Appendix K

Contingency Plan - 2016

Gude Landfill
Contingency Plan
Montgomery County, Maryland

Prepared for:

Department of Environmental Protection
Division of Solid Waste Services
Montgomery County, Maryland

Prepared by:

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031
(410) 584-7000

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LIST OF ACRONYMS AND ABBREVIATIONS

ACM	Assessment of Corrective Measures
CMA	Corrective Measure Alternative
COMAR	Code of Maryland Regulations
COPC	Constituent of Potential Concern
CP	Contingency Plan
cVOC	Chlorinated Volatile Organic Compound
DCE	Dichloroethene
EA	EA Engineering, Science, and Technology, Inc., PBC
EPA	U.S. Environmental Protection Agency
LEL	Lower Explosive Limit
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
PCE	Tetrachloroethene
RAO	Remedial Action Objective
TCE	Trichloroethene
VOC	Volatile Organic Compound
µg/L	Microgram(s) Per Liter (equivalent to parts per billion, ppb)

1. INTRODUCTION

1.1 PURPOSE AND SCOPE

The Montgomery County (County) Department of Environmental Protection owns and maintains Gude Landfill (the Landfill), located at 600 East Gude Drive, Rockville, Maryland 20850. This Contingency Plan (CP) was prepared for the Landfill, at the request of the Maryland Department of the Environment (MDE) in support of the recommended Corrective Measure Alternative (CMA) selected in the Assessment of Corrective Measures (ACM) report (EA Engineering, Science, and Technology, Inc., PBC [EA] 2016).

The selected CMA for Gude Landfill (EA 2016) is Toupee Capping and Additional Landfill Gas Collection. As part of this CMA, an engineered geosynthetic cap will be constructed on the top and select side-slopes of the Landfill, and the landfill gas collection system will be expanded. As described in the ACM, this CMA addresses contaminated groundwater, landfill gas emissions, and leachate seeps.

A contingency remedy is a cleanup technology or approach that functions as a "backup" remedy in the event that the recommended CMA fails to perform as anticipated or site conditions change, reducing the efficiency of the alternative. A contingency remedy may specify a new technology or approach that is different from the selected remedy, or it may simply trigger modification and enhancement of the selected technology. Contingencies generally should be flexible enough to allow for the incorporation of new information about site risks and technologies.

This document provides a framework for the monitoring and evaluation of the selected CMA for the Landfill to document progress toward the attainment of established Remedial Action Objectives (RAOs) for the site and dictate criteria or "triggers" for the implementation of contingency measures, should the monitoring and evaluation not show favorable progress.

This CP is divided into the following three sections:

- Section 1 provides an introduction and an explanation of the RAOs for the site;
- Section 2 provides an overview of the methodology for monitoring performance of the alternative with respect to the RAOs, and presents the contingency triggers; and
- Section 3 presents potential contingency actions should the contingency triggers occur.

Performance monitoring data will be used to ascertain whether or not triggers have been met, warrant further investigation or implementation of prescribed contingencies.

1.2 REMEDIAL ACTION OBJECTIVES

MDE has established the following RAOs for the Landfill, based on applicable or relevant and appropriate requirements (MDE 2009):

- No exceedances of maximum contaminant levels (MCLs), established by the U.S. Environmental Protection Agency (EPA) as limits for drinking water, in the groundwater at the Landfill property boundary or between the Landfill and adjacent streams (Code of Maryland Regulations [COMAR] 26.08.02).

- No lower explosive limit (LEL) exceedances for methane gas at the Landfill property boundary (COMAR 26.04.07.03B(9)).

- No non-stormwater discharges to the waters of the State (COMAR 26.08.04.08).

These represent the ultimate, final RAOs for the site, to be achieved in the long term through implementation of the CMA.

The short-term RAO for the site, which complements the long-term RAOs, is to continue to minimize any potential risks to human and ecological health. The Nature and Extent Study for the Landfill (EA 2010) found that no constituents of potential concern (COPC) at the site pose a concern for human or ecological receptors.

Because local groundwater aquifers near the Landfill are not used as a source of potable water, the only complete human health exposure pathway for contact with groundwater is the inhalation of volatile organic compounds (VOCs) within indoor air (i.e., basements, crawl spaces). Potential human receptors for which this pathway is complete include residents living in the Derwood Station residential development adjacent to the western boundary of the Landfill, as well as residents of the County Coalition for the Homeless, Men's Emergency Shelter (Men's Shelter) adjacent to the southwestern corner of the Landfill. Current concentrations in groundwater do not represent a concern for the health of these receptors (EA 2010). However, the Nature and Extent Study presented groundwater VOC concentrations that, if detected in groundwater within the Derwood Station community or in the vicinity of the men's shelter,

would require additional evaluation of potential human exposure. These concentrations are presented in the table below. The model evaluates long-term effects, so comparison of groundwater concentrations to these values should be used only for screening purposes (EA 2010).

Chemical	EPA Maximum Contaminant Level (µg/L or ppb)	Concentration of Concern for Human Health (µg/L or ppb)
Benzene	5	118
Cis-1,2-Dichloroethene	70	2,000
1,2-Dichloropropane	5	191
Methylene Chloride	5	3,850
Tetrachloroethene	5	68
Trichloroethene	5	298
Vinyl Chloride	2	16

Current VOC concentrations in groundwater beneath the residential areas are less than these concentrations; therefore, no current risk has been identified, and short-term RAOs are met.

2. PERFORMANCE MONITORING AND CONTINGENCY TRIGGERS

2.1 PERFORMANCE MONITORING AND DATA EVALUATION

2.1.1 Groundwater

Groundwater monitoring will be performed on a semi-annual basis, in conjunction with the current monitoring program for the Landfill. Samples will be analyzed for COPCs, including VOCs and metals, as well as landfill leachate indicators (alkalinity, nitrate, sulfate, etc.). A detailed evaluation of the groundwater monitoring data will be conducted every ten (10) years after implementation of the selected CMA, to assess progress toward meeting RAOs. The focus of the evaluation will be an assessment of changes in the concentrations of the COPCs, particularly those reported at concentrations that exceed their respective MCLs. The identified changes (or stable concentrations) will be evaluated in the context of the physical characteristics of local groundwater transport (groundwater velocity and direction).

As presented in the ACM, it is estimated that the timeframe to meet the RAO for groundwater at the Landfill will be met approximately thirty (30) to forty (40) years after implementation of the selected CMA. This is based on the decreased water infiltration and resulting leachate production expected following capping, as well as expected rate of degradation of organic COPCs. Following capping and the resulting decrease in leachate production, it is estimated that VOCs, which are the most widespread COPCs at the landfill, would be degraded in approximately thirty (30) to forty (40) years. For the metals exceedances that are representative of groundwater quality and likely reflect Landfill-related impacts (e.g., cadmium in well OB11), elevated concentrations are localized in nature and only slightly exceed the MCL. Therefore, it is expected that these concentrations will fall consistently below MCLs following capping and decreased leachate production.

Initially, the resulting decrease in water infiltration into the waste mass will likely increase the concentration of contaminants in leachate, by decreasing dilution. This may cause concentrations of leachate-derived constituents in groundwater to initially increase after capping, as the leachate present in the waste at the time of capping is gradually depleted. Following this initial response, the decreased volume of leachate and decreased mobility of leachate-derived constituents is expected to result in a substantial decrease in constituent concentrations in groundwater, and achievement of the long-term RAO for groundwater.

Due to the dechlorination process, the concentrations of chlorinated VOC [cVOC] daughter compounds (particularly cis-1,2-dichloroethene [DCE]) may increase even after the concentrations of trichloroethene (TCE) and tetrachloroethene (PCE) begin to decrease. Therefore, for the evaluation of changes in cVOC concentrations over time, molar concentrations of PCE, TCE, DCE, and vinyl chloride will be calculated to evaluate changes in total cVOC concentrations through time. Molar concentrations will be used to remove the mass bias when considering concentrations of compounds with different masses. For example, if one (1) mole of PCE is degraded to one (1) mole of TCE, the total number of moles of cVOCs remaining in the subsurface has not changed, but the mass of PCE is greater than the mass of TCE, so the mass-based concentration (i.e., micrograms per liter [µg/L]) of total cVOCs would be smaller. Therefore, the molar concentration will be used as a way to compare the amount of contaminant remaining without a bias due to the different masses of the compounds at different stages of degradation.

2.1.2 Landfill Gas and Leachate

Landfill gas monitoring will continue in accordance with the approved Landfill Gas Monitoring Plan. Results will be screened against the LEL for methane. It is anticipated that the RAO for landfill gas will be met once the landfill cap has been constructed and the expanded landfill gas collection system is in place.

As part of the post-closure monitoring and maintenance of the Landfill, the side-slopes are monitored regularly for any surface expressions of leachate. It is anticipated that the RAO for leachate will be met once the Northwest and West side-slopes have been capped.

2.2 DEVELOPMENT OF CONTINGENCY TRIGGERS

Site-specific criteria, or triggers, were developed for Gude Landfill to indicate whether the recommended CMA is performing as expected, or if changing conditions may require a reevaluation of the preferred CMA as discussed in the following sections.

The following are the potential contingency triggers identified for groundwater at the Landfill:

1) VOC concentrations in wells in the residential areas exceed human health criteria for vapor intrusion.

    - The purpose of this trigger is to protect human health until final RAOs are achieved.

- As described in Section 1.2, the Nature and Extent Study for the Landfill (EA 2010) provided groundwater screening levels for VOCs that would require additional evaluation of potential human exposure, due to the potential for risk associated with vapor intrusion. Groundwater monitoring data from the residential areas will be screened against these values.
- Potential contingencies will be triggered if COPC concentrations exceed the screening level at least two (2) times in two (2) years.

2) Evaluation indicates increasing concentrations that are inconsistent with expectations.

- As described above, concentrations are expected to vary over time after landfill capping, with an initial increase possible. However, it is anticipated that any increases in groundwater COPC concentrations will occur primarily during the first decade after capping, and that concentrations will begin to stabilize and then decrease in the second and third decade following cap construction.
- The detailed evaluation of remedy performance conducted every ten (10) years will identify any COPCs that appear to have sustained increases in concentration, and will assess whether they are representative of these expected increases, or whether they are indications that the remedy is not performing as expected.
- Following are examples of increases in concentrations that may be considered unexpected, based on analysis of available data:
  - Widespread increasing COPC concentrations extending more than ten (10) years after cap construction.
  - Isolated and consistently increasing COPC concentrations in individual wells, which do not match the overall trend reflected in the majority of site monitoring wells.

3) Concentrations are not decreasing at a sufficiently rapid rate to meet the remediation objectives in a reasonable timeframe.

- Starting twenty (20) years after cap installation, the evaluations performed every ten (10) years will include reevaluation of the expected timeframe for meeting RAOs based on the performance monitoring data.

4) Changes in land and/or groundwater use will adversely affect the protectiveness of the remedy.

- No significant changes to the land use or groundwater use that would affect exposure pathways are expected.
- The most notable change that would affect the protectiveness of the remedy would be plans to use the groundwater adjacent to the Landfill as a potable water supply.

5) Continued LEL exceedances for methane gas.

- Landfill gas concentrations measured during monitoring will be screened against the LEL for methane, and repeated exceedances at the Landfill property boundary more than two (2) years after implementation of the selected CMA will be a trigger.

6) Non-stormwater discharges (i.e., leachate seeps) observed in the capped areas following installation of the cap.

3. POTENTIAL CONTINGENCY ACTIONS

The following potential contingency actions are provided to describe possible approaches to the contingency triggers described above. It is expected that implementation of additional active remedial measures would require a reevaluation of the technologies screened in the ACM, and consideration of any new technologies that have become available since finalization of the ACM.

3.1 VOC CONCENTRATIONS IN WELLS IN THE RESIDENTIAL AREAS EXCEED HUMAN HEALTH CRITERIA FOR VAPOR INTRUSION

If COPC concentrations exceed the screening level at least two (2) times over two (2) years of semiannual monitoring, then additional human health evaluation will be performed, as recommended in the Nature and Extent Study (EA 2010).

If this additional human health evaluation indicates unacceptable risk to human receptors, then the County will consult with MDE on the appropriate course of action, including additional investigation of vapor intrusion via sub-slab and indoor air testing. If human health concerns are identified, the County will consult with MDE on the appropriate course of action, including potential implementation of contingency measures. Contingency measures could include mitigation of vapor intrusion, or remedial technologies to directly treat the contamination in the groundwater, such as enhanced bioremediation, which was evaluated in the ACM.

3.2 EVALUATION INDICATES INCREASING CONCENTRATIONS THAT ARE INCONSISTENT WITH EXPECTATIONS

If unexpected, sustained increases in COPC concentrations are identified, then additional evaluation will be performed to evaluate the impact of these increases on the expected timeframe to meet RAOs. If it is determined that the trends indicate that the remedy may not meet RAOs in an acceptable timeframe, then the County will consult with MDE on the appropriate course of action, including potential implementation of contingency measures. Contingency measures could include remedial technologies to directly treat the contamination in the groundwater, such as enhanced bioremediation.

3.3 CONCENTRATIONS ARE NOT DECREASING AT A SUFFICIENTLY RAPID RATE TO MEET THE REMEDIATION OBJECTIVES IN A REASONABLE TIMEFRAME

If the revised expected timeframe to meet RAOs, more than twenty (20) years after capping, is substantially longer than originally expected upon acceptance of the ACM, then the County will consult with MDE to determine whether the new timeframe is acceptable. If the new timeframe is not acceptable, then potential implementation of contingency measures will be discussed. Contingency measures could include remedial technologies to directly treat the contamination in the groundwater, such as enhanced bioremediation.

3.4 CHANGES IN LAND AND/OR GROUNDWATER USE WILL REDUCE THE PROTECTIVENESS OF THE ALTERNATIVE

If a land and/or groundwater use change that affects protectiveness is planned and approved by the County and MDE, then a revised assessment of human health may be required. The evaluation would include further evaluation to re-evaluate groundwater flow, potential exposure pathways, and treatment options appropriate to protect human health. If this evaluation indicates that the change will result in unacceptable risk to human receptors from contact with Landfill-related groundwater contaminants, then the County will discuss options for protection of human health with MDE. Contingency measures could include remedial technologies to directly treat the contamination in the groundwater, such as enhanced bioremediation.

3.4.1 Continued LEL Exceedances for Methane Gas

If LEL exceedances for methane are detected at the property boundary more than two (2) years after implementation of the selected CMA, and the exceedance is repeated over multiple monitoring events, then the County will discuss appropriate responses with MDE. A likely contingency measure would be installation of additional landfill gas collection wells, beyond those proposed as part of the selected CMA.

3.4.2 Non-Stormwater Discharges Observed in the Capped Areas Following Installation of the Cap

If non-stormwater discharges (i.e., leachate seeps) are observed in the capped areas following installation of the cap, then the County will perform repairs to prevent continued discharges at the observed seep locations and to protect the integrity of the cap.

4. REFERENCES

EA Engineering, Science, and Technology, Inc. (EA). 2010. *Gude Landfill Nature and Extent Study Report*. November.

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Maryland Department of the Environment (MDE). 2009. Meeting with Montgomery County Department of Environmental Protection. 26 February.