New York State Department of Environmental Conservation
Division of Solid & Hazardous Materials
Bureau of Pesticides & Radiation
50 Wolf Road, Albany, New York 12233-7255
518-457-2225 FAX 518-485-8390

[redacted]
Commissioner

Niagara Landfill Gas Extraction System
First Quarterly Sampling and Evaluation of Radon Releases
October 15-16, 1996

by

[redacted]

November 7, 1996

Summary

Bureau of Pesticides & Radiation staff collected six samples of landfill gas from the Niagara Landfill on October 15 & 16, 1996. These samples of landfill gas were collected from a sampling port located in the piping leading from the blower to the flare before the flame arrestor. Radon concentrations showed little variation over time. Mathematical models predict that the radon disperses to background concentrations within 40 meters of the stack. Annual average radon concentrations at ground level would be indistinguishable from background.

Background

History of Site

The Niagara Landfill is located in the Town of Tonawanda, Erie County (Figure 1). The site was an operating landfill in 1978 when Part 360 went into effect. Niagara Landfill, a subsidiary of Browning-Ferris Industries (BFI), operated the facility under NYSDEC Permit No. 9-1464-00147/00001-0. The land itself is owned by Seaway Industrial Development, Inc. The landfill ceased accepting waste in 1993 and is now undergoing closure. As part of closure operations, 6 NYCRR Part 360 requires a landfill gas venting system to be installed. At present, the landfill gas is actively being pumped to a flare system authorized under NYSDEC permit No. 9-0464-00184/00001.

The Niagara Landfill is one of the four properties designated as the Tonawanda Site by the United States Department of Energy (DOE) under the DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP). The Niagara Landfill Site comprises approximately 100 acres located in an industrialized area in northwestern Tonawanda, New York. In 1974,

uranium ore residues processed during the Manhattan Engineering District (MED) project were excavated from the Ashland 1 Site, which is adjacent to the Niagara Landfill, and relocated onto the Niagara Landfill Site in three areas identified as Areas A, B, and C (see Figure 2). Area A is the largest, covering about 10 acres. A fourth area, Area D, also contains MED waste. It is continuous with an area of contamination on the Ashland 1 site. The DOE has estimated that there are 91,100 cubic yards of FUSRAP material in Areas A and D and another 25,900 cubic yards of FUSRAP material in Areas B and C. At some point in time, the 2 acres in Areas B and C were covered with about 20 - 40 feet of refuse.

Gas Extraction System

The Niagara Landfill has 34 methane extraction wells (see Figure 3), which are collectively routed through a blower unit to a flare. Figure 4 shows the location of each of the 34 gas wells. BFI had originally designed the gas extraction system to cover the entire landfill. At DEC's recommendation, BFI deleted from the original plans four wells that would have been located near the contaminated soil. Thus, none of the wells in the gas extraction system collect gas directly from the FUSRAP material.

Sampling Procedure

In order to measure the radon release from the landfill, a plan was developed for sampling the radon in the gas pipe line after (i.e., downstream of) the blower and prior to (i.e., upstream of) the flare. Figure 5 shows the relationship of the sampling port to the rest of the system.

To take a sample, first a fitting was installed into the sample port and tygon tubing was connected to the fitting. The sampling train then consisted of an inline paper filter, a drierite cartridge, the Lucas cell and finally the 5 liter/minute air pump, all connected together using tygon tubing. Gas was pumped through the Lucas cell for five minutes to flush all of the high purity nitrogen out of the Lucas cell and replace it with landfill gas. (Note: high purity nitrogen is routinely used to flush out the cell after use.)

In the planning stages for this sampling event it was decided that a minimum of three samples would be required to make a determination of the radon concentration. In addition to our sampling, BFI arranged to have Wilkes University analyze three samples as well. On the afternoon of October 15, 1996, Bureau collected three landfill gas samples in our Lucas cells and three landfill gas samples in Lucas cells owned by Wilkes University. Wilkes University samples were collected alternately with ours. After the sampling was completed, DEC staff packaged and delivered the Wilkes University samples to Airborne Express for shipment to Wilkes University.

On the morning of October 16, 1996, DEC staff filled three more of the Bureau's Lucas cells to see if there was any variation of radon concentration with time of day. After sampling, Bureau staff returned to Albany with all six Lucas cells for analysis. A minimum

of four hours between sampling and analysis is required to allow for equilibration. Since the travel time from Buffalo to Albany is about 6 hours, this was not a problem. Bureau staff analyzed the samples for radon on October 16 and 17, 1996.

Results of Analysis

The samples were analyzed by the Bureau on our instrumentation, which consists of a Ludlum Model 182 Radon Flask Counter connected to a Ludlum 2000 Portable Scaler. The following table gives the analysis results (decay corrected to the time the gasses were extracted from the sampling port):

Lucas Cell No.	Sampling Date	Radon Concentration (pCi/l)
1194	10/15/96	194 +/- 3.5
1203	10/15/96	190 +/- 3.4
1199	10/15/96	193 +/- 3.5
1198	10/16/96	175 +/- 3.2
1193	10/16/96	192 +/- 3.5
1197	10/16/96	184 +/- 3.5

Discussion

The average radon concentration of the samples collected on the afternoon of October 15 was 192 pCi/l. The average concentration of the samples collected on the morning of October 16 was 184 pCi/l. The difference between the two averages is small (4%). For evaluating the impacts of the radon emissions, a concentration of 200 pCi/l was used.

Comparison to Previous Results

In February 1996, before the flare was operating, DEC sampled the gas in six of the gas wells, which were then venting directly to the atmosphere, under natural pressure. The results are presented in DEC's March 20, 1996 report. That report acknowledged that the operation of the flare could change the concentration of radon in the landfill gas, but also stated that the effect could be determined only by analyzing the gas once the flare was in operation. One purpose of the October 1996 sampling was to begin to answer that question.

The concentration of radon in the six wells sampled in February ranged from 87 to 193 pCi/l. (Those results were obtained when the Lucas cells were counted on DEC's instruments. A contractor lab also counted the same Lucas cells and found concentrations as

high as 299 pCi/l, but some of those results are probably in error, due to the different instruments used.) The range in the samples collected in October is 175 to 194 pCi/l. The two ranges overlap. The October samples were in effect drawn from all 34 wells, so detailed comparisons between the two data sets cannot be made. However, it is apparent that the operation of the flare has not substantially increased the concentration of radon in the landfill gas.

Impacts of Radon Emissions from the Flare

The concentration of radon in the emissions will be reduced by at least an order of magnitude due to the high volume of the exhaust flow. The landfill gas contains radon at about 200 pCi/l and flows to the flare at 1200 cubic feet per minute. The exhaust leaves the stack at about 52,000 cubic feet per minute. The increase in flow rate is due to combustion air (which enters the flare stack through louvers in the side of the stack) and the heating of the exhaust gasses (the temperature of the exhaust is 1400 degrees F). As a result of the higher outflow, the concentration of radon in the stack will be on the order of 10 pCi/l (in addition to the natural background radon in the air drawn into the stack through the louvers).

The impacts of the measured radon emissions were assessed using three Gaussian plume models: US Environmental Protection Agency's SCREEN3 model, DEC's Air Guide 1 model, and the US Environmental Protection Agency's CAP88. Inputs for the models were selected to be conservative; therefore, actual impacts will less than those predicted by the models.

SCREEN3 was used to assess the dispersion of the radon after release. SCREEN3 calculates the hourly average concentration of a pollutant at various distances from the stack. It was used only to estimate the distance from the flare stack at which the concentration of radon in the plume falls within the range of natural background concentrations of radon (i.e., 0.1 to 0.5 pCi/l). The model was run six times, under a full range of meteorological conditions. In all cases, the model predicted that the concentration of radon in the plume would fall below 0.5 pCi/l within 20 meters of the stack, and below 0.1 pCi/l within 40 meters. Under the more favorable meteorological conditions, the model calculates a radon concentration less than 0.5 pCi/l within 10 meters of the stack and less than 0.1 pCi/l within 20 meters. Screen3 was used only to estimate the dispersion of the radon near the stack.

DEC's Air Guide 1 model calculates a worst-case annual average concentration of a pollutant, based on the emission rate and meteorological data from the past five years. In this case, the meteorological data from the Buffalo International Airport was used. The model was used to predict the maximum annual average concentration of radon at ground level due to emissions from the flare. The result was 0.0001 pCi/l, which is less than 0.1% of natural radon concentrations. This concentration would be indistinguishable from background concentrations of radon.

A third model, CAP88 was used to assess the radiation dose a member of the general public could receive due to the radon emissions from the flare. CAP88 calculates the maximum radiation dose to a member of the general public using historical meteorological data. CAP88 was run three times, each time with a different set of meteorological data. The data sets used were from the Buffalo International Airport (in Cheektowaga), the City of Buffalo, and Niagara Falls. To simulate extreme, adverse conditions, the mixing height was fixed at 26 meters, or about twice the height of the stack, for the entire year. The effect is that the model mixes the plume only in the layer of air between ground level and an elevation of 26 meters. Mixing heights are usually on the order of hundreds of meters. A low, fixed mixing height cannot occur at the site, so the modeling results represent a radiation dose that no person will receive from this emission point. The dose is an extreme upper bound to the range of possible radiation doses due to this radon emission. The predicted maximum ground level concentration of radon was 0.0005 pCi/l (less than 0.1% of natural radon concentrations). This corresponds to a worst-case annual radiation dose of 0.01 millirem per year. This projected dose is less than 0.0001 of the dose due to background radiation.

The results from all three models confirm that the radon emitted from the flare will disperse within a short distance of the flare and at ground level will be indistinguishable from the radon naturally present in the air. Any radiation dose to the public will be minimal and well within the normal range of doses due to background radiation.

Conclusions

1. The radon released through the flare disperses to a concentration indistinguishable from background radon concentrations within 40 meters of the stack.

2. The projected maximum radiation dose due to the radon emissions is less than 0.01 mrem/year and less than 0.0001 of the dose due to natural background radiation.

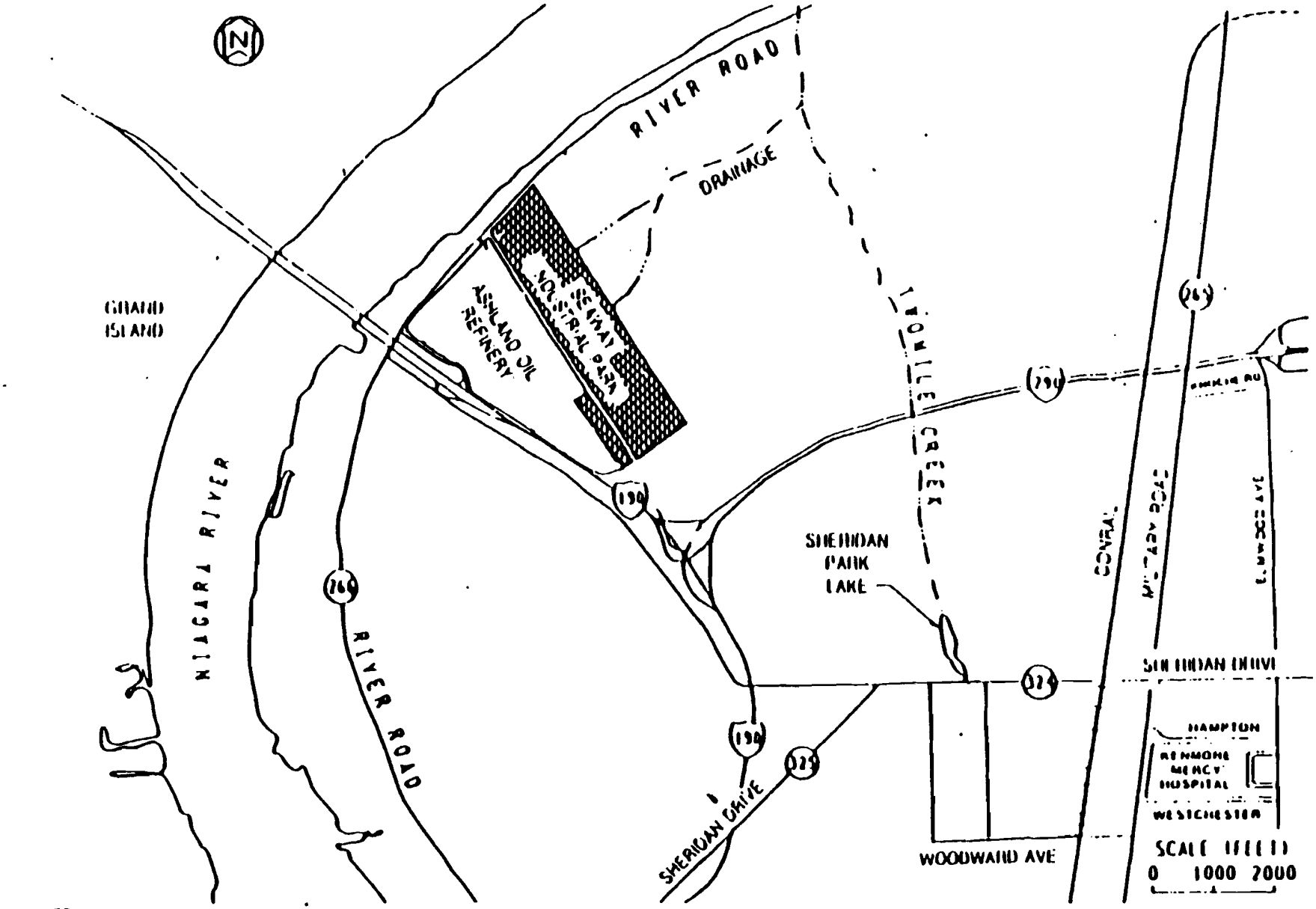
3. There is no adverse effect on the environment or the public health and safety from the emission of radon from the landfill.

4. There is a small difference in the radon concentrations in gas samples collected in the afternoon compared to those collected in the morning.

Future Actions

The Bureau will continue to perform quarterly monitoring during the first year of operation of the flare.

FIGURE 1



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GOVERNMENT SERVICES DIVISION

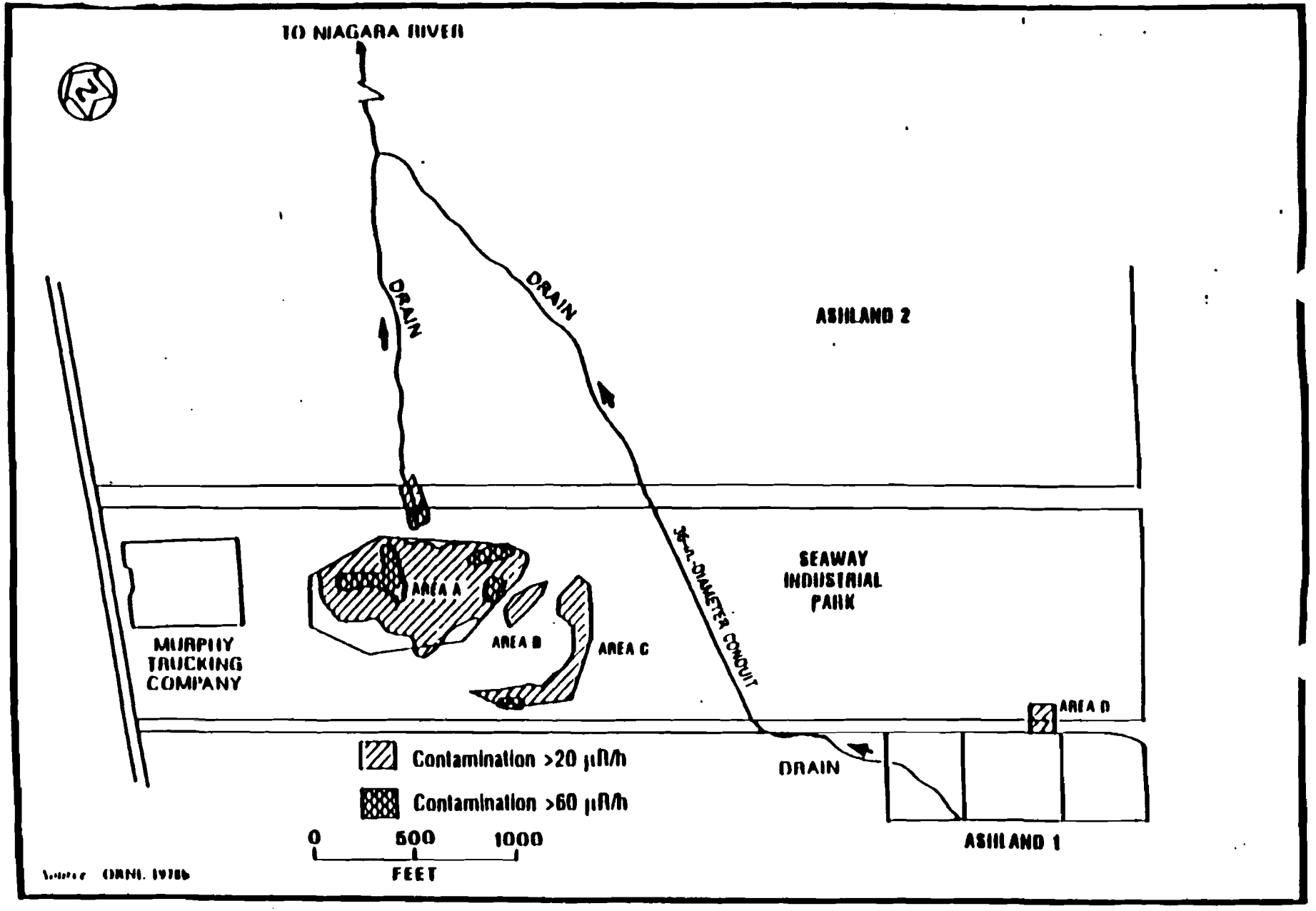
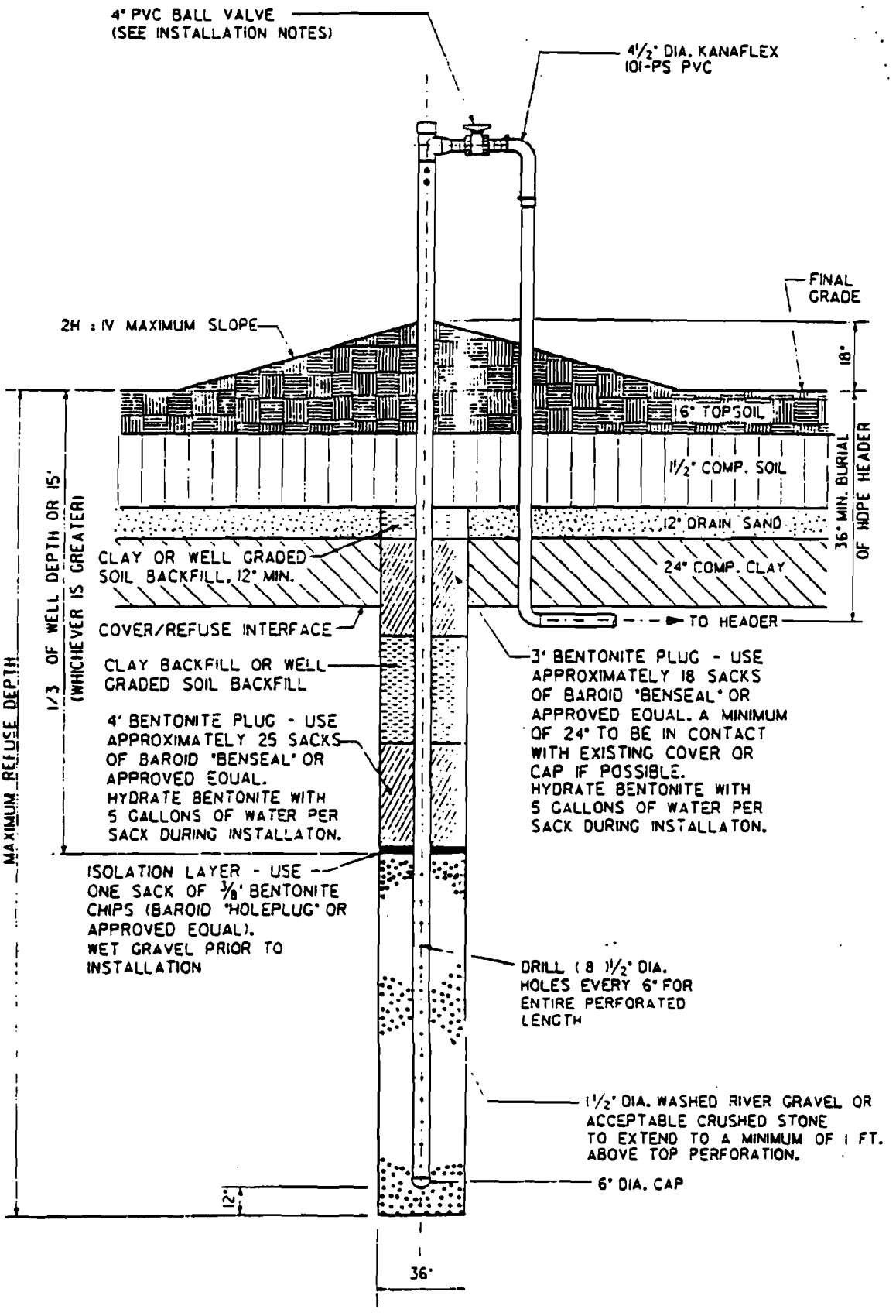


FIGURE 2 AREAS OF RADIOACTIVE CONTAMINATION AT SEAWAY INDUSTRIAL PARK

FIGURE 3



TYPICAL LANDFILL GAS EXTRACTION WELL DETAILS

NOTE 1: ADJUST PLUG AND BEDDING HEIGHTS AS NECESSARY
TO MEET ACTUAL FEILD CONDITIONS

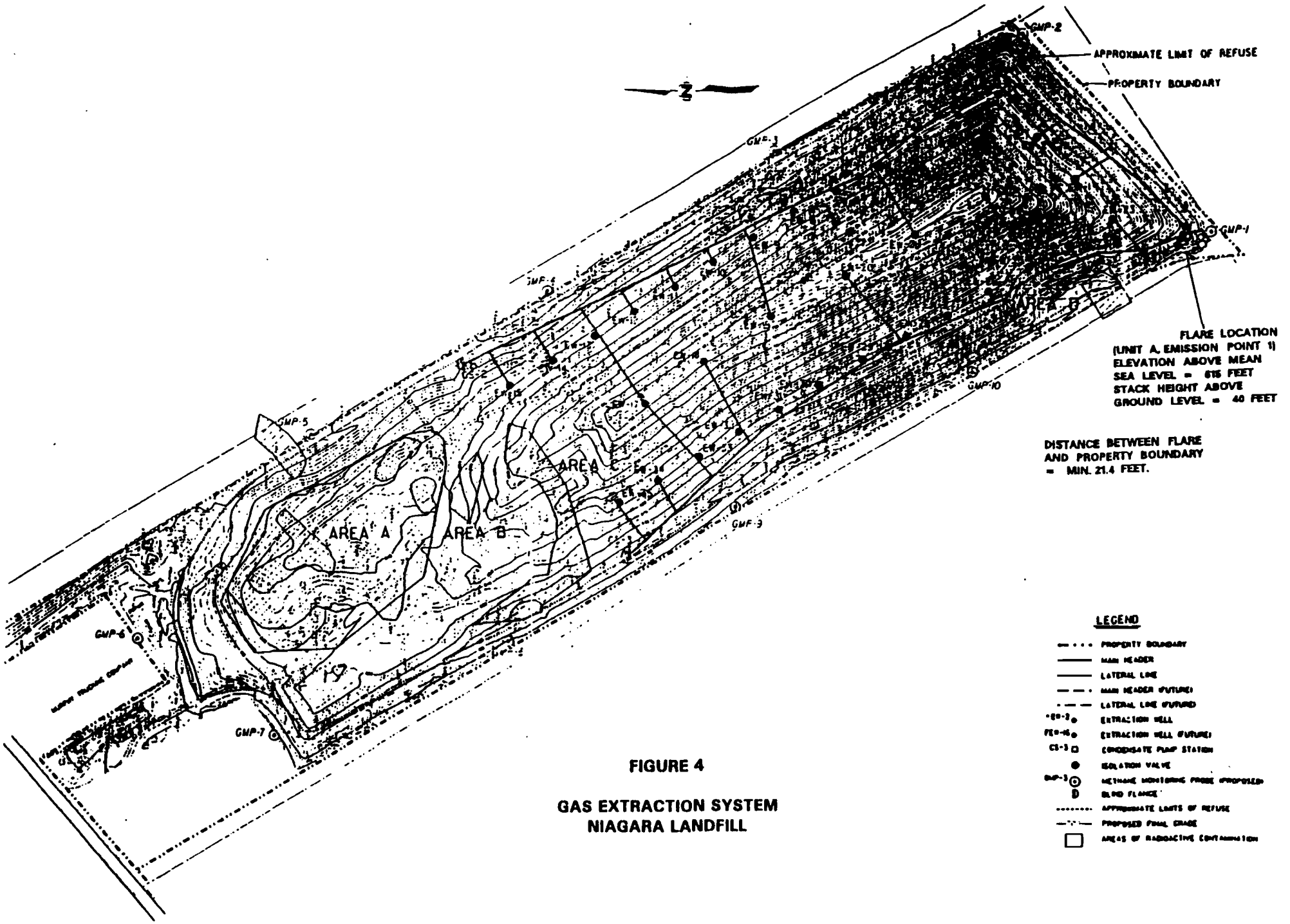
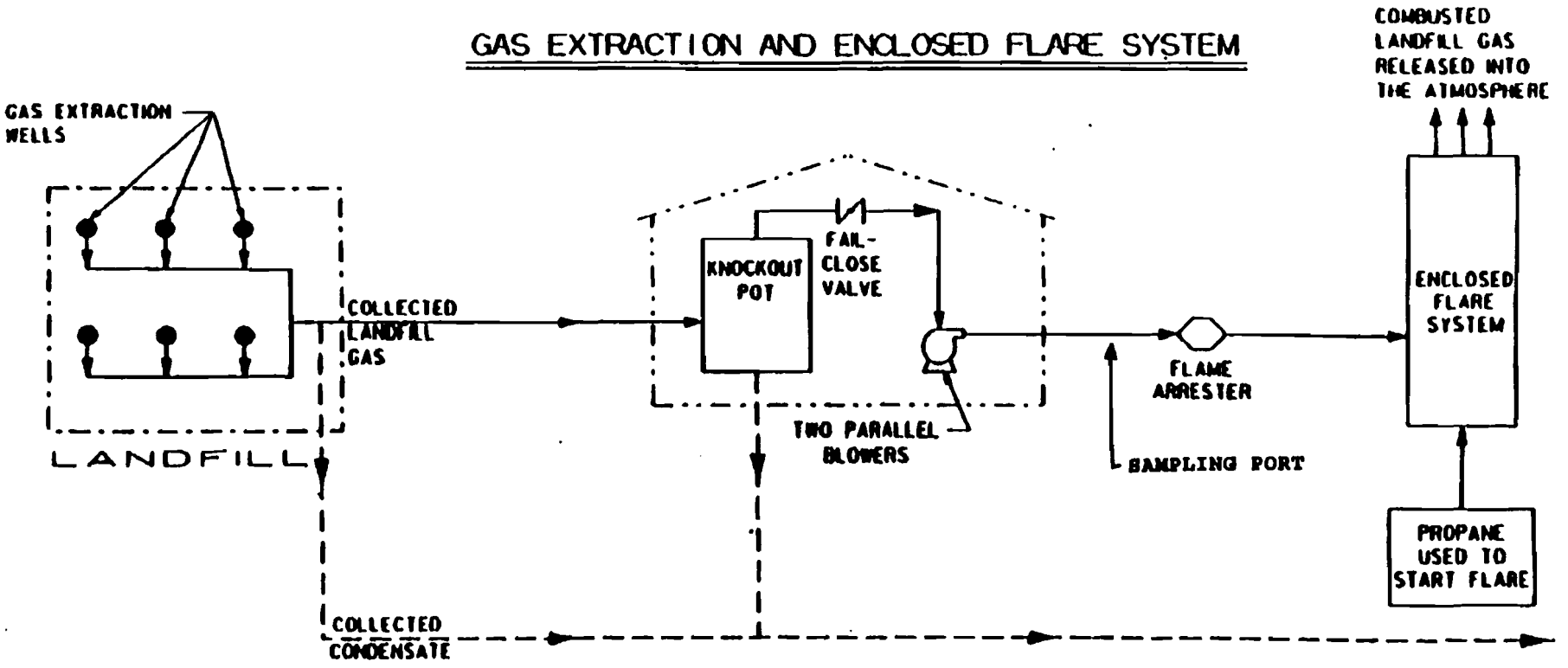


FIGURE 4

GAS EXTRACTION SYSTEM
NIAGARA LANDFILL

FIGURE 5


GAS EXTRACTION AND ENCLOSED FLARE SYSTEM
COMBUSTED LANDFILL GAS RELEASED INTO THE ATMOSPHERE
GAS EXTRACTION WELLS
LANDFILL
COLLECTED LANDFILL GAS
KNOCKOUT POT
FAIL-CLOSE VALVE
TWO PARALLEL BLOWERS
FLAME ARRESTER
SAMPLING PORT
ENCLOSED FLARE SYSTEM
PROPANE USED TO START FLARE
COLLECTED CONDENSATE