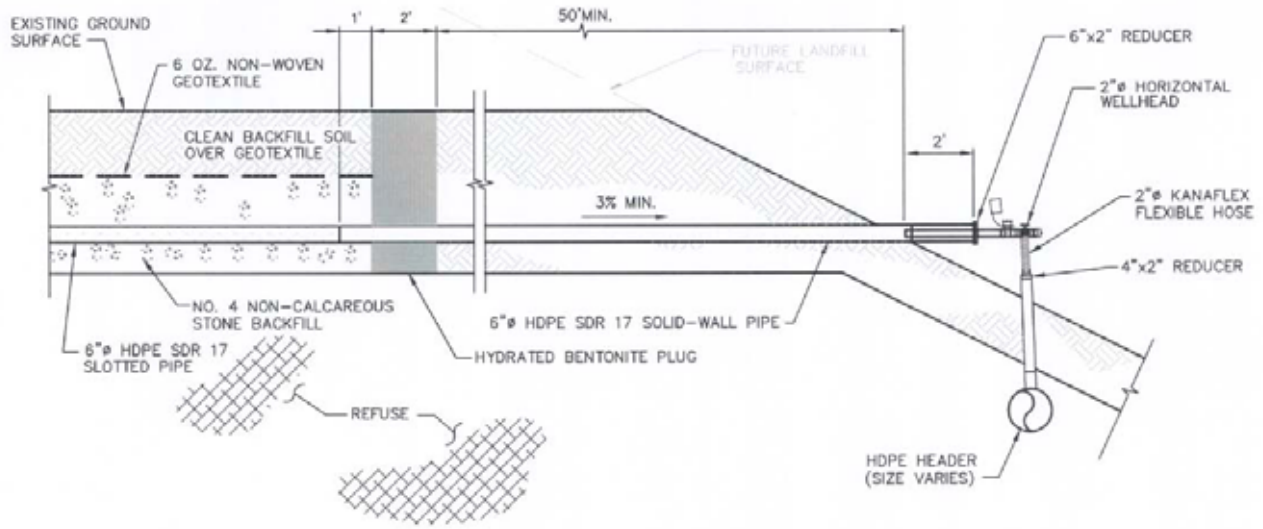


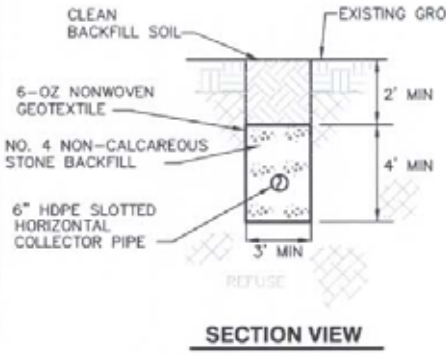
Exhibit 5–6. Single Header Line.

LFG Extraction Well



Horizontal Collector



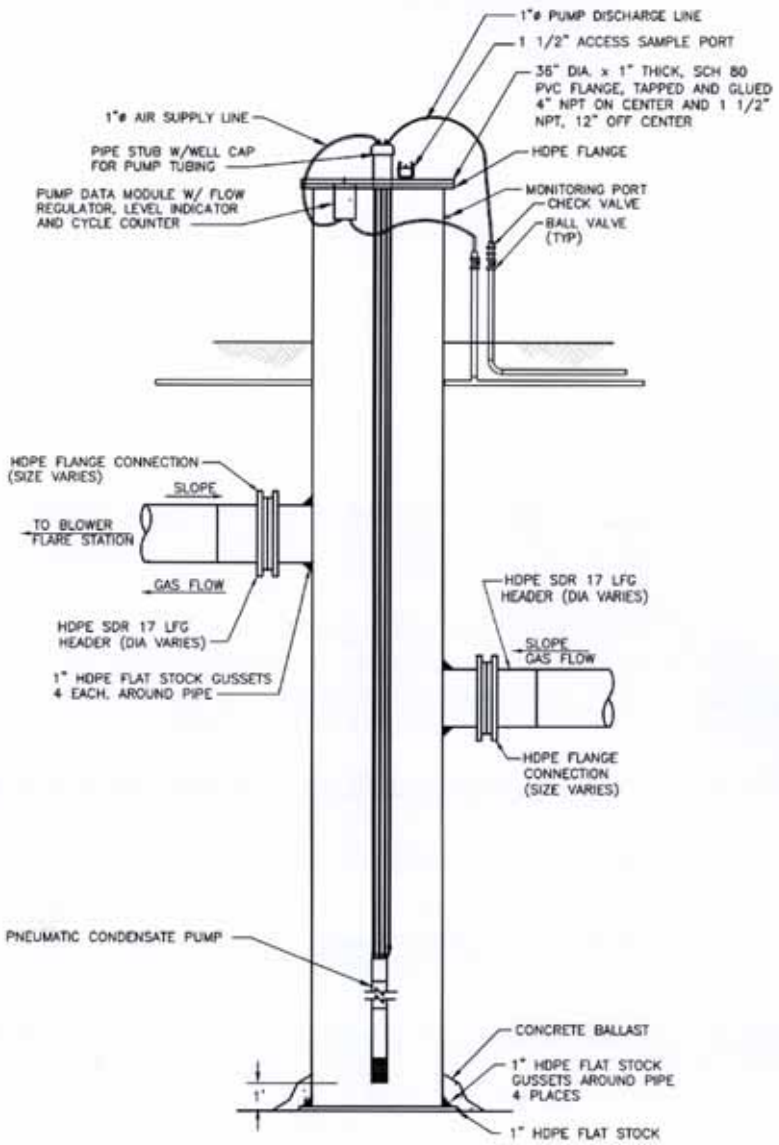


SECTION VIEW

NOTES:

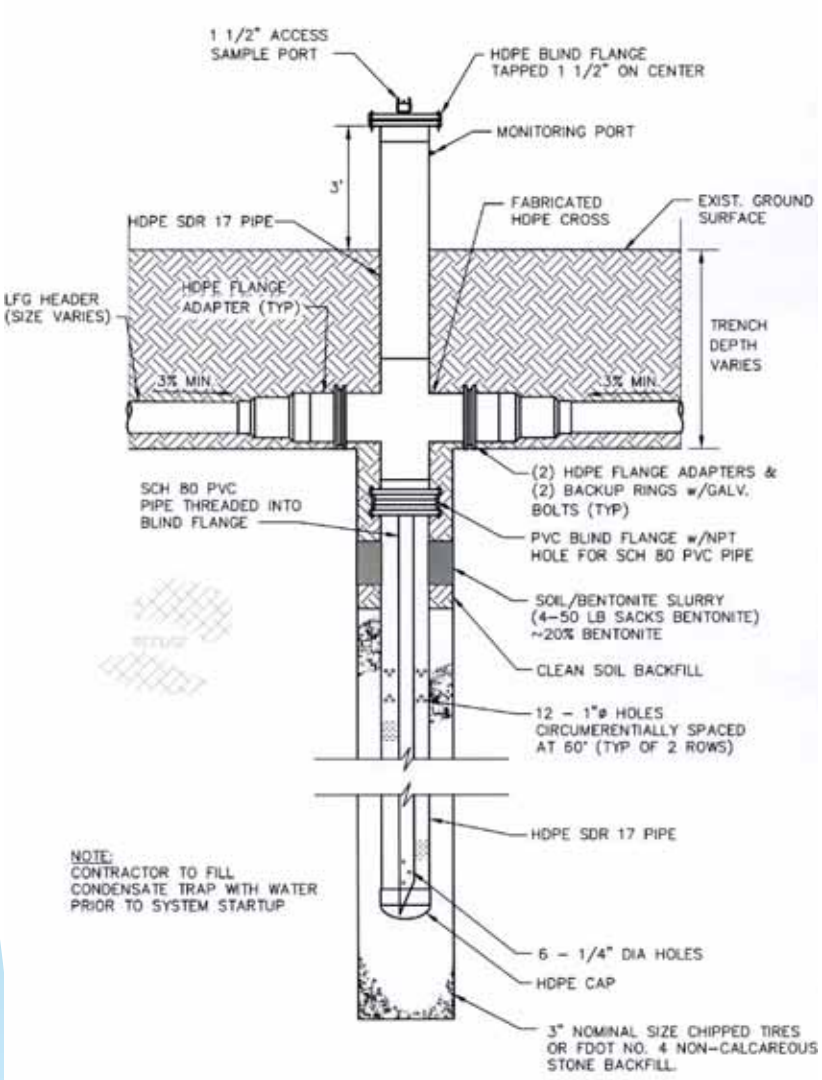
1. BACKFILL AROUND PERFORATED PIPE MUST BE HARD DURABLE NON-CALCAREOUS ROCK.
   a.) DUE TO THE CORROSIVE NATURE OF LEACHATE, CRUSHED CONCRETE IS NOT ACCEPTABLE.
   b.) DUE TO COMPRESSIVE FORCE OF REFUSE TO BE FILLED ABOVE THE COLLECTORS, CHIPPED TIRES ARE NOT ACCEPTABLE BACKFILL.

2. TO AVOID AIR INFILTRATION, COLLECTORS SHALL NOT BE OPERATED UNTIL THERE IS AT LEAST 20 FT OF OVERLYING REFUSE.

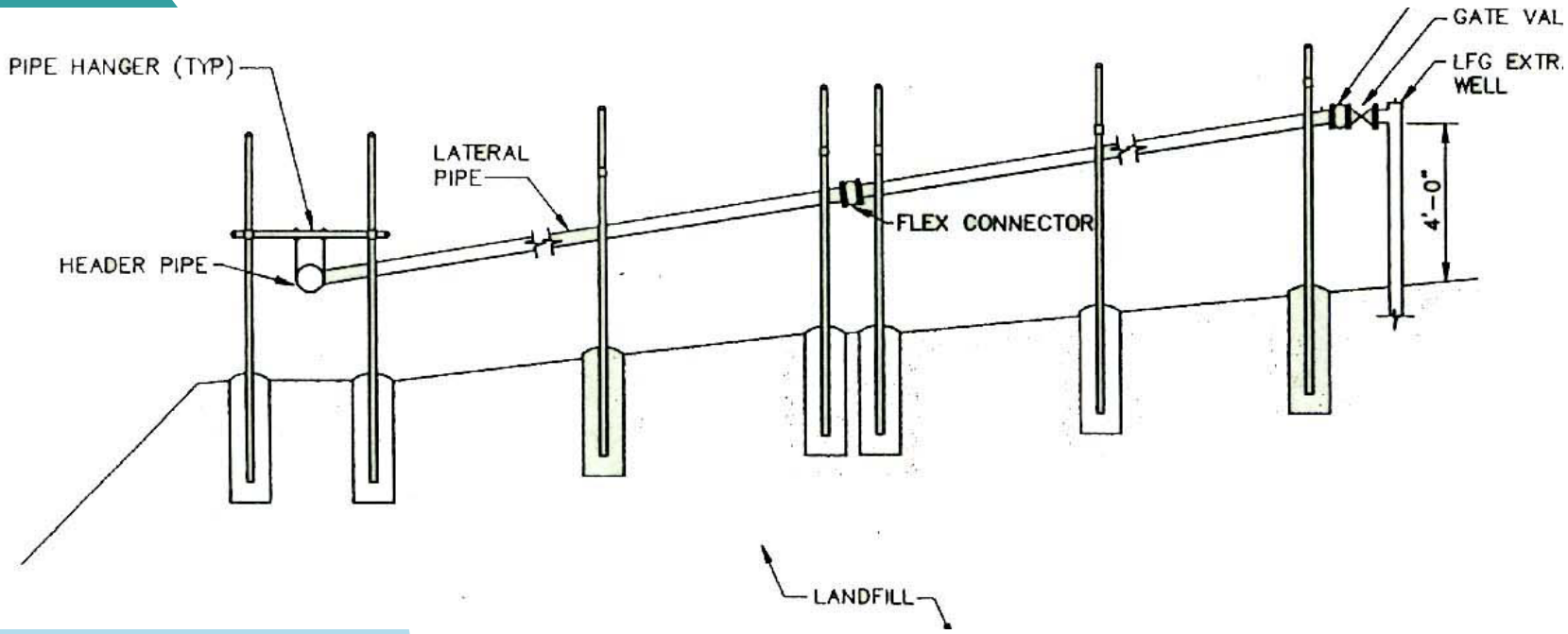


Condensate Sump

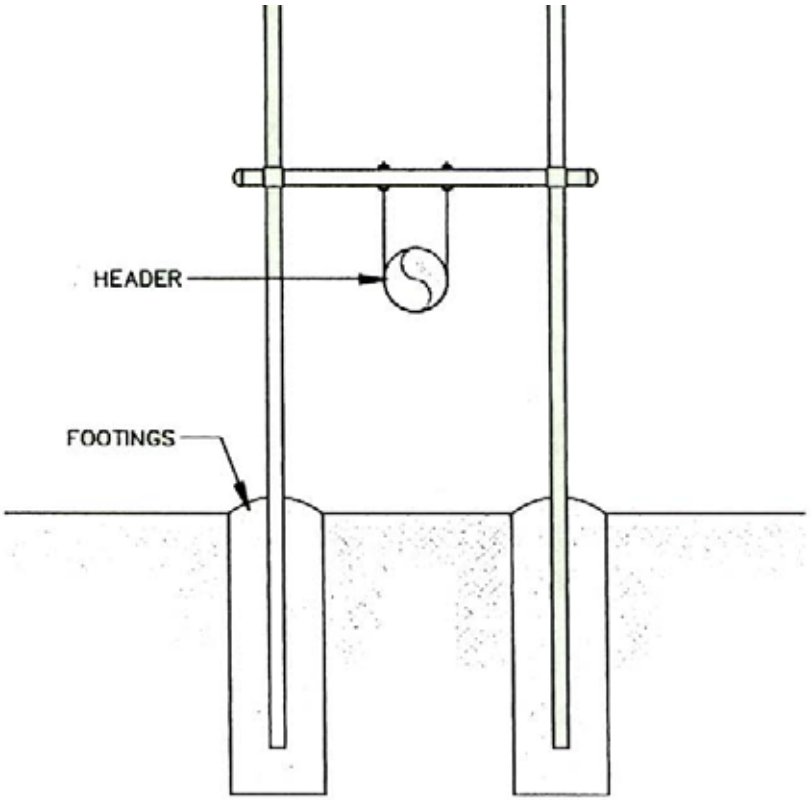
Condensate Trap



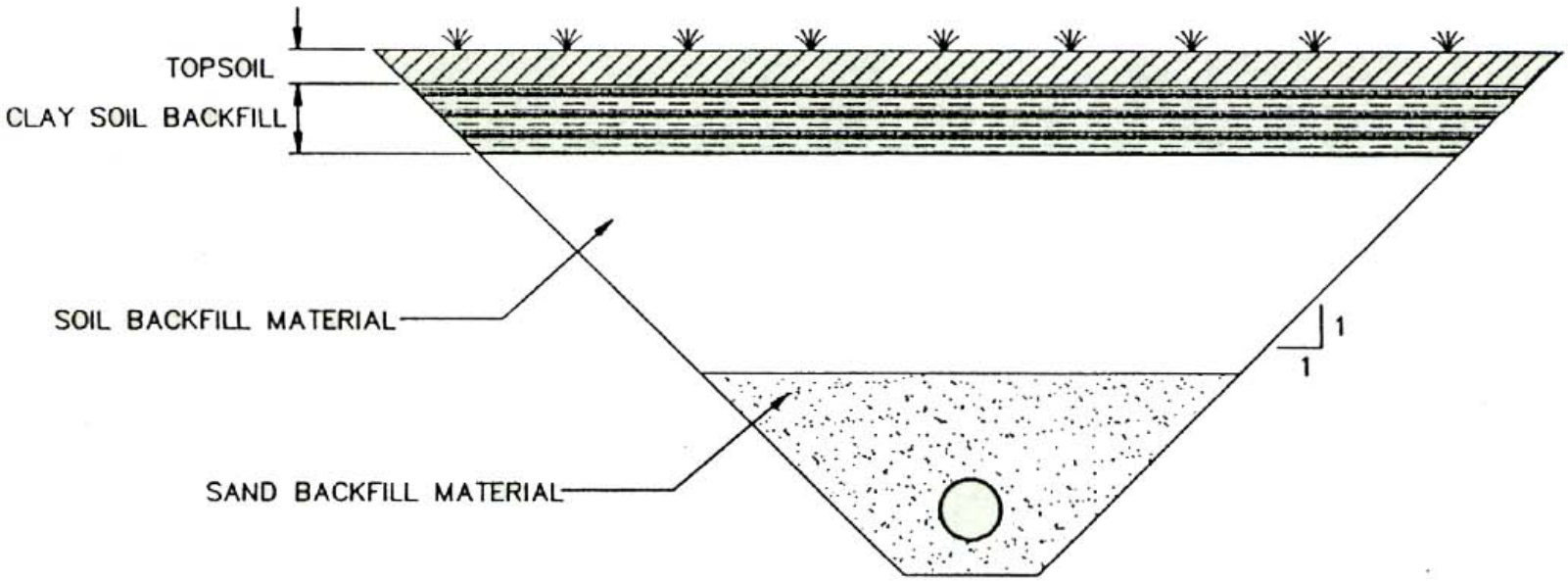
Aboveground LFG Collection Pipes



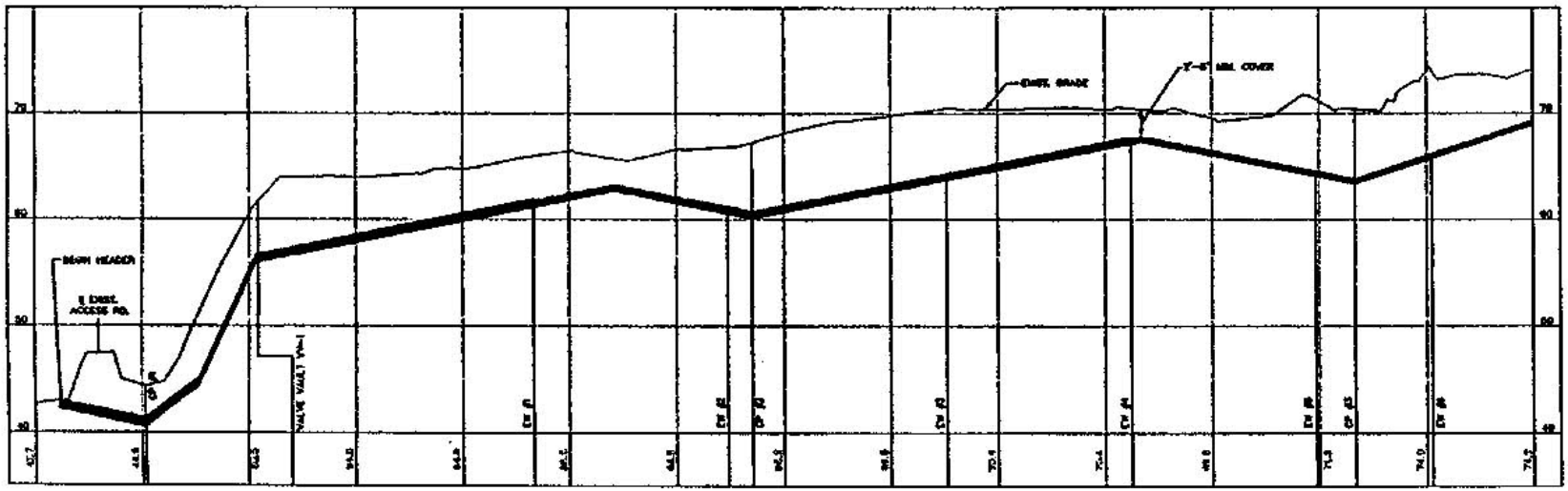
Aboveground LFG Pipe Support Detail



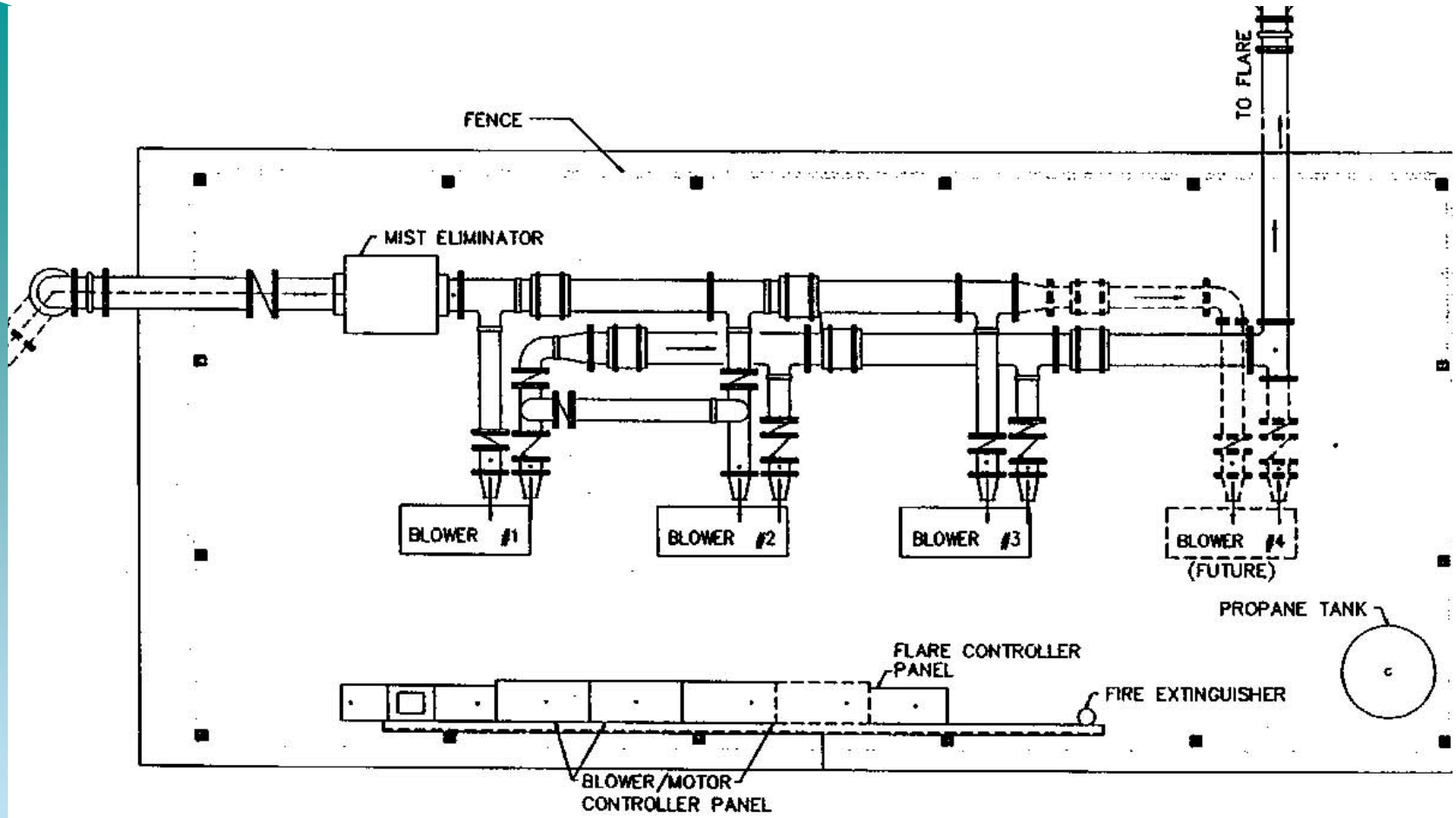
Underground LFG Pipe Trench Detail



LFG Header Profile



Blower Station



DISPOSAL AND UTILIZATION

Other Blower /Flare Design Elements

- Secured Area
- Aboveground Piping
- Valving
- Condensate Management
- Monitoring System / Access

Other Blower /Flare Design Elements (cont.)

- Security / Alarm / Control Systems
- Flame Arrestors
- Explosion Proofing
- Structure

LFG Blower Systems Design Elements

- Centrifugal Exhauster
- Explosion Proofed
- Condensate Management
- Electric Supply
- Electric Motor
- Number / Layout
- Material

LFG Treatment / Disposal Design Alternatives

- Atmospheric Vent
- GAC (Carbon) Treatment
- Open / Candle Flare
- Enclosed / Ground Flare
- Incinerator
- End Use

GENERAL\STEVE\USER\ENCFLARE

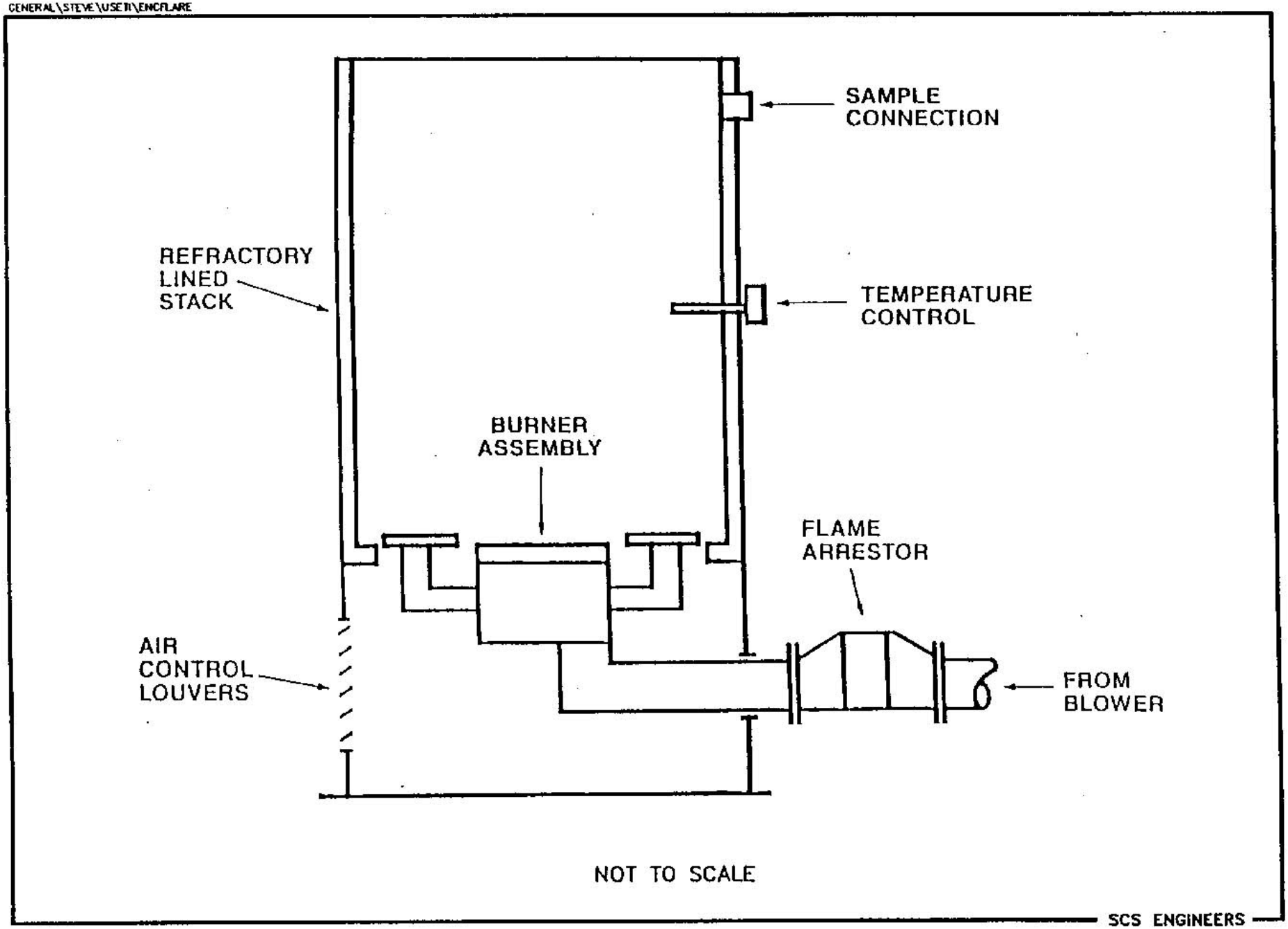


Exhibit 6-1. Flare.

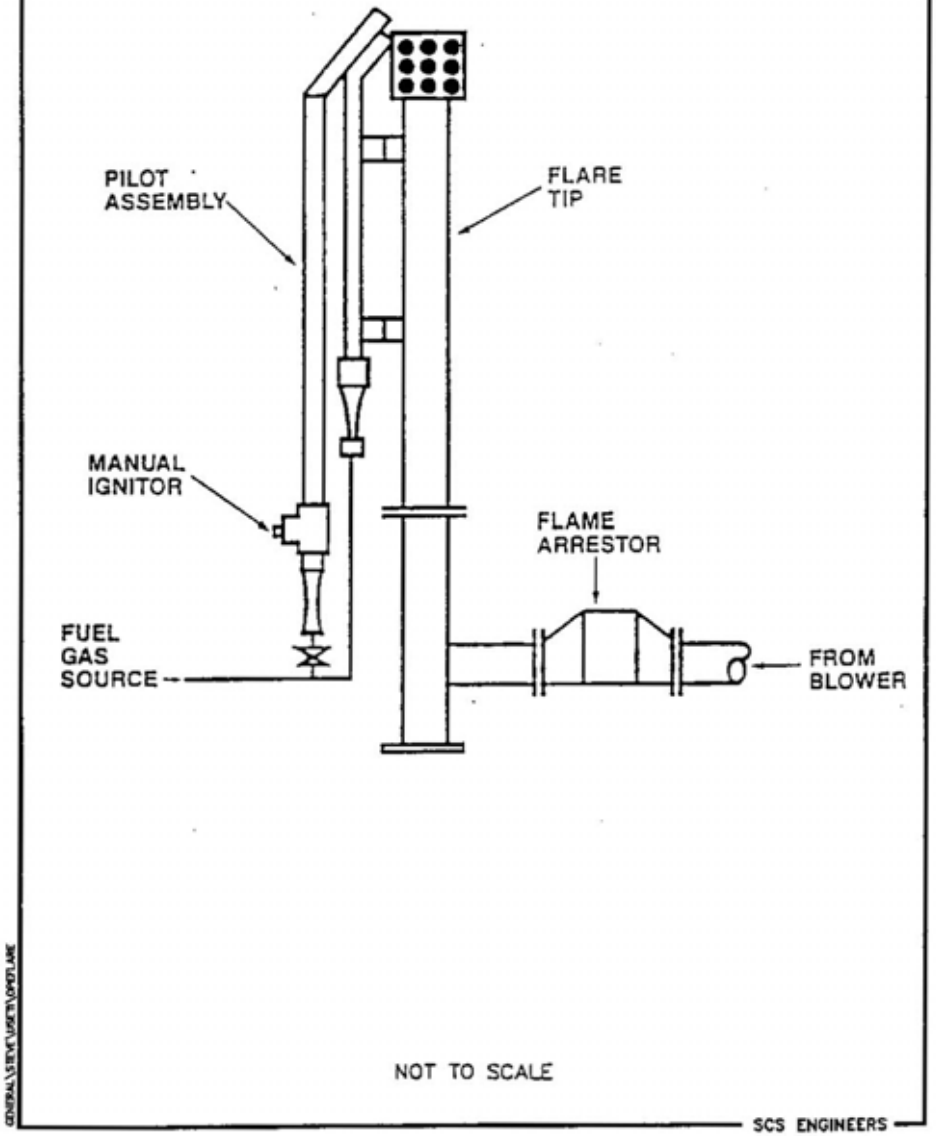


Exhibit 6-2. Flare

Energy Recovery

- Electric generation
- Medium Btu
- High Btu
- Vehicle fuel
- Carbon dioxide recovery
- Fuel cells
- Chemical feedstocks

CONSTRUCTION

Boring activity for installation of LFG well

Perforated and solid piping for LFG wells

Installation of LFG header piping

LFG wellhead near completion

Completed LFG wellhead

Installation of LFG header piping

HDPE header pipe and condensate piping in trench

LFG lateral connection to header pipe

LFG header piping and isolation valves

Trench compaction and backfill

LFG header roadway crossings

Geosynthetic liner over trench

Condensate sump

Condensate sump with air regulator

Condensate sump

Candle flare

Flare and blower station

Dual flame arrestors

Construction of ground flare

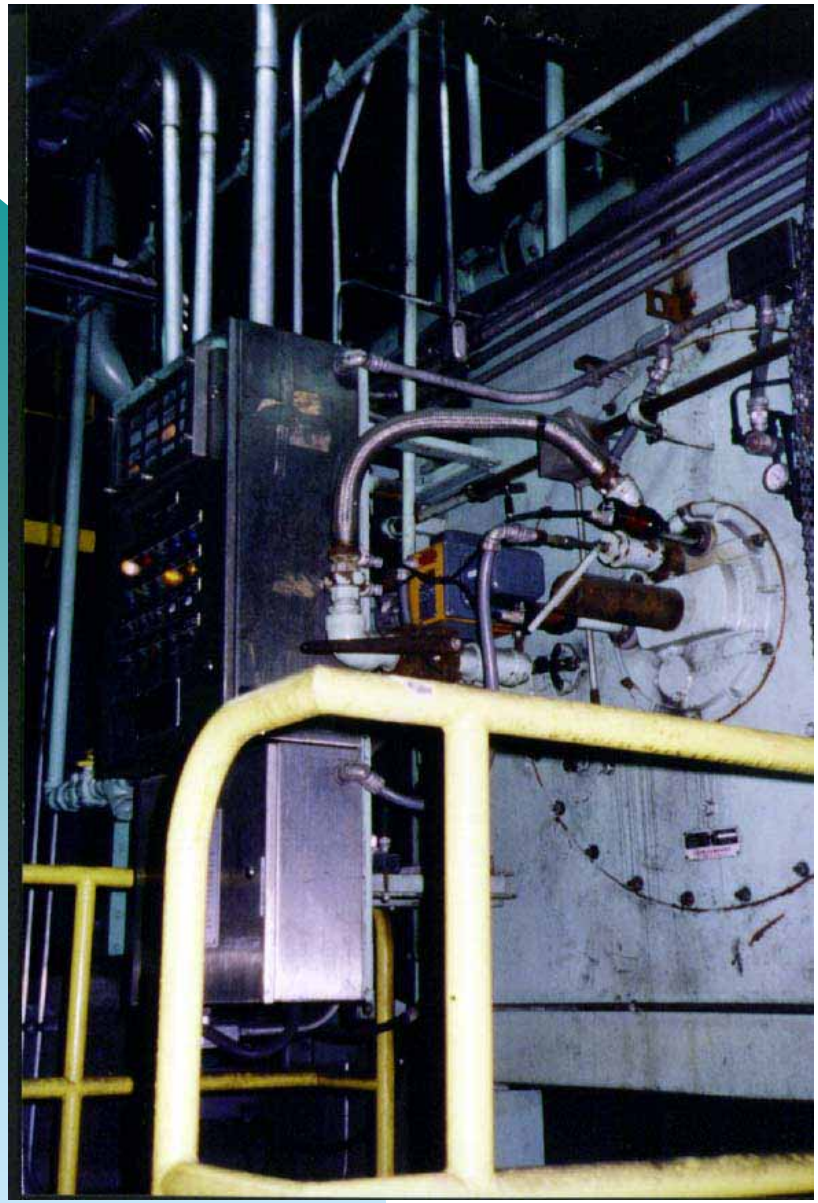
Ground flare condensate knock-out and instrumentation

Typical blower shelter

Microturbine Facility

Microturbine Facility

Blower and Compressor Skid



Direct Use in a Boiler

Reciprocating Engine Generators Using LFG

MONITORING, OPERATIONS, AND MAINTENANCE

What to Expect

- Full-time or part-time personnel dependent on complexity of system.
- Coordination of the LFG developers monitoring needs with that of regulatory needs.
- Maintenance of wellfield
- Maintenance of energy recovery unit

Surface Emission Monitoring

- Ensure Gas System Performance with Surface Emissions < 500 ppm CH4
- Use Portable CH4 Device : OVA, FID, SEM
- Walk over LF Surface in Serpentine Fashion, Lines Spaced 30 m on Center
- Test 5 to 10 cm Above LF Surface
- U.S. EPA Method 21 as Modified
- Quarterly monitoring

Title V Suggestions

- Carefully read draft permit.
- Make sure PTE allows for growth.
- See “big picture” - recognize potential secondary impacts to permit conditions.
- Evaluate all facility modifications w/r to impact on Title V permit.
- Take enforcement seriously.
- Budget for Title V annual fees.