Landfill Fire Risk Management Plan
Permit No. 74-SDP-02-76P

Northern Plains Regional Landfill
Graettinger, Iowa

Prepared for:

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Table of Contents

Section Page

Contents

0.0 EXECUTIVE SUMMARY 9
0.1 PLAN PURPOSE 9
0.2 RESOURCES 9
0.3 EMERGENCY CONTACTS 11
0.4 PLAN REVIEW/UPDATE SCHEDULE 12
0.5 TRAINING UPDATE SCHEDULE 12
0.6 RECOMMENDATIONS AND FOLLOW-UP 12
1.0 INTRODUCTION AND CASE STUDIES 14
1.1 FIRES IN LANDFILLS 14
1.2 PLAYERS INVOLVED 14
1.3 GOALS OF LANDFILL FIRE RISK MANAGEMENT PLANNING 14
1.4 CASE STUDIES 15
1.4.1 City of Iowa City Landfill Fire 15
1.4.2 Waste Commission of Scott County – Material Recovery Facility Fire 16
1.4.3 Metro Waste Authority Metro Park East Landfill Fire 17
1.4.4 Metro Waste Authority Recycling Facility Fire 17
1.4.5 Carroll County Landfill Fire 17
1.4.6 Plymouth County Landfill Fire 18
1.4.7 Cherokee County Landfill Fire 18
1.4.8 Northwest Iowa Regional Landfill Fire 18
1.4.9 Northern Plains Regional Landfill Various Fires 19
2.0 LANDFILL 101 20
2.1 LANDFILL REGULATIONS AND HISTORY 20
2.2 MODERN MUNICIPAL SOLID WASTE LANDFILLS 21
2.2.1 Classification of Landfills 21
2.3 DESIGN AND INFRASTRUCTURE 21
2.3.1 Construction 21
2.3.2 Landfill Liner 22
2.3.3 Leachate Collection System 23
2.3.4 Groundwater Protection 23
2.3.5 Gas Collection System 24
2.3.6 Landfill Cells 25
2.3.7 Active Landfill Area (Working Face) 25
2.3.8 Borrow Area 25
2.3.9 Future Expansion Area 25
2.4 ACCEPTED AND PROHIBITED WASTES 25
2.4.1 Accepted Wastes 25
2.4.2 Prohibited Wastes 26
2.4.3 Yard Waste 27

2.5 SUPPORT FACILITIES AND SERVICES 27
3.0 NATIONAL INCIDENT MANAGEMENT SYSTEM AND INCIDENT COMMAND STRUCTURE 27
3.1 INCIDENT COMMAND STRUCTURE (ICS) 28
3.1.1 Communications and Information Management 28
3.1.2 Resource Management 28
3.1.3 Command and Management 28
3.1.4 Incident Command Features 28
3.1.5 Northern Plains Regional Landfill ICS 32
3.2 ICS ROLES AND RESPONSIBILITIES 34
3.2.1 Management Functions 34
3.2.1.1 Command Section 35
3.2.1.2 Operations Section 35
3.2.1.2.1 Firefighting Group 35
3.2.1.2.2 Landfill Facilities Group 36
3.2.1.3 Planning Section 36
3.2.1.3.1 Engineering Support Group 36
3.2.1.3.2 Regulatory Affairs Group 37
3.2.1.4 Logistics Section 37
3.2.1.5 Finance Section 37
3.2.1.6 Additional Staff 38
3.2.1.6.1 Director of Communications 38
3.2.1.6.2 Health & Safety Officer 38
3.2.1.6.3 Liaison Officer 39
3.2.2 Other NIMS Definitions 39
3.2.2.1 Chain of Command 39
3.2.2.2 Unified Command 39
3.2.2.3 Incident Action Plan (IAP) 39
3.2.2.4 Incident Command Post (ICP) 40
3.2.2.5 Public Information Officer (PIO) 40
3.2.2.6 Joint Information Center (JIC) 40
3.2.3 After-Action Reports 40
4.0 SITE-SPECIFIC INFORMATION: NORTHERN PLAINS REGIONAL LANDFILL 41
4.1 BUILDINGS AND INFRASTRUCTURE 42
4.1.1 Scalehouse and Maintenance Building 42
4.1.2 Cold Storage Building 43
4.1.3 Flammable & Combustible Materials Storage Container 44
4.1.4 Emergency Weather Event Shelter 44
4.1.5 Facility Access Points 45
4.2 OPERATIONAL SUPPORT SYSTEMS AND UTILITIES 45
4.2.1 Active Control Panels 46
4.2.2 Fuel Storage Tanks 48
4.3 LANDFILL CELL DESCRIPTIONS 49
4.3.1 Petroleum Contaminated Soil (PCS) Treatment System 49
4.3.2 Active Landfill Areas (Working Face) 49
4.3.3 Reuse Recycling Area 50

4.3.4 Future Expansion Areas 50
4.4 SOIL SOURCES 50
4.5 WATER SOURCES 52
4.5.1 Hydrants (on and/or off-site) 52
4.5.2 Natural Water Sources (i.e., undesignated tributaries, creeks, etc.) 53
4.6 LEACHATE MANAGEMENT SYSTEM 53
4.7 GROUNDWATER AND STORMWATER MANAGEMENT SYSTEM 55
4.7.1 Stormwater Collection 55
4.7.2 Stormwater Retention Pond 55
4.7.3 Groundwater Monitoring 55
4.8 LANDFILL GAS COLLECTION AND CONTROL SYSTEM 55
4.9 LANDFILL EQUIPMENT RESOURCES 55
4.10 FIRE DEPARTMENT RESOURCES 58
4.11 LANDFILL POLICY 59
4.11.1 Accepted Wastes 59
4.11.2 Prohibited Wastes 59
4.12 CUSTOMER RE-DIRECTION PLAN 60
5.0 LANDFILL FIRE CHARACTERISTICS, CAUSES, AND DETECTION 61
5.1 COMBUSTION BASICS 61
5.2 LANDFILL FIRE CHARACTERIZATION 62
5.2.1 Surface Fires 63
5.2.1.1 Characteristics 63
5.2.1.2 Causes 63
5.2.1.3 Detection 64
5.2.2 Subsurface Fires 64
5.2.2.1 Characteristics 64
5.2.2.2 Causes 64
5.2.2.3 Detection 64
6.0 LANDFILL FIRE MANAGEMENT 65
6.1 FIRE INCIDENT TYPES 65
6.1.1 General Fire Response Plan 68
6.1.2 Proper Use of Fire Extinguishers 69
6.1.3 Type 0 Fires 70
6.1.4 Type 5 Fires 71
6.1.5 Type 4 Fires 72
6.1.6 Type 3 Fires 73
6.1.7 Type 2 Fires 75
6.1.8 Type 1 Fires 76
6.1.9 Cautions 76
6.2 LANDFILL AND FIRE DEPARTMENT RESOURCES 76
6.3 SUPPRESSION OF FIRES 79
6.3.1 Apply Cover 79
6.3.2 Water Supply 79
6.3.3 Foams 80
6.3.4 Excavation and Fire Break 81

6.3.5 Inert Gas Injection 81
6.3.6 Let it Burn / Do Nothing 81
6.3.7 Oxygen Injection 81
6.4 FACTORS TO CONSIDER 82
6.4.1 Wind and Weather 82
6.4.2 Multi-Agency Response 82
6.4.3 Personnel Safety 82
6.4.4 Access and Maneuverability of Heavy Equipment 82
6.4.5 Logistics 82
6.4.6 Environmental Impact 82
6.4.7 Landfill Contents 82
6.5 SURFACE FIRES 83
6.6 SUBSURFACE FIRES 83
7.0 HEALTH & SAFETY CONSIDERATIONS 83
7.1 POTENTIAL EXPOSURES AND SITE HAZARDS 84
7.2 HEALTH & SAFETY FOR RESPONDERS 85
7.2.1 Personal Protective Equipment (PPE) 85
7.2.1.1 PPE Compliance 85
7.2.1.2 PPE Levels 86
7.2.1.3 PPE Applicability 88
7.2.1.4 Landfill Fire PPE 88
7.2.1.5 Respiratory PPE – Fire Department 89
7.2.1.6 Respiratory PPE – Landfill Operators 90
7.2.1.7 PPE Training 91
7.2.2 Health Monitoring 92
7.2.3 Emergency Medical Service Locations 92
7.2.4 Emergency Contacts and Numbers 92
7.3 AREA HEALTH AND SAFETY 92
7.3.1 Air Monitoring 92
7.3.2 Respiratory Issues 93
7.3.3 Wind Patterns 93
7.3.4 Emergency Evacuation Policy 95
7.4 ENVIRONMENTAL CONSIDERATIONS 95
7.4.1 Stormwater Discharge Protection 96
7.4.2 Groundwater Protection 96
7.5 POST-INCIDENT MONITORING 96
7.5.1 Air Monitoring 96
7.5.2 Environmental Monitoring 97
8.0 COMMUNICATIONS 97
8.1 INTERNAL COMMUNICATION 98
8.2 FIRE DEPARTMENT COMMUNICATION 98
8.3 REGULATORY AGENCY NOTIFICATION 99
8.4 MEDIA COMMUNICATION 100
8.5 CUSTOMER COMMUNICATION 101
8.6 PUBLIC RELATIONS 101

9.0 LANDFILL FIRE MINIMIZATION 101
9.1 MONITORING 101
9.1.1 Infrared Cameras 101
9.1.2 Employee Visual Screening 102
9.2 OPERATIONS 102
9.2.1 Landfill Policy 102
9.2.2 Incoming Waste Inspections 102
9.2.3 Waste Compaction 103
9.2.4 Prohibit Smoking On-Site 103
9.2.5 Maintaining Good Site Security 103
9.2.6 Methane Gas Detection and Collection 103
9.2.7 Use of Daily Cover 104
9.2.8 Use of Intermediate Cover 104
9.2.9 Water Supply 104
9.2.10 Equipment Inspection and Maintenance 105
9.2.11 Active Face 105
9.2.12 Soil Stockpiles 105
9.3 TRAINING 105
9.3.1 New Hires 105
9.3.2 Emergency Personnel 106
9.3.3 On-Going Updates and Training 106
10.0 GENERAL COMMENTS 106
11.0 REFERENCES 107

Tables

Table ES-1. Internal Available Resources
Table ES-2. External Available Resources
Table 3-1. ICS Forms and Descriptions
Table 4-1. Landfill Equipment Resources
Table 4-2. Fire Department Equipment Resources
Table 5-1. Subsurface Landfill Fire Detection Methods
Table 6-1. Fire Incident Type Descriptions
Table 6-2. Fire Extinguisher Classes
Table 6-3. Landfill Equipment Resources
Table 6-4. Fire Department Equipment Resources
Table 6-5. Landfill Water Supply
Table 7-1. Landfill Equipment Air Protection Information
Table 7-2. Wind Direction and Possible Impact Zone

Exhibits

Exhibit 2-1. Anatomy of a Subtitle D Landfill
Exhibit 2-2. Landfill Cap and Bottom Liner Systems
Exhibit 2-3. 2022 Iowa Waste Characterization Study – Overall Statewide MSW Material Composition
Exhibit 3-1. Incident Command Structure
Exhibit 3-2. Unified Command Structure
Exhibit 5-1. Fire Tetrahedron
Exhibit 6-1. Incident Type Magnitude of Resource and Length
Exhibit 7-1. Spencer Wind Rose: January 2022 – December 2024

Figures

Figure 1-1. Waste Commission of Scott County MRF Fire
Figure 2-1. Landfill LFG Vent
Figure 4-1. Scalehouse and Entry
Figure 4.2. Storage Area within Shop - Yellow Flammable Cabinet Visible
Figure 4-3. Storage Area in Loft Space Above Offices
Figure 4-4. 1,000-gallon Propane Tank Along the East Side of Office Building
Figure 4-5. Flammable and Combustible Materials Storage Container
Figure 4-6. Tornado Shelter
Figure 4-7. Facility Entrance
Figure 4-8. Internal Haul Road
Figure 4-9. Control Panel A - Main Power Supply
Figure 4-10. Control Panel B - Scalehouse Panel
Figure 4-11. Control Panel C - Lift Station 3 Power
Figure 4-12. Control Panel D - Leachate Loadout Panel
Figure 4-13. Control Panel E - Lift Station 3 Control
Figure 4-14. Control Panel F - Lift Station 1 and 2 Power Supply
Figure 4-15. Portable 500-gallon Portable Diesel Tank
Figure 4-16. 1,000-gallon Diesel Tank and 100-gallon Diesel Tank Located Northwest of the Scalehouse
Figure 4-17. Closed Landfill Cells
Figure 4-18. Working Face

Figure 4-19. Portable Litter Fence
Figure 4-20. Portable Litter Fences
Figure 4-21. Soil Borrow Area in Southeast Corner of Cell E2 Expansion Area, North of Current Operations
Figure 4-22. Soil Stockpile Located North Cold Storage and Maintenance Buildings
Figure 4-23. Detention Ponds
Figure 4-24. Leachate Lagoon
Figure 4-25. Leachate Lagoon Loadout
Figure 4-26. Barrel Float for Drawing Water out of the Upper Pond
Figure 4-27. Leachate Cleanout
Figure 4-28. Leachate Lift Station 1
Figure 4-29. Single Axle Dump Truck with 5-yard Box
Figure 4-30. 15-yard Dirt Scraper
Figure 4-31. Payloader with 4.5 cu yd Bucket
Figure 4-32. John Deere 250G Excavator
Figure 4-33. Example of WSR and ASR received at the Landfill
Figure 5-1. Surface Fire
Figure 5-2. Subsurface Fire
Figure 6-1. Type 0 Landfill Fire (Photo courtesy of Todd Thalhamer)
Figure 6-2. Type 5 Landfill Fire (Photo courtesy of Todd Thalhamer)
Figure 6-3. Type 4 Working Face Fire (Photo courtesy of Todd Thalhamer)
Figure 6-4. Type 3 Subsurface Fire (Photo courtesy of Todd Thalhamer)
Figure 6-5. Type 2 Surface and Subsurface Fire in Panama (Photo courtesy of Todd Thalhamer)
Figure 7-1. Full Facial Masks
Figure 7-2. Organic Vapor Cartridges

Appendices

Appendix A Incident Command Structure Organizational Charts
Appendix A-1 Simple Incident Command Structure Organizational Chart
Appendix A-2 Complex Incident Command Structure Organizational Chart: Modified as Required for Type 5 – Type 2 Fires
Appendix B List of Contacts
Appendix C List of Media Contacts
Appendix D List of At-Risk Populations
Appendix E Directions to Emergency Medical Services
Appendix F Sample After-Action Report
Appendix G Emergency Evacuation Plan
Appendix H Site Maps
Appendix H-1 Landfill Site Vicinity Map
Appendix H-2 General Landfill Site Map
Appendix H-3 Landfill Infrastructure
Appendix H-4 Graettinger Hydrants
Appendix H-5 Landfill Water Sources
Appendix H-6 Landfill Electric Panel Locations

0.0 EXECUTIVE SUMMARY

The Northern Plains Regional Landfill (Landfill) is located at 3032 420th Ave in Graettinger, Iowa in Palo Alto County and is approximately 3 miles south of Graettinger, Iowa.

The Landfill has previously experienced fires at their municipal solid waste (MSW) operations. These fires have not damaged existing infrastructure; however, landfill fires like these require significant human and financial resources to extinguish.

In 2018, the Landfill worked with a consultant to develop a Landfill Fire Risk Management Plan (Plan) to identify fire mitigation responses and responsibilities. This Plan was developed in cooperation with Landfill staff, local and regional fire and emergency response personnel, and Todd Thalhamer, PE, who is a national expert on waste fire response. The Landfill held one training event which invited Landfill staff and local and regional emergency response personnel to go over key elements of this Plan.

0.1 PLAN PURPOSE

Fires at landfills and supporting facilities are not uncommon. While most fires can be quickly extinguished by Landfill staff, some require assistance from the primary fire department, and few result in requesting additional departments for mutual aid. Landfills present unique challenges and require uncommon firefighting methods compared to typical structure fires encountered by fire departments.

Larger scale fires require communication between and the cooperation of multiple entities including the Landfill staff, fire departments, sheriff's office, air quality monitoring officials, etc. It is important to know that Landfill fires present a potential health risk to responders and operators.

The 2018 Plan and training were intended to provide information to educate staff on different types and degrees of landfill fires, highlight risks associated with landfill fires, and outline extinguishment methods and communication procedures prior to an actual emergency.

This Plan updates the contents of the 2018 Plan concerning mitigation procedures and responsibilities, and methods to help reduce safety risks to responders and operators.

0.2 RESOURCES

Based on interviews with current Landfill staff, the following internal resources listed in **Table ES-1** are currently available in the event of a fire incident.

Table ES-1. Internal Available Resources

Description	Fuel Type	Usage Notes
Logistical Equipment		
2000 Chevy Tahoe	Gas	Misc. 4x4
2008 Ford F150	Gas	Misc. 4x4
2014 Chevy 2500HD Pickup	Gas	Misc./Snow removal, 4x4
2023 Kubota RTV-1100CWH/HS	Diesel	Misc.
Case Skid Loader	Diesel	Misc.
1976 Motor Grader	Diesel	Grade roadways
1999 Case IH MX 120 with loader	Diesel	Mow grass
2019 International Semi Tractor	Diesel	Leachate tanker hauling
1986 Leachate Tanker (Trailer)	N/A	7,000 gallons
2019 MAC LLT Tanker Trailer	N/A	8,000 gallons
2019 Dodge Ram 2500	Gas	
2020 850L John Deere Dozer	Diesel	
2021 Grasshopper Lawn Mower	Gas	
1996 615C II Dirt Scraper	Diesel	
2018 John Deere 250G Excavator	Diesel	
1990 644E John Deere Payloader	Diesel	
Dirt Moving Equipment		
2019 963 Cat Track Loader	Diesel	
2023 Al Jon Compactor	Diesel	With push blade
2000 International Dump Truck	Diesel	6 cubic yards
1999 International Dump Truck	Diesel	
Fire Fighting Equipment		
Class B Foam		35 gallons
Class A Foam		85 gallons

Based on interviews and research with external support services, the following external resources listed in **Table ES-2** are currently available in the event of a fire incident. The Graettinger Volunteer Fire Department (Fire Department) is the primary source of firefighting assistance.

Table ES-2. External Available Resources

Name	Tank Capacity (gallons)	Pump Rating (GPM)
First Out: Graettinger Volunteer Fire Department		
Pumper Truck	1,000	1,250
Pump Truck (doubles as Tanker)	1,500	1,000
Tanker	2,500	
Tanker	1,500	
Pickup Truck 4x4	250	
Side-by-Side	85	
Ground-Based Monitor Nozzles (2)		500
Class A Foam – on each pumper truck (30 gallons)		
Class A Foam – at fire station (45 gallons)		
Class A Foam – at Landfill (85 gallons)		
Foam Application Tools: Pro Pack, Inductor, Nozzles		
Second Out: Emmetsburg Volunteer Fire Department		
Pumper Truck	1,000	1,500
Pumper Truck	1,000	1,500
Pumper Truck	1,000	1,500
Tanker Truck	1,800	1,500
Pickup Grass Unit	400	50
Can Am ATV – Side-by-Side (high pressure with foam nozzle)	60	
Can Am ATV – Side-by-Side (high pressure pump)	60	
Third Out: Ruthven Volunteer Fire Department		
Main Pumper	1,000	1,250
Pumper Truck (dump capable)	1,250	1,250
Tanker Truck (dump capable)	2,000	
Tanker Truck	1,000	
Pickup Truck	250	
Can-Am Defender 4x4 UTV	75	
Can-Am Defender 4x4 UTV	75	
Fourth Out: Wallingford Volunteer Fire Department		
Engine 1	1,000	1,000
Engine 2	1,000	750
Tanker	1,500	
Chevy Grass Wildland Truck		

0.3 EMERGENCY CONTACTS

The emergency contact list is the first page of this binder. Included are the Landfill contacts and Palo Alto County emergency personnel including the emergency management agency director, sheriff, fire departments, and state contacts. Contact numbers for additional outside resources such as heavy equipment, trailers, catering, and foam suppliers are also included should they be required for a larger incident. This list should be maintained, and amended as changes occur. The list should be reviewed and updated every year.

0.4 PLAN REVIEW/UPDATE SCHEDULE

The operational areas and activities occurring at the Landfill can change on a regular basis. As such, a review of this Plan should occur on an annual basis with a comprehensive update performed every five years. Annual changes/modifications should be noted in a master document to be distributed to other Plan holders during regular training updates.

0.5 TRAINING UPDATE SCHEDULE

Refresher training should occur at least every five years. New Landfill employees and other new emergency response volunteers and staff should have this Plan reviewed with them upon hiring. Fire departments are required to perform 24 hours of continuing education on an annual basis; as such, an annual refresher and site visit to the Landfill could serve as appropriate training hours. At a minimum, training with current Landfill employees and emergency personnel should occur as changes occur in staffing, facilities, and operations. The first full refresher training should be held in 2030 unless significant modifications to the facility or other Plan components warrant it be completed sooner.

0.6 RECOMMENDATIONS AND FOLLOW-UP

Based on the overall review of the Landfill, internal and external resources, and available staffing, the following items are recommended:

Communication

- Practice communications between the Landfill, City, and Fire Department so operations can be set up early and continue throughout the fire response.
- Notify the Fire Department when infrastructure changes within the Landfill. This will ensure the latest information will be communicated to the responding firefighting departments.
- Test radio communications on-site with Landfill staff and emergency response crews (Fire Department and mutual aid departments).
- Provide the Fire Department with updated maps of the Landfill and after-hour contacts at least annually.
- Create a formal, written agreement with Dickinson Landfill to serve as the alternate disposal facility in case of emergency at the Landfill.

General Fire Prevention and Mitigation Activities

- Continue to stage a designated soil stockpile next to the operating face for firefighting operations.
- Maintain the haul road to allow traffic to move completely around the site on internal roads.
- Ensure the Fire Department has access to the necessary keys to enter the Landfill and on-site structures.
    - Designate and maintain an access point to the upper pond (southeast of the scalehouse) allowing firefighting equipment access to the stored water within the pond.
    - Test interoperability of equipment (i.e., hose connections, etc.).
    - Evaluate potential to establish and maintain an emergency secondary entrance to the site.
    - Create a lithium-ion battery recycling and collection program.

- Landfill staff to coordinate with fire department personnel when heavy equipment operators can perform mitigation efforts so that the fire departments are ready to provide support (i.e., water application, emergency rescue, etc.).
- Make sure Class B foam stored at the Landfill has not exceeded the recommended storage time, i.e., "shelf life".
- After Class B Foam expires, purchase Class A foam for storage at the Landfill.
- Consider adding a second entrance to the Landfill to improve access for emergency personnel.
- Consider purchasing portable LED light bars to be prepared for insufficient natural lighting during a fire incident.
- Consider purchasing an early fire detection system for a faster on-site response, which could possibly eliminate the need for a Fire Department response.

General Recommendations

- Require post-event medical evaluations for staff.
- Consider working with the fire department to identify appropriate training (i.e., 24-Hour HAZWOPER) and refresher requirements for Landfill staff that may be involved in performing fire mitigation activities.
- Consider performing a table-top exercise which simulates emergency events and responses to both rehearse and inform potential fire mitigation plan updates.

Respiratory and Personal Protective Equipment

- Consider purchasing powered air-purifying respirators (PAPRs) along with high efficiency particulate air (HEPA) and organic vapor cartridges for heavy equipment operators to use when performing mitigation efforts that exceed 30 minutes.
- Develop a respiratory protection program that includes respirator-clearance medical screening, fit test for employees, equipment maintenance procedures, and an employee training program.
- Consider performing ambient air evaluations to establish air quality baseline for various operator assignments.
- Work with the Fire Department to evaluate the type of fire-resistant protective clothing. Landfill staff should consider having on-site for Landfill equipment operators to use if they are directly engaged in fire mitigation actions that exceed 30 minutes.
- Consider installing activated carbon recirculation air filters on equipment likely to be assigned to direct fire mitigation activities.

1.0 INTRODUCTION AND CASE STUDIES

The occurrence of fires in landfills is not uncommon. According to data from the National Fire Incident Reporting System (NFIRS), an average of 8,400 Landfill fires are reported at solid waste management facilities each year. Other sources state that one in 200 fires escalates to a major incident, which would equate to 42 major incidents per year. It was also noted that the probability of a small fire is greater than 50%, while the likelihood of a major fire is 0.05% (Thalhamer, 2009).

The Northern Plains Regional Landfill (Landfill) site located at 3032 420th Ave in Graettinger, Iowa has experienced fires at their municipal solid waste (MSW) operations in the past. While Landfill operators have been able to extinguish most of the fires quickly, the Graettinger Fire Department and other departments performing mutual aid have responded to larger fires.

A site map of the Landfill is provided in **Appendix H-2**. This site map shows the Landfill's general layout and operational areas, including structures, location of electrical panels and propane tanks, and on-site water access (i.e., sediment ponds and creeks).

1.1 FIRES IN LANDFILLS

Causes of landfill fires can include chemical reactions, reactive materials, overdraw of landfill gas systems, smoking or sparks, landfill equipment, lightning strikes, and hot spots. Fires can also begin in a vehicle transporting waste to the landfill or occur at the working face (where waste is tipped for disposal management).

Across the industry, waste and recycling management facilities have experienced increased fire occurrences, believed to be caused by improper management and disposal of lithium-ion batteries. Lithium-ion batteries vary in size and are used in a variety of consumer products making them difficult for waste and recycling managers to identify and remove from received materials. Damaged or crushed lithium-ion batteries can start a "thermal runaway" event which releases heat and can ignite adjacent materials.

Regardless of why they start, it is important to extinguish fires as quickly as possible to avoid harm and damage to humans, surrounding environment, and vehicles/equipment – including the engineered landfill cells and associated infrastructure.

1.2 PLAYERS INVOLVED

Many landfill fires are addressed solely by landfill staff. However, there are occasions where outside assistance is needed. This may vary from the primary responding local fire department to multiple fire departments being called in to provide mutual aid. Other agencies and groups that may be involved include county emergency management agencies, State Hygienic Laboratory, Iowa Department of Natural Resources (DNR), United States Environmental Protection Agency (U.S. EPA), American Red Cross, equipment providers, and other emergency response agencies.

1.3 GOALS OF LANDFILL FIRE RISK MANAGEMENT PLANNING

Goals in assembling the Plan and in completing the training include:

1. Educate emergency responders on the facilities and environmental controls in place at a municipal solid waste (MSW) management facility, including on-site infrastructure that can become fire hazards or assist in extinguishing a fire.
2. Inform emergency responders and Landfill staff on causes and characteristics of landfill fires.

3. Provide an incident command structure and introduction of potentially involved parties prior to the time when an actual incident is occurring.
4. List internal and external resources that may be necessary to fully respond to an event.
5. Educate Landfill staff and emergency responders about potential environmental, safety, and health hazards.
6. Provide landfill firefighting techniques and methodologies that may be used to address a fire.
7. Provide education and training on environmental suppression tactics.

Each of these will be further explored throughout this Plan and the subsequent training.

1.4 CASE STUDIES

As previously noted, landfill fires are not uncommon. Several fire events have made national and international headlines – from the Harrold Road Landfill fire on New Providence in Nassau, Bahamas to the 2012 City of Iowa City Landfill fire in Iowa. Details regarding several Midwest fires are briefly discussed below.

1.4.1 City of Iowa City Landfill Fire

On Saturday, May 26, 2012, at approximately 6:30 PM (only one hour after the last employee left the facility) a fire alarm was called at the Iowa City Landfill. The fire lasted for four months, destroyed or damaged over nine acres of the constructed 14.7-acre cell including associated infrastructure (i.e., liner system, underground drainage system, leachate collection system, etc.) and cost approximately $3 million to extinguish and mitigate. An investigation into the cause of the fire was inconclusive, but staff suspect that hot coals from a charcoal grill may have been in one of the loads received at the end of the day, thus quickly igniting other waste and the tire chip drainage media.

At approximately 6:30 PM, Landfill management called staff back to the Landfill to assist in extinguishing the fire. Since this was the Saturday of Memorial Day weekend some staff were unavailable or several hours away due to the extended holiday. Available Landfill staff quickly discussed the difficulties associated subsurface Landfill fires with Iowa City Fire Department responders. Complexities include the non-uniform characteristics of the MSW, oxygen fuel from the leachate collection system underneath the MSW, intense heat emitted by the tire and plastic components (i.e., drainage media, liner, and piping), and proximity concerns about the adjacent cell containing 40 years of waste, similar infrastructure, and a Landfill gas collection system.

Landfill staff rapidly created fire breaks with two dozers and a compactor. Initially, staff efforts were uncoordinated and unsupervised, thus posing a safety risk to the personnel and the equipment. Coordinated efforts were established, and staff attempted to create a fire break by peeling the tire chips, geonet, and flexible membrane liner (FML) to the side leaving the 4 feet of clay liner exposed. Eventually, a third constructed fire break was successful in containing the fire. However, fire eruptions from the cell's leachate collection lines occurred in locations assumed to be successfully separated from the fire. These eruptions increased the complexities and potential safety risks associated with controlling and extinguishing the fire.

Within six hours, the third constructed fire break remained stable and prevented the fire from spreading further into the non-covered portions of the cell. By midnight, the Iowa City Fire Department fire trucks returned to their stations. The Iowa City Landfill equipment and staff played the biggest role in fighting the fire. Fire trucks would be needed later to help control air particulate emissions, manage fire flare-ups, and keep heavy machinery cool as they worked near the fire. Within the first 18 hours, more than nine acres of the Landfill were on fire, fire eruptions were occurring, liner and leachate systems were destroyed, and the groundwater underdrain system was impacted.

On Sunday, May 27, 2012, Iowa City officials contacted the Johnson County Health Department and the State Hygienic Laboratory to request air monitoring for smoke and particulates. The air emission results were made public and evacuated families were permitted to return since air pollution monitoring results indicated there was not an immediate public health or safety risk.

At the time of the fire, the facility was currently working to place the first four feet of select waste in the new 14-acre cell. The cell had been operational for approximately six months. The cell construction consisted of an underground drainage system, four feet of compacted clay, a FML, geonet fabric, and 1.5 to 3.0 feet of tire chips as a leachate drainage media. The cell was approximately 50% covered with four feet of waste as of May 26, 2012.

Key Takeaways:

- Have a joint safety and planning meeting between Landfill operators, city staff, and fire departments
- Have a Knox-box with Landfill gate and building keys
- Have a Landfill site map printed and available for use in planning purposes
- Maintain a dedicated stockpile of soil to be used to cover the working face in the event of a fire
- Continue to perform proper daily cover operations
- When using tire chips as the leachate drainage layer, place the first lift of waste quickly to cover the material

1.4.2 Waste Commission of Scott County – Material Recovery Facility Fire

On June 20, 2023, a fire occurred in the material receiving area inside the Waste Commission of Scott County's Material Recovery Facility. Staff noticed the fire and evacuated customers from the area. The loader operator attempted to use the bucket to pull out the burning materials so additional staff could use fire extinguishers. This attempt spread the burning material, introduced oxygen to the fire, and lodged burning material against the arm of the loader.

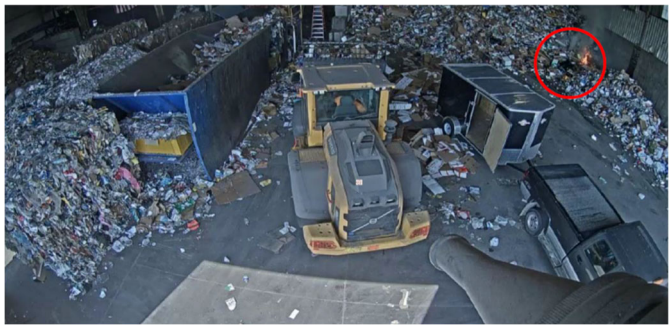


Figure 1-1. Waste Commission of Scott County MRF Fire

The loader operator ceased trying to pull out the material and staff used fire extinguishers to douse the burning material lodged against the arm of the loader. This had to be done twice to fully extinguish the fire.

The Material Recovery Facility's fire suppression system (Fire Rover) was activated but its operation was delayed due to an internet connection disruption. The system suppressed the fire until the fire department arrived to fully extinguish the burning material.

Key Takeaways:

- Develop a backup plan for known internet connection issues that would prevent fire suppression system controls
- Review procedures and train personnel about addressing fires with Landfill equipment

1.4.3 Metro Waste Authority Metro Park East Landfill Fire

On April 12, 2022, the Metro Park East Landfill had a working face fire. The fire was discovered around 8:30 PM. Landfill operators were called out and began hauling and applying dirt to the working face area. Three fire departments arrived to tinder and apply water to the working face. High winds made battling the fire difficult, but Landfill staff and the fire departments were able to fully extinguish the fire within four hours.

Tarps used as alternative daily cover were destroyed. The cause of the fire is unknown.

Key Takeaways:

- Communication and coordination with Landfill staff and fire departments was important
- Dedicated stockpiles of dirt would assist fire mitigation efforts

1.4.4 Metro Waste Authority Recycling Facility Fire

At about 4:00 PM on September 12, 2023, the Metro Waste Authority Recycling Facility had a fire inside the building. It is believed that a lithium-ion battery caught fire and traveled through the processing system, igniting other materials and spreading the fire. Fire alarms activated and employees evacuated the facility. Four fire departments arrived on the scene, began fire mitigation efforts, and quickly extinguished the flames.

The Johnston-Grimes Metropolitan Fire Department Chief estimated the fire and smoke damage to be around $1 million. Recycling processing operations were reduced for several months as repairs were being made to equipment and the facility.

While the cause of the fire is unknown, Metro Waste Authority staff took the opportunity to educate the public about the importance of proper management of hazardous materials such as rechargeable batteries, pepper spray, and other materials or products that may cause harm to workers and/or damage equipment.

Key Takeaways:

- Train staff on communication and evacuation procedures
- Continue to educate the public on proper management of hazardous and dangerous materials

1.4.5 Carroll County Landfill Fire

Two fires at the Carroll County Landfill occurred within days of each other. On May 15 and May 19, 2023, the Landfill had fires that are suspected to have been caused by improperly disposed lithium-ion batteries. Staff and emergency responders believe the lithium-ion batteries that started the fire were delivered in a trailer load of waste from a nearby transfer station. Landfill staff excavated the burning material, applied dirt, and worked with the fire departments to apply water to extinguish the fire.

Key Takeaways:

- Assist transfer station staff in identifying and removing hazardous and/or dangerous materials
- Continue public education on proper management of hazardous and/or dangerous materials

1.4.6 Plymouth County Landfill Fire

Around midnight on February 9, 2018, a fire was reported at Plymouth County Landfill in Le Mars, Iowa. Responders and staff initially used an on-site excavator to separate and spread out the burning area, while protecting the equipment with firefighting resources. They determined that this method was too difficult and time consuming, so they switched to a different side of the fire and used more equipment. A heavy construction equipment contractor was called in to assist Landfill staff with cutting out the burned areas. This new combination brought the fire under control within 24-36 hours and prevented further spread.

The cold weather and snow impacted the speed and efficiency of the response. There were also environmental concerns since the smoke could be seen over 2 miles away. The Fire Department believed the fire started spontaneously, since the fire originated in an area of the landfill untouched for more than 2 years, but the exact cause was never determined.

Key Takeaways:

- Firefighting tactics can switch quickly. Communication across all channels is imperative.
- Extremely cold/snowy weather should be taken into consideration as it can be a hazard to responders and result in slower firefighting efforts.
- Maintaining an updated contact list can help expedite response times for additional support.

1.4.7 Cherokee County Landfill Fire

Multiple fire departments were called to a structure fire at the Cherokee County Landfill in Cherokee, Iowa on June 18, 2021 at 4 p.m. The fire, most likely caused by a battery, was in the storage shed. While a third of the building was badly damaged, the fire did not reach the waste delivery areas. Normal operations continued, and residents could drop off their garbage if needed. Cherokee Medical was on-site checking vitals of firefighting due to the extremely hot weather. No injuries were reported.

Key Takeaways:

- Extremely hot weather should be taken into consideration as it can be a hazard to responders and result in slower firefighting efforts.
- Communication is key when multiple organizations arrive to assist.
- It is important to properly manage all shop items since landfill fires can and do occur outside the landfill waste delivery areas.

1.4.8 Northwest Iowa Regional Landfill Fire

On October 8, 2024, three fire departments responded to a fire at the Northwest Iowa Regional Landfill, located near Sheldon, Iowa. The Hospers Fire Department was the first to arrive and saw a “decent-sized area of garbage on fire.” Hospers Fire Department was joined by the Granville and Sheldon Fire Departments, dousing the affected area with water until Landfill personnel arrived and used equipment to smother the fire with dirt. It took about two hours to fully extinguish the fire. The cause of the fire was never determined but, since it was nighttime, responders didn’t suspect landfill equipment.

Key Takeaways:

- Communication is key when multiple organizations arrive to assist.
- Having a supply of soil near the landfill will make firefighting easier.

- When firefighting efforts use water, it is important to check for environmental issues stemming from runoff and/or an overloaded leachate system.
- Firefighting efforts can be hindered by nighttime conditions.

1.4.9 Northern Plains Regional Landfill Various Fires

The Landfill has managed small working face fires, customer vehicle fires, and larger fires requiring outside assistance. Brief descriptions of each and how they are typically handled are provided below.

Small Working Face Fires

Approximately once a month Landfill staff respond to small fires at the working face. Landfill staff smother the fire by spreading dirt over it and therefore depriving the material of oxygen. These small fires are quickly extinguished and typically take less than 30 minutes to manage. Lithium batteries are responsible for most of these working face fires, but they can also be caused by compacting the waste (i.e., friction, compaction, puncturing, etc.) as well as the mixing and interaction of the waste itself.

Customer Vehicle Fires

Approximately once a quarter, a customer vehicle arrives at the Landfill with a smoldering or ignited load. These fires are generally caused by fire rubble, which is not monitored for 30-60 days before delivery to the Landfill and/or customers not alerting Landfill staff about the potential for a hot load.

Landfill staff direct the driver to bypass the scale and tip the material directly east of the scale in a grassy area. The designated area should already have an adequate amount of soil on the ground and be far enough away to prevent contact with other waste and/or flammable materials (i.e., tire chips, FML, etc.).

The tipped load is then covered with dirt and monitored for safety and operational impacts. The Fire Department sprays the tipped waste with water until there are no visible flames and minimal smoke. The Landfill then places dirt on top of the tipped material to help remove and prevent oxygen from getting to the material. The Fire Department sprays the pile with additional water.

The pile is left undisturbed for several days and then Landfill staff use a dozer to spread out the material to inspect for any smoldering. If the material no longer poses a fire hazard, it is transported to be incorporated into the working face material.

Larger Fires Requiring Outside Assistance – November 2024

At approximately 8:30pm, a resident contacted Mark White expressing concerns that the Landfill was on fire. Mark called Dan Chism. Dan coordinated with staff to return to the Landfill. An operator used the dozer to separate the burning materials and cover the area with clay. Communication went well between the City and Landfill staff since they were all on Spencer's channel. Upon the arrival of the Graettinger Fire Department, there was some confusion as to where the firefighters needed to be stationed. The firefighters wet down the area and the fire was completely extinguished in less than 1 hour.

Key Takeaways:

- A central meeting location would increase coordination for set-up and placement. Moving forward, the Landfill will designate the east side of the shop as the muster point for all responding personnel since it has a concrete pad and good lighting.
- Communication went quite well, but the Graettinger Fire Department could be better integrated in the process. Alpha Wireless has indicated that, since everyone can access Channel 8, that channel will be used moving forward to communicate during emergency events.

Larger Fires Requiring Outside Assistance – August 5, 2020

On August 5, 2020, at 5:30pm, the City of Spencer City Administrator was informed of a fire in one of the NPRL Landfill cells. The Landfill crew and contractors remained on-site to do what they could, but the Graettinger and Emmetsburg fire departments were dispatched soon after to provide assistance. The blaze was reported to be extinguished by 8pm, and one staff member remained behind to monitor hot spots. Even though it seemed like the fire was fully extinguished, the site of the fire did smolder for a month. There were no injuries at the scene and the cause of the fire remains unknown.

Key Takeaways:

- Communication went well between the City, Landfill, and Fire Department personnel as operations were set up early and continued throughout the response.
- Having only 1 entrance to the Landfill slowed the response time of the Fire Departments.
- Portable lighting should be available to aid emergency personnel in setting up and operating their equipment if natural lighting is insufficient during the fire. The Fire Departments are considering the purchase of LED light bars.
- An early fire detection system would have activated a faster firefighting effort and possibly eliminate the need for the Fire Department response.

2.0 LANDFILL 101

Generally speaking, landfills have been the primary means of handling solid waste for centuries. Over time, as safety and environmental rules have changed, the methods and procedures used to manage and operate MSW landfills have also greatly changed, especially over the last 50 years. Solid waste management facilities have evolved from disposal on virgin ground in town "dumps" and/or burn barrels in backyards to the highly engineered, designed, and regulated MSW landfills in operation today. Modern-day MSW landfills are now able to safely manage residential and industrial, commercial, and institutional (ICI) wastes in an environmentally sound manner.

2.1 LANDFILL REGULATIONS AND HISTORY

Solid waste disposal is regulated by two main acts of Congress: the 1965 Solid Waste Disposal Act and the 1976 Resource Conservation and Recovery Act (RCRA). Prior to the passing of these regulations, unmanned dump sites on the outskirts of cities were the common solid waste disposal method. According to the United States Environmental Protection Agency, the increasing number of environmental quality issues required further legislation. RCRA was passed to "…address the increasing problems the nation faced from our growing volume of municipal and industrial waste." The USEPA further states that RCRA, which amended the Solid Waste Disposal Act of 1965, set national goals for:

- Protecting human health and the environment from the potential hazards of waste disposal;
- Conserving energy and natural resources;
- Reducing the amount of waste generated; and
- Ensuring wastes are managed in an environmentally sound manner.

RCRA has been amended three times since its adoption in 1976: the Hazardous and Solid Waste Amendments of 1984, the Federal Facilities Compliance Act of 1992, and the Land Disposal Program Flexibility Act of 1996. Regardless of the details of each act and amendment, it is important to understand

that landfills are no longer unlined dump sites. They are now highly regulated and engineered facilities that handle the disposal of MSW in a manner that protects human health and the environment.

The most common type of landfill is the MSW landfill. According to the federal regulations (40 CFR 258), an MSW landfill is defined as a discrete area of land or an excavation-site that receives household waste, commercial solid waste, nonhazardous sludge, household hazardous waste (i.e., conditionally exempt small quantity generated waste), and industrial solid waste.

It should be noted that the federal regulatory design criteria for MSW landfills are sufficiently protective of the environment to allow receipt of other waste types including C&D and certain industrial wastes. It was the U.S. EPA's intention for the states to use the federal MSW landfill regulations as a guide for developing their own MSW landfill regulations tailored to the unique circumstances of each state; however, State regulation could not be less stringent than the federal regulation baseline.

2.2 MODERN MUNICIPAL SOLID WASTE LANDFILLS

Landfill regulations and responsibilities continue even after a landfill is closed. Regulations are in place to protect human health and the environment, namely, to allow for stable landfill structures that do not adversely affect groundwater, surface water, or air quality. The cost of properly permitting and engineering landfills is significant and the cost of constructing, operating, and closing a landfill is even greater. The construction of a 5-acre cell potentially costs from $1,500,000 to $4,000,000 or more due to the liner components, associated infrastructure, and third-party construction quality assurance. The layout and infrastructure associated with a modern MSW landfill are detailed below.

2.2.1 Classification of Landfills

Landfills may accept different types of waste including MSW, construction and demolition (C&D) wastes, and industrial, commercial, and institutional (ICI) wastes. Depending on permit requirements, solid waste facilities may bury these wastes in the same working face, or they may have dedicated, separate areas within the same MSW disposal unit for each waste type. Entities may also be set up to provide separate disposal units for MSW and C&D wastes, which may or may not be on landfill property. If a landfill is accepting only C&D wastes, the design, construction, operation, and closure criteria may differ from that of a traditional MSW landfill.

2.3 DESIGN AND INFRASTRUCTURE

Landfill facilities are required to be designed and permitted in advance of the actual construction. Current local, state, and federal regulations call for plans to be submitted that meet the applicable rules, reviewed by regulatory agencies, placed for public comment, and approved. Any one of those components can mean an extended timeframe from inception of a landfill design to approval of the layout and construction of the disposal space.

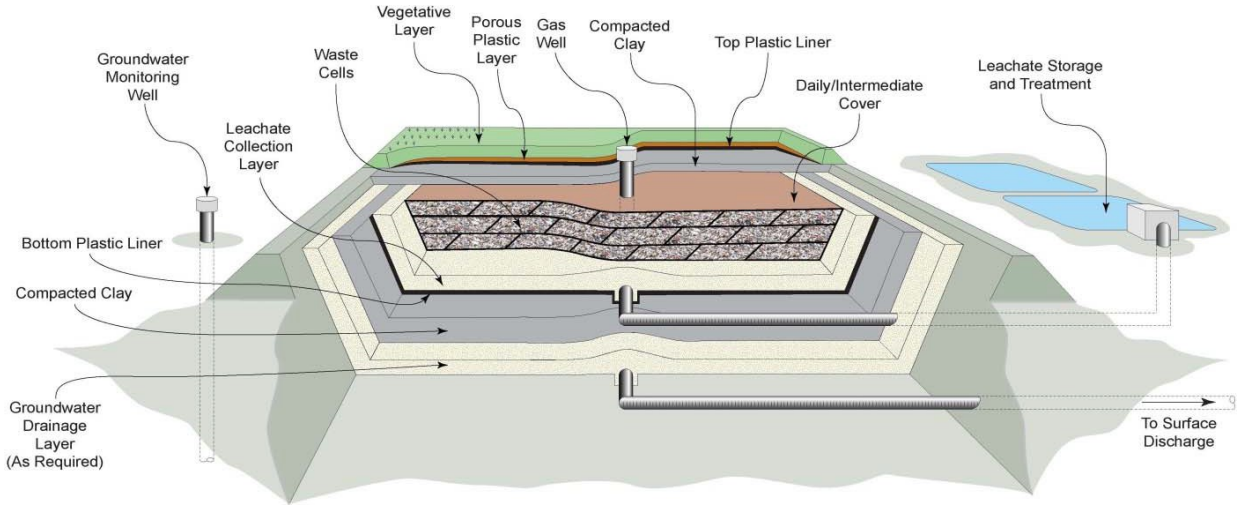
2.3.1 Construction

Federal regulations (40 CFR Part 258 Subtitle D) dictate the minimum standard to which landfills today can be constructed. Iowa adopted the Subtitle D standards so engineered landfills are often referred to as "Subtitle D". A rough cross-section of a landfill constructed to Subtitle D standards is detailed in **Exhibit 2-1** below. It is important to note that within Iowa, most landfills constructed before 2007 do not have the Bottom Plastic Liner or the Top Plastic Liner noted in **Exhibit 2-1**. Initial landfills in the early 1970s generally started by just dumping waste on the ground or in a trench (or ravine) and layering waste and dirt cover. No bottom liner or method of collecting leachate was included in the process of construction.

Facilities continuing to accept waste after October 9, 1993 were required to have a liner and leachate collection system in place to protect surface water and groundwater from leachate contamination. The liner

system in Iowa often consisted of four feet of compacted clay and a leachate collection system. Since most landfills in operation today have been in operation since the 1970s, they typically will have all three liner systems: unlined, clay-lined, and Subtitle D-lined areas.

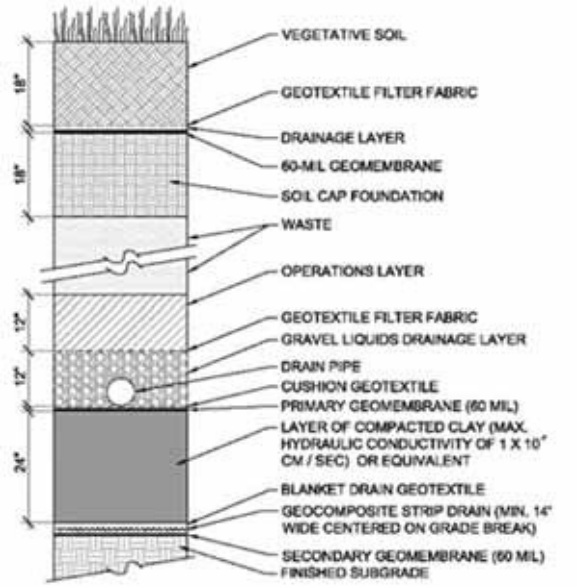
Exhibit 2-1. Anatomy of a Subtitle D Landfill



2.3.2 Landfill Liner

Federal regulations prescribe usage of a landfill liner, which is placed beneath the waste. Regulatory agencies at the state and/or local level may require more stringent liner requirements. Facilities have the option of utilizing the prescriptive design or submitting an alternative design. The prescriptive design consists of two components: an upper component of a minimum 30-mil flexible membrane liner (FML) and a lower component of a minimum two-foot layer of compacted soil with a hydraulic conductivity of no more than $1x10^{-7}$ cm/sec. The FML component is typically a sheet of 60-mil thick high density polyethylene (HDPE). Alternatively, a facility may use a clay-only liner if it can be demonstrated that the concentration values of a given set of parameters will not be exceeded in the uppermost aquifer at the approved point of compliance. Exhibit 2-2 provides a cross-section of a landfill liner and cap system.

Exhibit 2-2. Landfill Cap and Bottom Liner Systems



2.3.3 Leachate Collection System

Leachate is the liquid generated within a waste mass as decomposition occurs or as stormwater percolates through the disposed waste. Leachate may flow out of the waste by gravity or as the waste is compressed during compaction. The characteristics of landfill leachate can vary greatly depending on the composition of the waste. Leachate contains both dissolved (such as sodium and chloride) and suspended materials (such as waste materials or precipitates).

Leachate will take the path of least resistance within the landfill cell. It flows through pore space, cracks, and fissures within the waste. Modern landfills in non-arid climates are designed with a leachate collection system at the base of the landfill to not only collect the generated leachate and remove it from the cell, but also to protect surface and groundwater from leachate contamination.

To do this, most MSW landfills are designed using a "composite liner," which consists of a 2-foot layer of soil material compacted to meet a permeability standard and overlain with an impermeable flexible membrane liner (FML). The leachate collection system includes a layer of high permeability material placed above the FML, which is engineered to collect and convey leachate to a network of pipes and out of the landfill to a pump or storage facility. Collected leachate is then treated at a wastewater treatment plant and/or used on-site for leachate recirculation within the waste mass. Federal regulations require that the leachate collection system be designed and constructed to limit the depth of leachate over the liner to no greater than 30 centimeters (1 foot).

2.3.4 Groundwater Protection

Landfills are required to protect the surrounding environment. As such, groundwater monitoring wells are installed around the perimeter of the landfill to determine if there is any indication of constituents leaving the landfill in the groundwater. Depending on the specific site and conditions, these wells are typically sampled two times per year.

2.3.5 Gas Collection System

As disposed waste decomposes in an oxygen-deficient environment, large quantities of methane (which is highly flammable) and carbon dioxide are generated. Several factors including the waste composition, age of the in-place waste, moisture content, and temperature determine the quantity and quality of gas generated. Landfill gas (LFG) is approximately 50% methane and 45% carbon dioxide. Both methane and carbon dioxide are colorless and odorless, so any gas odor comes from the balance of constituents found in the LFG. MSW landfills are the third-largest source of human-related methane emissions in the United States, accounting for approximately 14.4% of these emissions in 2022 (EPA, 2022).

The remaining 5% of LFG is typically small amounts of nitrogen, oxygen, ammonia, sulfides, hydrogen, carbon monoxide, and non-methane organic compounds (NMOCs). Federal regulations require landfills that cross certain thresholds (based on existing waste in place and NMOC emissions) to collect and control LFG emissions.

The federal regulations require MSW landfill operators to monitor at least quarterly for methane in facility structures and for subsurface off-site migration. Exceedances of regulatory threshold methane concentrations require reporting, implementation of public safety measures, and remediation.

MSW landfills that accepted waste after November 8, 1987, are required to install gas collection and control systems if:

- The MSW landfill is a major source of HAPs (Hazardous Air Pollutants); or
- The MSW landfill is collocated with a major source of HAPs; or
- The MSW landfill is an area source of HAPs that has a design capacity of equal to or greater than 2.5 million Mg and 2.5 million cubic meters and has estimated uncontrolled NMOC emissions equal to or greater than 50 Mg/yr; or
- The MSW landfill is an area source of HAPs that has a design capacity of equal to or greater than 2.5 million Mg and 2.5 million cubic meters and includes a bioreactor and that is not permanently closed as of January 16, 2003.

The basic components of an LFG collection system include wells (horizontal collection lines and/or vertical wells installed into the waste mass). LFG collection systems are either passive extraction and/or an active (vacuum). For active systems, header and lateral piping are installed to connect the wells to a vacuum source. These components combine to collect the LFG.

There are a variety of methods to dispose of collected methane gas. Some examples include destruction of the methane by burning the gas with a flare or in an engine to generate electricity or converting LFG to compressed natural gas (CNG) for use in alternative fuel vehicles or to be added to natural gas pipelines.

Facilities that have not yet reached these thresholds may still choose to install LFG collection systems for various other reasons (i.e., available end-user, groundwater contamination issues, landfill odors, stressed vegetation, etc.). These smaller systems can be active or passive. Passive systems may include flares placed on leachate collection wells or vents (see **Figure 2.1**) drilled into the landfill substrata and vented with no active system pulling on the gas.

Figure 2-1. Landfill LFG Vent

2.3.6 Landfill Cells

While a landfill facility may have an overall disposal design plan ranging from 10 to 100 acres, disposal area construction occurs in smaller increments called landfill cells. A letter or number designation is typically used to denote the area or cell names. Due to several factors, landfills may not be constructed sequentially by cell nomenclature (Cell 1 A, 1 B, etc.) but in any case, cell numbers typically provide a method to identify past, current, and future disposal areas.

2.3.7 Active Landfill Area (Working Face)

The active landfill area is the portion of the landfill where waste may still be placed. These are areas that have remaining capacity for disposal operations. It is the location where the placement, compaction, and cover operations are currently occurring. The working face is a very busy location with heavy traffic and different-sized vehicles present. Large pieces of heavy equipment (i.e., bulldozers, compactors, large dump trucks, and trailers) along with a mix of pickup trucks and cars with small utility trailers are at and around the working face. Site staff together with customers (people with varying degrees of operational awareness) make for a potentially dangerous mix. Waste is compacted as it is placed, so there is typically a solid base for heavy equipment to drive over. However, during wet conditions, movement at the working face and access roads can become more challenging.

2.3.8 Borrow Area

Federal and state regulations require a minimum of a six-inch soil cover to be placed over the working face at the end of each day. In some cases, alternative cover, such as a tarp or spray-on cover, is approved. If an alternative cover is approved, the facility is typically required to cover the working face with the minimum six inches of soil one time per week. In addition, soil is used for both the construction of cell liners and closure covers. Because landfills require significant amounts of soil, they typically establish borrow areas on-site where this soil is removed for use. Ideally, the borrow area is close to the active cell as well as the future landfill expansion area.

2.3.9 Future Expansion Area

A landfill generates revenue to operate through the disposal of waste. One way to look at the potential revenue is to calculate “air space”. Cubic yards of air space are the commodity a landfill facility sells. This is the permitted and constructed space (cubic yards of air space) available for the disposal of solid waste. Accordingly, landfills plan long in advance to ensure sufficient air space is available to generate revenue. landfills prepare by investigating land ownership options, applying for and complying with local, state, and federal permitting regulations, and continuing to meet local zoning requirements to ensure uninterrupted disposal services. Therefore, depending on the remaining life of the landfill, there may be significant acreage surrounding the current active area that is owned by the landfill entity.

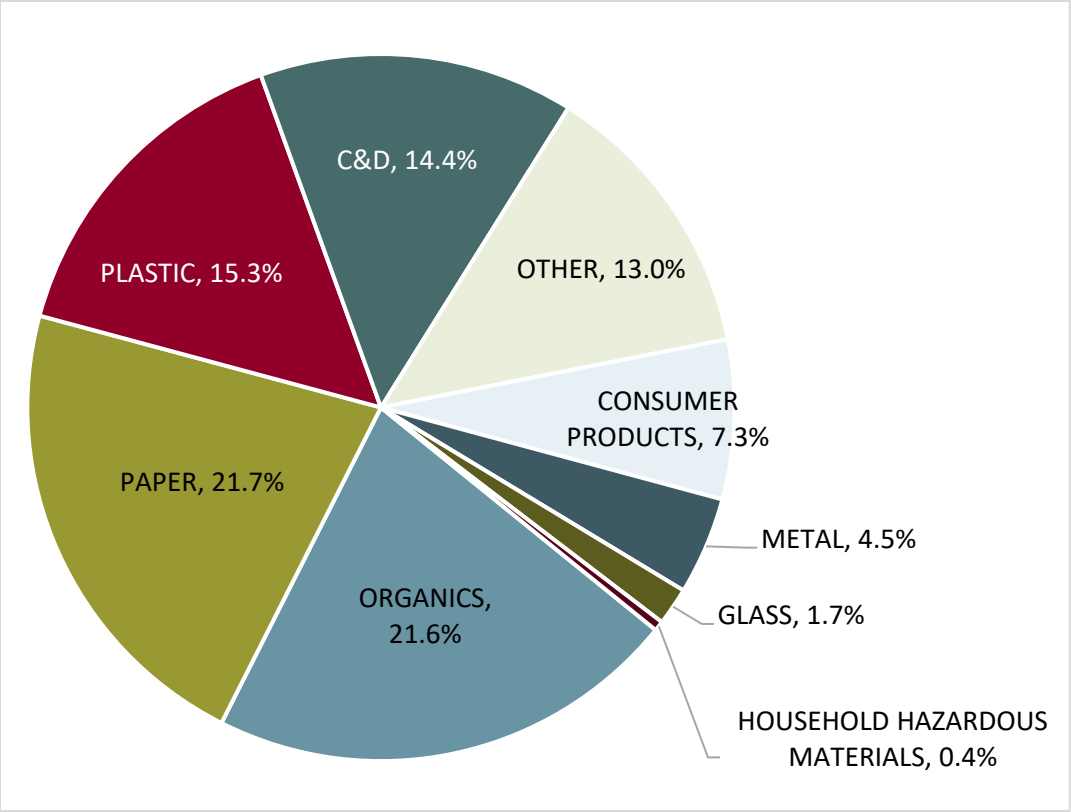
2.4 ACCEPTED AND PROHIBITED WASTES

2.4.1 Accepted Wastes

Federal Code of Regulations 40 CFR §258.2 includes the definition of various wastes. These include MSW or household waste, RCRA Subtitle D waste (such as commercial solid waste), non-hazardous sludge, small quantity generator waste, and industrial solid waste. Commercial solid waste is further defined as “… all types of solid waste generated by stores, offices, restaurants, warehouses, and other non-manufacturing activities, excluding residential and industrial wastes.” MSW landfills are permitted to accept and dispose of all these wastes.

The Iowa DNR performed a waste characterization study in 2022 to better understand the composition of MSW. The breakdown of major material types identified is shown in percentages in **Exhibit 2-3** below. This is only a representation of the MSW managed in the state at the time of year in which the study was performed, which can influence the composition of the identified waste.

Exhibit 2-3. 2022 Iowa Waste Characterization Study – Overall Statewide MSW Material Composition



Despite regulations and trained/certified landfill operators overseeing disposal operations, unknown and potentially dangerous items still find their way into the landfill. Older landfill sections filled before today's stringent regulations can also harbor items that will require extra caution should a fire event occur in those locations. The key is to be aware that there will always be unknowns.

2.4.2 Prohibited Wastes

Federal Code of Regulations 40 CFR §258.28 (liquids), 40 CFR §258.261 (regulated hazardous wastes), and 40 CFR §258.761 [polychlorinated biphenyls (PCBs)] list wastes that are prohibited from disposal at MSW landfills. Liquid wastes are prohibited unless it is a household waste other than septic waste or leachate/gas condensate derived from the MSW landfill. Regulated hazardous wastes are not permitted for disposal at an MSW landfill. Hazardous waste is defined and listed in detail in 40 CFR §258.261.3.

State regulatory agencies may further define items prohibited for disposal in landfills within their region. The local governing authority of a landfill may also set additional restrictions on acceptable waste for disposal. State and local bans may include items such as televisions, electronic waste, car batteries, motor oil, tires, white goods (washers, dryers, stoves, and refrigerators), yard waste, and cardboard. It is important to note that due to the age of the facility and the regulations in place at the time of disposal, materials that are prohibited for disposal today may have been accepted in the past.

Despite load screening procedures, some items may remain hidden. It is impossible to identify every item being disposed of at the landfill. Keep this in mind and exercise extreme caution when working in or around waste as explosives, flammable gas, liquid or solids, oxidizers, poisons, corrosive materials, and even low-level radioactive materials may be present. These materials present additional hazards when involved in a fire.

2.4.3 Yard Waste

Most landfills no longer accept yard waste (e.g. brush, trees) across the US because not only does it generate harmful methane gas and acidic leachate, but it also takes up valuable landfill space. Some landfills do accept yard waste as an alternative daily cover (ADC) component or a biofiltration media for petroleum-contaminated soil (PCS) treatment.

Yard waste is prohibited from being disposed of in Iowa landfills without a specific exemption from the Iowa Department of Natural Resources (DNR). The Landfill does not accept yard waste for disposal.

2.5 SUPPORT FACILITIES AND SERVICES

MSW landfills are typically co-located on a property with other structures and service offerings. These facilities typically include, at a minimum, a scalehouse and a maintenance shop. The scalehouse identifies and weighs all incoming and outgoing vehicles to determine fees and placement for disposal. The maintenance shop performs regular maintenance of and repairs for landfill equipment. Other structures may include administrative offices and a facility that accepts and processes recyclable materials.

3.0 NATIONAL INCIDENT MANAGEMENT SYSTEM AND INCIDENT COMMAND STRUCTURE

To have a uniform command structure when addressing emergency situations, the Homeland Security Presidential Directive (HSPD) 5, "Management of Domestic Incidents" directed the Secretary of Homeland Security to develop and administer a National Incident Management System (NIMS) and a National Response Framework (NRF). According to the United States Federal Emergency Management Agency (US FEMA), NIMS:

… provides a consistent nationwide template to enable Federal, State, tribal, and local governments, nongovernmental organizations, and the private sector to work together to prevent, protect against, respond to, recover from, and mitigate the effects of incidents regardless of cause, size, location, or complexity in order to reduce the loss of life and property and harm to the environment.

NIMS itself is not an operational incident management or resources allocation plan; rather it represents a core set of doctrines, concepts, principles, terminology, and organizational processes that enable effective, efficient, and collaborative incident management.

NIMS outlines the Incident Command System (ICS), which is a standardized approach to incident management that:

- Enables a coordinated response among various jurisdictions and agencies.
- Establishes common processes for planning and managing resources.
- Allows for the integration of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure.

This portion of the Plan is not intended to be a complete course on IS-100.b: Introduction to Incident Command System, ICS-100 or IS-700.a: National Incident Management System (NIMS) An Introduction. While public officials and emergency responders attending this course have already been through these full courses, an abbreviated overview will be presented here for Landfill staff. The full training is available on FEMA's website as an independent study if there is interest in taking the course for the first time or as a refresher.

Content for this section includes direct quotes and paraphrasing of information obtained from the FEMA website (FEMA, 2014).

3.1 INCIDENT COMMAND STRUCTURE (ICS)

The goal of NIMS is to provide a consistent and systematic approach to emergency response. The key aspects and ideology of the program are listed below. These goals are achieved through the development ofprotocols, adding qualifications or certifications, and training to ensure awareness of the procedures. The components listed are communication and information management, resource management, and command and management. These three components were designed to work together, not independently of each other, and are explained in further detail below.

3.1.1 Communications and Information Management

Communication is important to respond effectively as a team. Individuals should not only know what they are supposed to do but also what others around them are trying to accomplish. The NIMS system is based on assigning tasks to different teams or individuals who, when properly communicating, can resolve issues quickly and safely, limiting costs and loss of property. Effective communication can be accomplished through meetings at a common command post before tasks are performed.

3.1.2 Resource Management

Resources (e.g., personnel, equipment, or supplies) are needed to effectively combat a landfill fire. The management and supply of necessary resources must be well coordinated and be able to adjust for changing situational needs. NIMS develops the framework for mechanisms of resource management to identify needs, acquire needed resources, mobilize, track, report, and recover from an incident.

3.1.3 Command and Management

The command and management portion of NIMS is there to ensure control and coordination between all parties involved. The Incident Command System (ICS), multiagency coordination, and public information are the pillars that establish proper command and management of any situation.

3.1.4 Incident Command Features

The ICS has developed common terminology to improve communications between entities and within a company. The terminology used is described throughout this section in bullet points.

- Organizational Functions: Major functions and functional units with incident management responsibilities are named and defined. Terminology for the organizational elements is standard and consistent.
- Resource Descriptions: Major resources – including personnel, facilities, and major equipment and supply items – that support incident management activities are given common names and are "typed" with respect to their capabilities to avoid confusion and to enhance interoperability.

- **Incident Facilities:** Common terminology is used to designate the facilities in the vicinity of the incident area that will be used during the incident.

Plain language should be used when identifying a specific incident. This aims to get away from the common coding system used by local law enforcement to identify situations. Rather than saying "We have a 10-33 on ABC Street" an officer should say "There is an audible alarm sounding on ABC Street." This prevents any confusion while eliminating the limited specificity of the code system.

Establishing and/or transferring command should be clearly established from the beginning of initiating ICS. It must be clear who is in charge and who will be in command in the event of their absence. The Incident Commander (IC) should be the one who has responsibility for the location and the skills to guide their team to a quick and successful incident resolution. If command is transferred, be sure that everyone involved is informed by either radio or a meeting. NIMS provides several forms to be used for the necessary documentation throughout an event. ICS 203 Organization Assignment List may be used for establishing the IC and ICS 210 Resource Status Change can be used for transferring the IC position. These forms are available at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://training.fema.gov/emiweb/is/icsresource/assets/ics%20forms/ics%20form%20203,%20organization%20assignment%20list%20(v3).pdf.

- **Chain of Command:** Chain of command refers to the orderly line of authority within the ranks ofthe incident management organization.
- **Unity of Command:** Unity of command means that all individuals have a designated supervisor to whom they report at the scene of the incident.

All personnel must know who is above and below them in the chain of command. This will eliminate the chance for conflicting orders and the confusion of which one to carry out. It is important for other organizations involved to accept a unified command so parties can act in unison. Problems can arise when different jurisdictions act differently without having a common leader. This can lead to working against each other's goals rather than together to meet a common goal. The ICS for responding to a Landfill fire is included in **Appendix A**.

During the conception of an incident, after command has been established, entities should have a meeting to discuss the goals of their incident response. Which groups will work towards certain objectives? What smaller objectives can be managed to realize a larger one? These are key questions when setting objectives that will lead to the overall success of the ICS. Always have objectives and the responsible parties documented by the recorder. The ICS forms 201 and 202 can be used to assist with this planning and documentation.

An IAP is a guide for all tasks personnel should be working towards. It should be clear and concise, with details on communications, objectives, and strategies. Not all incidents will require a written plan because some small incidents can be resolved with a quick verbally communicated IAP. As incidents become more complex, the IC should consider developing a written IAP. The available ICS forms including notation on those typically included in an IAP are listed in **Table 3-1** below.

Table 3-1. ICS Forms and Descriptions

Form Number	Form Title	Description
ICS 201	Incident Briefing	Provides the Incident Command/Unified Command and General Staffs with basic information regarding the incident situation and the resources allocated to the incident. This form also serves as a permanent record of the initial response to the incident.
*ICS 202	Incident Objectives	Describes the basic strategy and objectives for use during each operational period.
*ICS 203	Organization Assignment List	Provides information on the response organization and personnel staffing.
*ICS 204	Assignment List	Used to inform personnel of assignments. After Incident Command/Unified Command approves the objectives, staff members receive the assignment information contained in this form.
*ICS 205	Incident Radio Communications Plan	Provides, in one location, information on the assignments for all communications equipment for each operational period.
**ICS 205A	Communications List	Records methods of contact for incident personnel.
*ICS 206	Medical Plan	Provides information on incident medical aid stations,transportation services, hospitals, and medical emergency procedures.
ICS 207	Incident Organizational Chart	Presents flow chart of the incident chain of command.
**ICS 208	Safety Message/Plan	Safety Plan
ICS 209	Incident Status Summary	Summarizes incident information for staff members and external parties and provides information to thePublic Information Officer for preparation of media releases.
ICS 210	Resource Status Change	Used when a resource is transferred from one task to a new task.
ICS 211	Check-In List	Used to check in personnel and equipment arriving at or departing from the incident. Check-in/out consists of reporting specific information that is recorded on the form.
ICS 213	General Message	Used by: Incident dispatchers to record messages, EOCand other incident personnel to transmit, Incident personnel to send notifications in writing.
ICS 214	Activity Log	Provides a record of unit activities. Unit Logs canprovide a basic reference from which to extract information for any After-Action report.

Form Number	Form Title	Description
ICS 215	Operational Planning Worksheet	Documents decisions made concerning resource needs for the next operational period. The Planning Section uses this worksheet to complete Assignment Lists and the Logistics Section uses it for ordering resources for the incident.
ICS 215A	Incident Action Plan Safety Analysis	Communicates to the Operations and Planning Section Chiefs safety and health issue identified by the Safety Officer.
ICS 218	Support Vehicle and Equipment Inventory	List of equipment able to be utilized.
ICS 219	Resource Status Cards	Used by the resources unit to record the status and location of resources and equipment.
ICS 220	Air Operations Summary	Provides information on air operations including the number, type, location, and specific assignments of helicopters and fixed-wing aircraft.
ICS 221	Demobilization Check-Out	Used to ensure that resources leaving the incident have completed their assignments and provides the planning section documentation of the release.
ICS 225	Personnel Performance Evaluation	Used to evaluate the performance of individuals or teams.
*ICS 230	Meeting Schedule	Schedules operational period meetings and briefings information.

Table 3-1 Notes:

1. The ICS Forms identified with an asterisk (*) are typically included in an IAP.
2. Forms identified with two asterisks (**) are additional forms that could be used in the IAP.
3. The other ICS Forms are used in the ICS process for incident management activities but are not typically included in the IAP.
4. The date and time entered in the form blocks should be determined by the Incident Command or Unified Command. Local time is typically used.

Depending on the size and complexity of the incident, modular organization of the chain of command can be established. Teams are based on function and might consist of a firefighting team, a logistics team, an administrative team, etc. All groups are covered by the blanket of the IC or unified command but have the authority to command within their group to accomplish their assigned objectives. The number of groups can be adjusted as the incident either grows or shrinks in complexity. To maintain proper control and supervision of their team, group leaders should have no more than five team members. All team members must discuss

with their supervisor any potential action before they act differently than what has been previously communicated.

It is important to know what resources are available or potentially available for use. All resources including personnel, equipment, facilities, organizations, etc. should be well communicated. When more resources are needed, there should be a plan in place to procure the additional items or personnel. Facilities in close proximity to the incident should be made available for all involved parties. IC shall designate certain facilities as the ICP, bases or camps, staging areas, distribution points, and triage areas. Different designations can be made as needed.

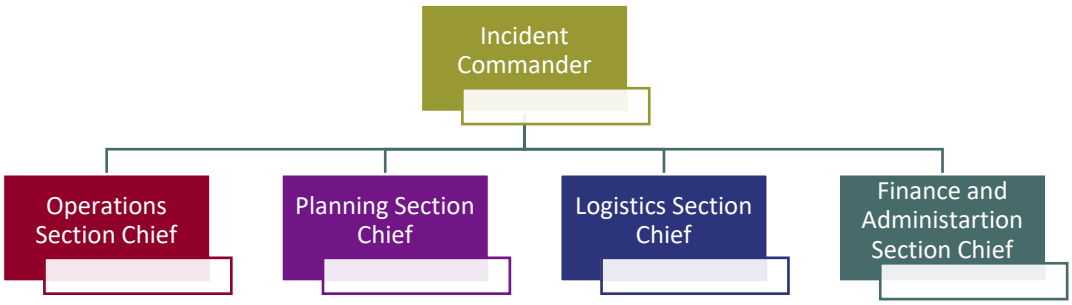
Means of communication with key personnel should be well documented using the ICS forms 205 and 205A or similar documents. These are readily accessible online through the FEMA webpage. 205A is a general communication guide, listing all key personnel's contact information, role, and best method of communication. Since many incidents are handled via radio communication, ICS 205 has been developed specifically for radio communications. This form shows the frequencies in which people can be reached and what their function is in the IC.

It is also a good idea to establish a way of sharing information and documents between entities. This is easily accomplished with today's technology by either email or shared networks located on the incident site.

3.1.5 Northern Plains Regional Landfill ICS

The ICS in **Exhibit 3-1** was developed to help organize and coordinate resources should a fire requiring external assistance occur at the Northern Plains Regional Landfill.

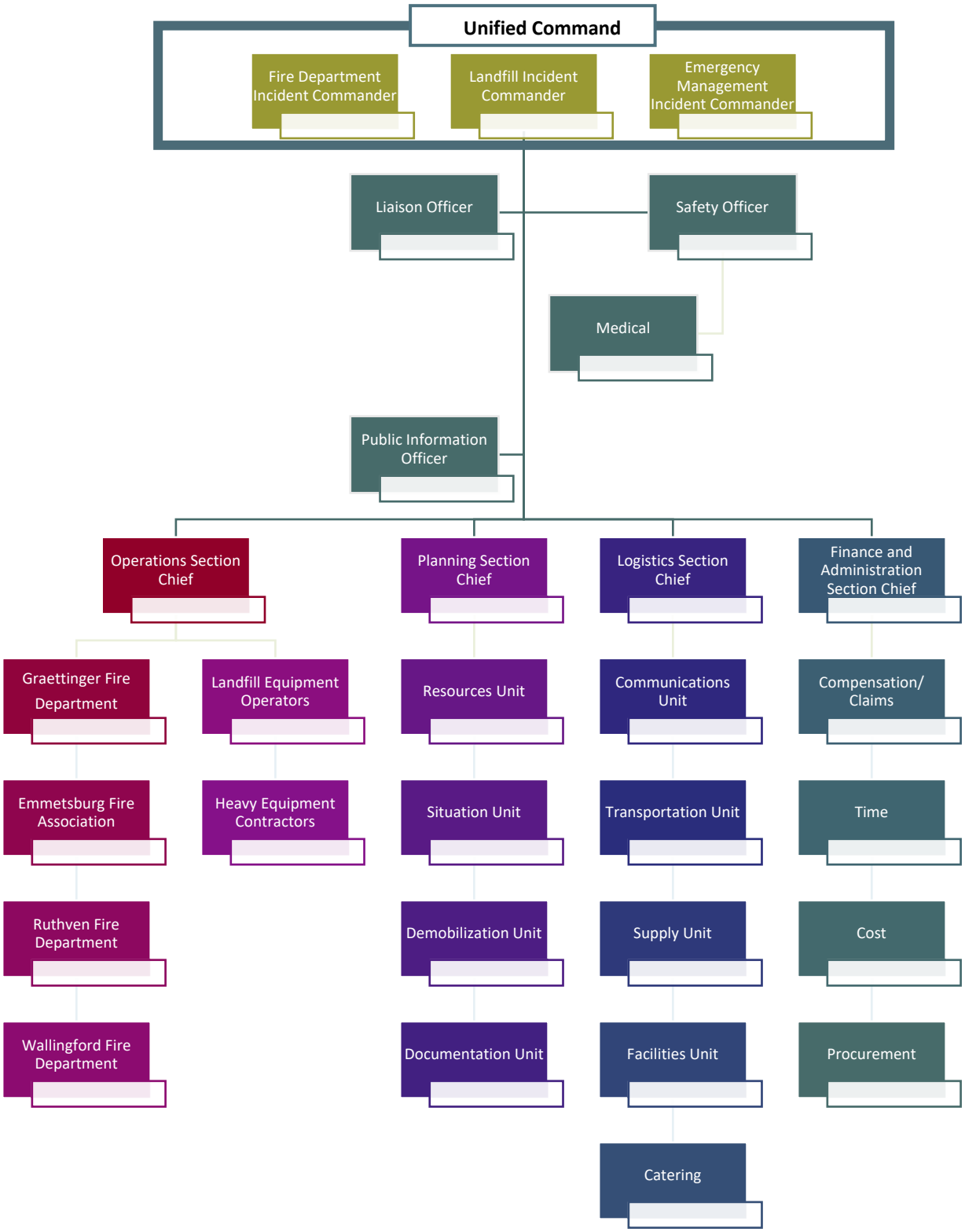
Exhibit 3-1. Incident Command Structure



In recognition of the solid waste engineering expertise required to effectively combat a large Landfill fire, the Landfill staff will need to work closely with responding personnel. For this reason, emergency response to incidents that may occur at the Landfill will implement a Unified Command System (UCS) in lieu of a single ICS. This is to say that while site command will be delegated to a single individual, decisions made as the response evolves will include a joint effort of the fire scene commander and the ranking representative from the Landfill. The command relationship is further described in **Section 3.1.3**.

Several key groups will operate within the individual ICS sections. **Exhibit 3-2** illustrates the UCS that will be implemented in response to large Landfill fires. A brief description of some of the roles within the UCS is discussed further below.

Exhibit 3-2. Unified Command Structure



Within the Operations Section, the Firefighting Group and Landfill Facilities Group will work to combat the fire. The Planning Section, Engineering Support Group, and Regulatory Affairs Group will provide technical information and guidance to the Unified Command and Operations Sections. A Director of Communications (DOC), Health & Safety Officer (HSO), and various liaisons are typically included in the command structure as well, and report directly to the UCS. Each section and position are described in further detail in **Section 3.2**.

Blank Incident Command Structure and Unified Command Structure forms are located in **Appendix A**.

3.2 ICS ROLES AND RESPONSIBILITIES

Most incidents can be solved by in-house personnel, like a small working face fire. However, sometimes incidents get too large and partnerships among local, state, and federal agencies, as well as nongovernmental and private-sector organizations, may be required. As partners, all parties must respond together toward a common objective.

The ICS helps ensure response efforts are well communicated and therefore, coordinated. ICS is a standardized, on-scene, all-hazards approach to incident management. ICS allows all responders to adapt to an authority structure that matches the complexities and demands of the incident while respecting agency and jurisdictional authorities. Although ICS promotes standardization, all situations are different, and the system should be expanded or contracted according to the situational requirements. This section will detail the proper ICS in the event of a landfill fire. This includes a variety of teams that will coordinate their efforts to control and eliminate the fire hazard.

3.2.1 Management Functions

Five major management functions need to be covered for an incident: command,operations, planning, logistics, and finance and administration.

- **Command** sets the incident objectives, strategies, and priorities and has the overall responsibility for the incident.
- **Operations** conducts the operations necessary to reach the incident objectives. Operations establishes tactics and directs all operation resources.
- **Planning** supports the incident action planning process by tracking resources, collecting/analyzing information, and maintaining documentation.
- **Logistics** arranges resources and services to support the achievement of the incident objectives.
- **Finance and Administration** monitors costs related to the incident and provides accounting, procurement, time recording, and cost analysis.

Depending on the size of an incident, the IC may handle all the management functions. As the size of the incident grows, management functions can be delegated. The IC can expand their command staff to include a Public Information Officer, Safety Officer, and Liaison Officer. Again, these should only be utilized if the magnitude of the incident does not allow the IC to handle all the functions. When utilized, the expanded command staff may take on the following functions:

- **Public Information Officer** serves as the conduit for information to internal and external stakeholders, including the media, stakeholders, and the public.
- **Safety Officer** monitors safety conditions and develops measures for ensuring the safety of all incident personnel.
- **Liaison Officer** serves as the primary contact for other agencies assisting during an incident.

3.2.1.1 Command Section

The Incident Commander (IC) has the overall responsibility for managing the incident by creating a plan of action and delegating tasks to the correct people. As previously stated, the five major components of ICS include command, operations, planning, logistics, and finance/administration as needed. The IC's key roles are to ensure safety, provide information to external teams, and communicate with other agencies. In the case of a fire at the Landfill, the chain of command may look like the ICS included in **Appendix A**.

If a more qualified IC arrives and assumes command, a jurisdiction or agency is legally required to take command, or if the incident changes in complexity, a transfer of command may occur. The transfer of command must include a briefing which may be oral, written, or a combination of both. An IC has the authority to elect a Deputy IC as an advisor and as a clear designation of who is in command in the event of the IC's absence.

The general staff are responsible for covering the other four major management functions required for an incident: operations, planning, logistics, and finance/administration. An individual may be placed over each of these sections and assigned the title of General Staff, or Section Chief. These individuals report directly to the IC. The IC will also determine if an event is large enough to warrant these general staff positions or if the IC will cover this position. Likewise, these positions may be further expanded if warranted. A brief description of the function of each General Staff Section Chief is included below.

3.2.1.2 Operations Section

The Operations Section Chief is responsible for developing and implementing strategies and tactics to accomplish the incident objectives. This means that the Operations Section Chief organizes, assigns, and supervises all the tactical or response resources assigned to the incident. Additionally, if a staging area is established, the Operations Section Chief would manage this area.

The Operations Section includes the Firefighting Group and the Landfill Facilities Group which will work together to respond to fires. Other agencies or personnel may be assigned to the Operations Section at the discretion of the Unified Command.

3.2.1.2.1 Firefighting Group

The Firefighting Group will be composed of trained professional and/or volunteer firefighters belonging to one of the responding departments. Under the command of the Fire Scene Commander or their designee, the Firefighting Group will conduct the fire attack utilizing available apparatuses and materials.

In addition to the fire attack, the Firefighting Group will monitor surface temperatures using thermal imaging equipment during and after the active response to the fire. Spotters will work in conjunction with the Landfill Facilities Group to identify developing hazards such as hot spots, sinkholes, or other stability issues.

3.2.1.2.2 Landfill Facilities Group

The Landfill Manager or other designee assigned by the Landfill Manager will serve as the Landfill Facilities Group leader.

The Landfill Facilities Group includes not only the Landfill personnel and equipment on-site, but also mobilized resources from other City and/or County departments, and contracted companies utilizing heavy equipment during the response. Excavators, bulldozers, scrapers, dump trucks, and other "heavy iron" assets are expected to be utilized during the response.

Typical tasks for the Landfill Facilities Group include but are not limited to:

- Trenching to create fire breaks or expose material
- Excavating and piling hot or burning material to facilitate application of water or foam
- Excavating, transporting, and applying soil to smother burning material
- Providing spotters to identify potential weak points developing in the Landfill cell, such as sinkholes or cracks

Operating heavy equipment in the vicinity of a Landfill fire requires specific training and safety precautions that exceed the typical training equipment operators receive. Only properly trained and equipped operators will be allowed into the scene, as determined by the Unified Command, HSO, and Landfill policies.

3.2.1.3 Planning Section

The Planning Section includes the Engineering Support Group and the Regulatory Affairs Group. Other agencies or personnel may be assigned to the Planning Section at the discretion of the Unified Command.

The Planning Section Chief oversees the collection, evaluation, and dissemination of operational information related to the incident. It is the Planning Section's responsibility to prepare and disseminate the IAP, as well as track the status of all incident resources. The Planning Section Chief provides responders with accurate information and other resources like maps and floor plans.

3.2.1.3.1 Engineering Support Group

The Engineering Support Group is comprised of, at a minimum, one facility staff member familiar with the design, construction, and operation of the Landfill and operational areas. It is anticipated that one or more representatives from engineering firms who have participated in the design or construction of the Landfill or operational areas will also be called to assist in the response.

The Engineering Support Group is charged with providing pertinent design and historical information to assist in the firefighting effort. Additional responsibilities may include identification of soil borrow or disposal areas required during the response.

3.2.1.3.2 Regulatory Affairs Group

Several regulatory agencies may become involved as a result of a Landfill fire. The Regulatory Affairs Group is responsible for advising the Unified Command of potential regulatory requirements arising from the response and, in particular, notification requirements. At the discretion of the Unified Command, the Regulatory Affairs Group may interface directly with representatives from public health and environmental agencies. Information releases from the Regulatory Affairs Group will be screened by the Director of Communications (DOC) under the direction of the Unified Command.

3.2.1.4 Logistics Section

The Logistics Section Chief is responsible for providing facilities, services, and material support for the incident. Logistics is critical for more complex incidents. The Logistics Section Chief assists the IC and Operations Section Chief by providing the resources and services required to support incident activities. During an incident, the Logistics Section Chief is responsible for ensuring the well-being of responders by providing sufficient food, water, and medical services. The Logistics Section Chief is also responsible for arranging communication equipment, computers, transportation, and anything else needed to support the incident response.

Personnel assigned to the Logistics Section by the Unified Command are responsible for providing material support to every facet of the response. Some logistical needs may be met internally by responding entities, such as bunker gear and self-contained breathing apparatus (SCBA) for fire department personnel. As supplies become exhausted or additional needs are identified, the Logistics Section will work to meet the developing needs.

Critical needs anticipated for a large fire response include but are not limited to:

- Water tenders to supply the firefighting effort
- Air pack refilling (mobile air)
- Sanitary facilities
- Food and beverages
- Expendable health and safety supplies
- Additional staff

3.2.1.5 Finance Section

The Finance and Administration Section Chief is responsible for the financial and cost analysis aspects of an incident. These include contract negotiation, recording personnel and equipment time, documenting and processing claims for accidents and injuries occurring at the incident, and keeping a running tally of the costs associated with the incident.

The Finance Section will include a representative from Palo Alto County with the authority to contract for response needs. The Finance Section leader will seek approval for larger procurements from the Solid Waste Department Director, who is part of the Unified Command.

In addition to procurement, the Finance Section is responsible for tracking cost information to include but not limited to staff hours, materials consumed, and equipment utilized on-site. The Finance Section will work with all responding agencies to identify critical cost tracking information to the maximum extent possible.

3.2.1.6 Additional Staff

Depending on the complexity of the incident, additional command staff may be assigned to certain objectives. As previously noted, the expanded command staff positions include the Director of Communications, Safety Officer, and Liaison Officer.

3.2.1.6.1 Director of Communications

No communication with the public, and particularly members of the media, is authorized without the consent of the Unified Command and/or the DOC. The DOC will serve as the primary point of contact for members of the media and the general public.

During the response, the DOC is expected to hold regular meetings with the media to explain the response progression, any potential hazards the public should be aware of, and when the Landfill area is expected to resume normal or modified operations.

3.2.1.6.2 Health & Safety Officer

Depending on the size of the response, a team of health & safety professionals may be required to support site activities. At a minimum, an HSO will be assigned who has the requisite training and experience to determine the need for and suitability of personnel protective equipment (PPE) and monitoring equipment that may be required.

Air quality at the scene poses the greatest concern for responders during a Landfill fire. The HSO, in consultation with on-site Fire Departments, will be responsible for directing placement of air quality monitors at the site to protect responders and, if appropriate, around the site to protect the public. The HSO will also determine PPE needs and enforce compliance with health and safety requirements on-site to include proper medical monitoring of responders. Rest, hydration, and staff rotation should also be considered.

Responding fire departments are expected to manage their own PPE requirements, enforce compliance, and provide medical monitoring in accordance with fire department standard operating procedures (SOPs). Fire departments will also be requested to support medical monitoring to other responders. The incident HSO maintains authority over all safety issues on-site.

3.2.1.6.3 Liaison Officer

The Unified Command will appoint liaisons to various agencies or organizations on an as-needed basis depending on scene conditions. Liaisons may report directly to the Unified Command or one of the various sections or groups.

3.2.2 Other NIMS Definitions

Other items that are discussed throughout this Plan are briefly noted below.

3.2.2.1 Chain of Command

A clearly stated, orderly line of authority is needed to properly respond to an incident. Election of an IC to direct and control personnel will help in resolving the problem quickly and efficiently. This will also help avoid any confusion concerning who is in control. Regardless of who the commander is, all input from any level of the chain of command should be considered. Many personnel may have experience with the situation and their opinion could be very influential. The IC position should be given to the most qualified individual to handle the specific situation or to an agency legally required to take control of the situation.

3.2.2.2 Unified Command

NIMS encourages the use of Unified Command, which consists of the ICs from the various jurisdictions or agencies operating together to form a single command structure in the field. When implemented properly, Unified Command enables agencies with different legal, geographic, and functional responsibilities to coordinate, plan, and interact effectively.

The ICs within the Unified Command make joint decisions and speak as one voice. Any differences are worked out within the Unified Command. Unity of command is maintained within the Operations Section. Each responder reports to a single supervisor within his or her area of expertise and assignment.

When more than one agency has incident jurisdiction, or when incidents cross political jurisdictions, the use of Unified Command enables multiple organizations to perform the functions of the Incident Commander jointly. Each participating partner maintains authority, responsibility, and accountability for its personnel and other resources while jointly managing and directing incident activities through the establishment of a common set of incident objectives, strategies, and a single Incident Action Plan (IAP).

3.2.2.3 Incident Action Plan (IAP)

An IAP formally documents incident control objectives, operational period objectives, and the response strategy defined by incident command during response planning. It contains general tactics to achieve goals and objectives within the overall strategy, while providing important information on event and response parameters. Equally important, the IAP facilitates dissemination of critical information about the status of response assets themselves. Because incident parameters evolve, action plans must be revised on a regular basis (at least once per operational period – or once every shift) to maintain consistent, up-to-date guidance across the system.

3.2.2.4 Incident Command Post (ICP)

The ICP is a predefined temporary facility and signifies the physical location of the tactical-level, on-scene incident command and management organization. It typically comprises of the IC's immediate staff and may include other designated incident management officials and responders from federal, state, local, and tribal agencies, as well as private-sector, nongovernmental, and volunteer organizations.

Typically, the ICP is located at or in the immediate vicinity of the incident site and is the focus for the conduct of direct, on-scene control of tactical operations. Incident planning is also conducted at the ICP; an incident communications center would also normally be established at this location. The ICP may be co-located with the incident base, if the communication requirements can be met. The ICP may perform functions similar to a local Emergency Operations Center in the context of smaller jurisdictions or less complex incident scenarios. It is commonly marked with a green emergency light, to be identified from a distance.

3.2.2.5 Public Information Officer (PIO)

The PIO Position is based on the following three principles:

- PIO supports the Incident Command.
- Public information functions must be coordinated and integrated across jurisdictions and across functional agencies; among federal, state, local, and tribal partners; and with private-sector and nongovernmental organizations.
- Organizations participating in public information coordination retain their independence.

When an incident occurs, the relevant agencies or departments are dispatched to the scene. The lead agency assumes IC and a PIO is designated. Usually, this person is a full-time PIO whose role in an incident has been predetermined in emergency plans and standard operating procedures.

The PIO is a key staff member supporting the ICS. The PIO advises and represents the Incident Command on all public information matters relating to the management of the incident.

3.2.2.6 Joint Information Center (JIC)

The Joint Information Center (JIC) is one way to ensure the coordination of public information. The JIC can be designated as a central location where information can be coordinated and integrated across jurisdictions and agencies, government partners, the private sector, and nongovernmental agencies.

3.2.3 After-Action Reports

Recording and documenting incidents plays a critical role in improving team response to future incidents. The After-Action report is a great development tool for a more precisely defined NIMS and ICS in the event of future fires. The report can also help the operators learn what mistakes may have been made during the incident.

The After-Action report should include:

- Probable/most likely cause of the fire

- Date and time of detection
- Any photos taken
- How was the command handled?
- Who was involved (names, organizations, governments, etc.)?
- Fire containment strategies used and their effectiveness
- Fire extinguishing methods used and their effectiveness
- How long did it take to contain? Extinguish?
- Resources utilized and associated costs

4.0 SITE-SPECIFIC INFORMATION: NORTHERN PLAINS REGIONAL LANDFILL

The Landfill is owned and operated by the City of Spencer. The Landfill, located at 3032 420th Ave, Graettinger, IA 51342, is approximately 3 miles south of the City of Graettinger, Iowa and serves the following counties and cities:

Clay County

- City of Spencer
- Unincorporated areas of Clay County

Emmet County

- All cities
- Unincorporated areas of Emmet County

Palo Alto County

- All cities except West Bend
- Unincorporated areas of Palo Alto County

Pocahontas County

- All cities except Fonda and Gilmore City
- Unincorporated areas of Pocahontas County

Other Entities

- City of Whittemore
- City of Bode
- City Terril
- City of Superior

Facility hours are Monday through Friday 8:30am to 3:00pm, with closures occurring on most major holidays.

The Landfill is approximately 71 acres, and the property includes an additional 152 acres that may be suitable for landfilling and facility buildings, buffer, access roads, surface water diversion structures, and recycling/salvage operations.

The Landfill accepted an average of approximately 38,600 tons MSW annually over the fiscal years 2020-2024. There was a 56% increase in waste received between FY2023 and FY2024, from 32,890 tons to 51,360 tons respectively.

The Landfill operates as a MSW Landfill under Sanitary Disposal Facility Permit No. 74-SDP-02-76P. The Landfill began accepting solid waste in the mid-1970s (1976) under this permit and the facility has been receiving waste since that time.

4.1 BUILDINGS AND INFRASTRUCTURE

The Landfill has several buildings and operational areas which support the MSW services. Below is a list of buildings and a brief description of their functions. A current facility site map that details operational areas, buildings, overhead and buried utilities, and key infrastructure is in **Appendix H-3**. **Appendix H-6** identifies the location of electrical panels that may need to be accessed to turn off power to buildings or infrastructure (i.e., pumps).

4.1.1 Scalehouse and Maintenance Building

The scalehouse serves as the main office for Landfill staff and for customer payment functions. It also has areas dedicated to maintenance (shop) and equipment storage.

Figure 4-1. Scalehouse and Entry

The tonnage receipts and waste type information by load are stored at the scalehouse.

The scalehouse is heated with a propane-fired forced air furnace located in the utility closet on the south side of the building.

The shop area is heated with propane-fueled radiant heaters mounted on the ceiling.

The office has three fire extinguishers: two 10-lb extinguishers for electrical fires and one 5-lb ABC extinguisher. The shop has five fire extinguishers. Additional extinguishers are in/at the cold storage building, leachate loadout building, portable 500-gallon fuel tank, and 1,000-gallon fuel tank (south of Cell E1).

Figure 4.2. Storage Area within Shop - Yellow Flammable Cabinet Visible

Flammable torch (acetylene) gases are stored in the shop area.

Flammable liquids are stored in a labeled flammables storage cabinet on the east wall of the shop area.

New and used bulk lubricants and hydraulic fluids are stored in drums and smaller containers on the ground floor of the shop area.

The Landfill installed a bulk oil system in 2024 with two 120-gallon tanks: one for hydraulic oil and one for engine oil. These tanks are in the northwest corner of the shop with the other lubricants stored in drums and pails as well as the 250-gallon tote for used oil.

Electrical panels for the building are located in the shop in the utility closet and the south wall of the storage area above the office.

Figure 4-3. Storage Area in Loft Space Above Offices

The shop area has a loft area over the office on the southwest side of the building which houses new lubricants and various supplies.

There is a 1,000-gallon propane tank located near the east side of the office/maintenance building.

Figure 4-4. 1,000-gallon Propane Tank Along the East Side of Office Building

4.1.2 Cold Storage Building

The Landfill has a cold storage building northeast of the scalehouse/maintenance building. It faces north and south with an overhead door entrance on the south side. An additional, smaller overhead door is located on the northeast corner of the building. This building holds the excavator, scraper, road grader, 3 pickups, tractor loader, and payloader.

4.1.3 Flammable & Combustible Materials Storage Container

The Landfill has a cargo container situated west of the cold storage building. This container is used for electronic devices and batteries that are found in the Landfill. The Retrofit Companies, located in Minnesota, comes for a pickup when a pallet of items has accumulated.

Figure 4-5. Flammable and Combustible Materials Storage Container

4.1.4 Emergency Weather Event Shelter

Directly east of the scalehouse is a constructed tornado shelter, which has a passive vent and a sign on the north-facing access door.

Figure 4-6. Tornado Shelter

4.1.5 Facility Access Points

The only entrance to the Landfill is from Highway 4 (420th Avenue). A site vicinity map of the Landfill is provided in **Appendix H-1**.

There is a 10-foot-tall chain link fence around the perimeter with a sliding double gate entry.

The Landfill has a locked gate that secures the access road into the Landfill during non-operational hours. The gate is secured with a City of Spencer lock (opened with a City padlock key).

The Landfill has a camera system overlooking the scale and front gate as well as a security system through Knight Protection (Spencer, Iowa company).

The entrance area, driveway, and parking lot are all paved. Internal haul roads connect operational areas of the facility. These roads are generally gravel or dirt.

Roads are maintained in a manner to allow safe passage for all waste disposal areas.

Figure 4-7. Facility Entrance

4.2 OPERATIONAL SUPPORT SYSTEMS AND UTILITIES

Below is a brief description of the Landfill's current operational systems and utilities. The location of these operational systems is shown in **Appendices H-2, H-3, and H-6**. also identifies the location of electrical panels that may need to be accessed to turn off power to buildings or infrastructure (i.e., pumps).

Figure 4-8. Internal Haul Road

4.2.1 Active Control Panels

There are several electric panels on the property that allow access to shut-off switches. These electric panels provide power to a variety of infrastructure (i.e., buildings, water pumps, leachate pumps, etc.). Appendix H-6 identifies the location of these control panels on a site map.

Control Panel A is located on a utility pole near the southwest corner of the scalehouse and is the main power supply for the site.

Control Panel B is in the utility closest in the southwest corner of the shop area in the scalehouse and contains various circuit breakers for that building.

Control Panel C is located on the west side of the haul road near where the road bends to the north. The panel supplies power to Lift Station 3.

Control Panel D is located on the east interior wall of the leachate loadout building and supplies power to the loadout pump.

Control Panel E is located across the road from Control Panel C and controls Lift Station 3.

Control Panel F is located between the west detention pond and the leachate loadout building on a utility pole in the staging area. This panel provides power to Lift Station 1.

Figure 4-9. Control Panel A - Main Power Supply

Figure 4-10. Control Panel B – Scalehouse Panel

Figure 4-11. Control Panel C - Lift Station 3 Power

Figure 4-12. Control Panel D - Leachate Loadout Panel

Figure 4-13. Control Panel E - Lift Station 3 Power Supply

Figure 4-14. Control Panel F - Lift Stations 1 and 2 Power Supply

4.2.2 Fuel Storage Tanks

Below is a list of fuel tanks of varying sizes and stored material that are at the Landfill. Appendix H-2 identifies the location of these tanks on a site map.

One 1,000-gallon liquid propane tank east of the scalehouse/maintenance building

One 1,000-gallon diesel fuel tank northeast of the scalehouse

One 1,000-gallon fuel tank south of Cell E1

One 500-gallon portable fuel tank northwest of the cold stor

One 100-gallon gas tank northeast of the cold storage building

Figure 4-15. Portable 500-gallon Portable Diesel Tank

Figure 4-16. 1,000-gallon Diesel Tank and 100-gallon Diesel Tank Located Northwest of the Scalehouse

4.3 LANDFILL CELL DESCRIPTIONS

As depicted in **Appendix H-3**, the Old Landfill Area contains waste landfilled from 1976 to 2010. These landfill Cells 1 through 12 and 1A through 21A were filled, closed, and capped per regulations at the time. Areas with a constructed cap may include – from bottom to top: layers of uncompacted soil, a thin plastic liner (if there is a Flexible Membrane Liner (FML) at the bottom of the Landfill), compacted soil (typically clay), waste with daily cover materials, and un-compacted soil layer on top (for vegetative growth).

Figure 4-17. Closed Landfill Cells

Cells A through D were constructed with composite liners and leachate collection systems and received waste between 2006 and 2020.

Currently, waste disposal is limited to Cell E1, across the haul road to the west of the closed cells. There is a planned expansion in Summer or Fall 2025 to the area directly north of Cell E1. That area is known as Cell E2 Expansion.

Both closed and active cells are depicted in **Appendix H-3**.

4.3.1 Petroleum Contaminated Soil (PCS) Treatment System

The Landfill accepts hazardous petroleum contaminated soil. It is delivered to the top of a liner in Cell A1.

4.3.2 Active Landfill Areas (Working Face)

The working face is the area where waste is actively being deposited (or tipped) into the Landfill. The location of the working face may change as frequently as day-to-day due to current operational conditions. At the end of each operational day, the Landfill covers the received waste with a daily cover that consists of auto shredder residue (ASR) and wire shredder residue (WSR) which helps prevent litter from blowing and vectors (i.e., birds, rats) from accessing the waste. While the Landfill does not apply dirt as daily cover, it is used as an intermediate and final cover.

Figure 4-18. Working Face

The Landfill is unique within the State of Iowa in that over 50-60% of the waste received at the Landfill consists of various forms of ASR and WSR. Before being applied as alternative daily cover, the shredder residue is tested by the generators to comply with Iowa Department of Natural Resources (Iowa DNR) rules and regulations and the Landfill's permit

requirements to ensure the material, as a homogenous waste stream, does not have hazardous characteristics and is not flammable.

In addition to the boundary chain link fence, the Landfill has 17 portable litter fences that are used for litter control in the active landfilling areas.

Figure 4-19. Portable Litter Fence

Figure 4-20. Portable Litter Fences

NOTE: The Landfill accepts on average approximately 135 tons of waste per day. About 50-60% of that waste is ASR and WSR. MSW is estimated to contain approximately 11.73 million British thermal units (Btus) per ton, while ASR is estimated to contain 15 million Btus. Therefore, it could be expected that daily waste received at the Landfill could have 1,827 million BTUs. Gasoline has approximately 114,102 Btus per gallon. Therefore, in terms of BTUs, the Landfill receives the waste equivalent of approximately 16,000 gallons of gasoline on average per day.

4.3.3 Reuse Recycling Area

The Landfill does not accept materials for reuse and/or recycling.

4.3.4 Future Expansion Areas

It is expected that the current Cell E1 will be full and closed sometime in 2026. The area to the north of Cell E1 has been designated as E2 Cell expansion area. There are plans to continue disposal to the west with Cells F – H.

4.4 SOIL SOURCES

The soil borrow areas provide the Landfill with soil necessary for daily operations and construction activities. The Landfill's soil stockpile is located north of the cold storage building. The primary soil

borrow area is on the east side of the E2 Cell expansion area. A secondary soil borrow area is located east of the closed cells. Both borrow areas could be used if soil was required for fire management.

The Landfill can obtain 15 yards of cover dirt in less than 10 minutes for firefighting activities using a scraper, 2 single axle haul trucks, and an excavator with a 54-inch-wide bucket. It is recommended that soil stockpiles be placed near the working face over time to ensure access to enough soil to cover the working face at any given time. It is estimated that approximately 220 cubic yards of material would be needed to cover the current 175' x 100' working face with 6 inches of soil.

While the Landfill uses ASR as an alternative daily cover, ASR is not recommended as an inert Landfill firefighting material.

Figure 4-21. Soil Borrow Area in Southeast Corner of Cell E2 Expansion Area, North of Current Operations

Figure 4-22. Soil Stockpile Located North Cold Storage and Maintenance Buildings

4.5 WATER SOURCES

4.5.1 Hydrants (on and/or off-site)

Graettinger water towers and hydrants are listed in **Appendix H-4**. In case of a fire emergency at the Landfill, the Fire Department would use the water tower located at the northwest corner of Graettinger, which is about 2 miles north of the facility.

While there are no on-site hydrants at the Landfill presently, there are plans to install rural water at the Landfill within the next 2 years. Upon completion of the installation, the Landfill will have its own fire hydrant on-site.

4.5.2 Natural Water Sources (i.e., undesignated tributaries, creeks, etc.)

The Landfill has two natural water sources that could be used in firefighting efforts. Detention Ponds A (west) & B (east) are fed via tile lines from neighboring agricultural fields. The ponds are located east of the scalehouse/maintenance buildings (see **Appendix H-5**).

The detention ponds usually have water; therefore, they can be considered a source of water for fire suppression activities.

Landfill staff should maintain a good access road to the ponds for firefighting equipment to gain access to this on-site water source. The pond closer to the scalehouse is larger and has an access road to it.

Figure 4-23. Detention Ponds

The Landfill also owns the Acreage Pond in the northeast corner of their property line. While this is a water source, it is too far from the landfilling area to be considered for firefighting efforts.

4.6 LEACHATE MANAGEMENT SYSTEM

The Landfill has one Leachate Lagoon which temporarily stores a maximum of 630,000 gallons of leachate before it is hauled via tanker truck to the City of Spencer Wastewater Treatment Plant.

The Leachate Lagoon is fed by several lift stations. Lift stations are pumps that raise leachate from a lower elevation. The lift stations have individual electrical panels. These panels can be turned off if the Landfill does not want leachate to enter the lagoon.

Figure 4-24. Leachate Lagoon

A leachate loadout station is located east of the scalehouse. This building has a control panel within it that controls the leachate lagoon pump.

Leachate piezometers are located throughout the site and provide access to pipes that are installed into the waste mass down to varying depths. The piezometers are used to measure the level of leachate on the Landfill liner.

Leachate cleanouts are separate junctions of the leachate collection lines that are used for cleaning (vacuum or flushing) out the lines.

The Landfill is currently repurposing the old leachate loadout stand into a pond-fill loadout northeast of the upper pond (see **Figure 4-25**). This provides the Landfill with an additional water source in fire emergencies by allowing them to use a trash pump to fill water tankers from the top. The transition is expected to be completed in Summer 2025.

Figure 4-25. Leachate Lagoon Loadout

Figure 4-26. Barrel Float for Drawing Water out of the Upper Pond

There are several groundwater monitoring wells throughout the site but outside the waste disposal area. These wells provide access to groundwater for sampling purposes to monitor potential Landfill environmental impacts.

The leachate collection management features described above are highlighted in **Appendix H-3**.

Figure 4-27. Leachate Cleanout

Figure 4-28. Leachate Lift Station 1

4.7 GROUNDWATER AND STORMWATER MANAGEMENT SYSTEM

4.7.1 Stormwater Collection

The Landfill operates under NPDES General Permit for industrial sites and SWPPP. As such, stormwater generated at the working face is handled within the waste mass and treated as leachate. Stormwater run-off is diverted from the active Landfill and borrow areas when possible and routed to the stormwater sedimentation basin designed for a 24-hour, 25-year storm. Inundation with large quantities of foam and water may affect the ability of the leachate collection system to handle the flows. Water that is handled through the stormwater BMPs must not inundate the system and needs to meet required testing parameters.

4.7.2 Stormwater Retention Pond

The Upper Pond serves as the overflow pond for stormwater. It filters down to the Lower Pond.

4.7.3 Groundwater Monitoring

Groundwater monitoring wells installed around the perimeter of the Landfill are monitored for several constituents twice per year.

4.8 LANDFILL GAS COLLECTION AND CONTROL SYSTEM

The Landfill does not currently have landfill gas (LFG) extraction wells or vent pipes installed on or off-site. However, piezometers within the waste mass have been known to collect and vent Landfill gases.

4.9 LANDFILL EQUIPMENT RESOURCES

The Landfill has on-site resources in the event of a fire. These resources are summarized in Table 4-1 to provide an understanding of what is available and what may need to be acquired. Example equipment photos are below.

Table 4-1. Landfill Equipment Resources

Description	Fuel Type	Usage Notes
Logistical Equipment		
2000 Chevy Tahoe	Gas	Misc. 4x4
2008 Ford F150	Gas	Misc. 4x4
2014 Chevy 2500HD Pickup	Gas	Misc./Snow removal, 4x4
2023 Kubota RTV-1100CWH/HS	Diesel	Misc.
Case Skid Loader	Diesel	Misc.
1976 Motor Grader	Diesel	Grade roadways
1999 Case IH MX 120 with loader	Diesel	Mow grass
2019 International Semi Tractor	Diesel	Leachate tanker hauling
1986 Leachate Tanker (Trailer)	N/A	7,000 gallons
2019 MAC LLT Tanker Trailer	N/A	8,000 gallons
2019 Dodge Ram 2500	Gas	
2020 850L John Deere Dozer	Diesel	
2021 Grasshopper Lawn Mower	Gas	
1996 615C II Dirt Scraper	Diesel	
2018 John Deere 250G Excavator	Diesel	
1990 644E John Deere Payloader	Diesel	
Dirt Moving Equipment		
2019 963 Cat Track Loader	Diesel	
2023 Al Jon Compactor	Diesel	With push blade
2000 International Dump Truck	Diesel	6 cubic yards
1999 International Dump Truck	Diesel	
Fire Fighting Equipment		
Class B Foam		35 gallons
Class A Foam		85 gallons

Figure 4-29. Single Axle Dump Truck with 5-yard Box

Figure 4-30. 15-yard Dirt Scraper

Figure 4-31. Payloader with 4.5 cu yd Bucket

Figure 4-32. John Deere 250G Excavator

4.10 FIRE DEPARTMENT RESOURCES

The first responders have several resources in the event of a Landfill fire. These resources are summarized in **Table 4-2** to provide an understanding of what is available and what may need to be acquired.

Table 4-2. Fire Department Equipment Resources

Name	Tank Capacity (gallons)	Pump Rating (GPM)
First Out: Graettinger Volunteer Fire Department		
Pumper Truck	1,000	1,250
Pump Truck (doubles as Tanker)	1,500	1,000
Tanker	2,500	
Tanker	1,500	
Pickup Truck 4x4	250	
Side-by-Side	85	
Ground-Based Monitor Nozzles (2)		500
Class A Foam – on each pumper truck (30 gallons)		
Class A Foam – at fire station (45 gallons)		
Class A Foam – at Landfill (85 gallons)		
Foam Application Tools: Pro Pack, Inductor, Nozzles		
Second Out: Emmetsburg Volunteer Fire Department		
Pumper Truck	1,000	1,500
Pumper Truck	1,000	1,500
Pumper Truck	1,000	1,500
Tanker Truck	1,800	1,500
Pickup Grass Unit	400	50
Can Am ATV – Side-by-Side (high pressure with foam nozzle)	60	
Can Am ATV – Side-by-Side (high pressure pump)	60	
Third Out: Ruthven Volunteer Fire Department		
Main Pumper	1,000	1,250
Pumper Truck (dump capable)	1,250	1,250
Tanker Truck (dump capable)	2,000	
Tanker Truck	1,000	
Pickup Truck	250	
Can-Am Defender 4x4 UTV	75	
Can-Am Defender 4x4 UTV	75	
Fourth Out: Wallingford Volunteer Fire Department		
Engine 1	1,000	1,000
Engine 2	1,000	750
Tanker	1,500	
Chevy Grass Wildland Truck		

4.11 LANDFILL POLICY

The Landfill has developed criteria delineating acceptable and unacceptable wastes for disposal at the facility.

4.11.1 Accepted Wastes

The Landfill is currently permitted to receive MSW for disposal. This waste may consist of waste from commercial and residential sources, special wastes as defined by the Iowa DNR, C&D, and materials containing asbestos.

The Landfill is permitted to use a percentage of the ASR and WSR received at the site as alternative daily cover (ADC) to cover waste at the Landfill working face. ASR and WSR are predominantly non-metallic materials consisting primarily of foam, plastics, rubber, glass, wood, and sediment.

Figure 4-33. Example of WSR and ASR received at the Landfill

ASR and WSR are tested by the generators to comply with Iowa DNR rules and regulations and the Landfill's permit requirements to ensure the material, as a homogenous waste stream, does not have hazardous or toxic characteristics and is not flammable.

The Landfill receives materials that are designated as special waste due to their special handling requirements. These materials include:

- Spent abrasives, pit waste, and paint filter waste generated by Dethmers Manufacturing (Demco Mfg / Maurer Mfg)
- Filter cakes and paint filter waste generated by GNK (Moveero) in Armstrong
- Paint filter waste generated by GNK (Moveero) in Estherville
- Microbiology lab waste generated by Iowa Lakes Community College
- Paint filter waste generated by Montag Manufacturing
- Paint filter waste generated by Positech
- Thinner bottom waste (non-hazardous), used paint filters, and sludge from Vander Haag's Inc.

None of the above materials are known to be reactive. However, Landfill operators should always watch for reactive materials. As new waste streams are introduced to the Landfill, they should be observed for reactivity to ensure they are handled accordingly.

4.11.2 Prohibited Wastes

To ensure that the Landfill complies with DNR Regulations, the following list of items and materials are not accepted at the Landfill:

- **Appliances** – Including, but not limited to air conditioners, clothes dryers, clothes washers, dehumidifiers, dishwashers, freezers, furnaces, water heaters, ice machines, microwaves, stoves, ovens, ranges, and refrigerators
- **Auto Batteries**
- **Car Bodies**
- **Scrap Metal**
- **Tires** (all sizes)
- **Electronics**
- **Household Hazardous Waste** – Including, but not limited to compact/tube fluorescent bulbs, electric ballasts, insecticides, liquid paint, oil filters, paint thinner/stripper, pesticides, rechargeable batteries, and waste oil
- **Livestock Carcasses**
- **Paunch Manure**
- **Yard Waste**
- **Organic Waste for Composting**
- **Recyclable Materials**

4.12 CUSTOMER RE-DIRECTION PLAN

Events such as Landfill fires, extreme climatic events, or other major disruptions to facility operations may arise. If such an event were to occur, modifications to facility operations would be made to continue disposal of waste at the facility if possible. The determination of whether waste could be safely disposed of will be made by the Landfill Manager. If continued waste disposal is not possible, communication will be provided to residents and haulers including alternate facility locations from the Landfill Manager.

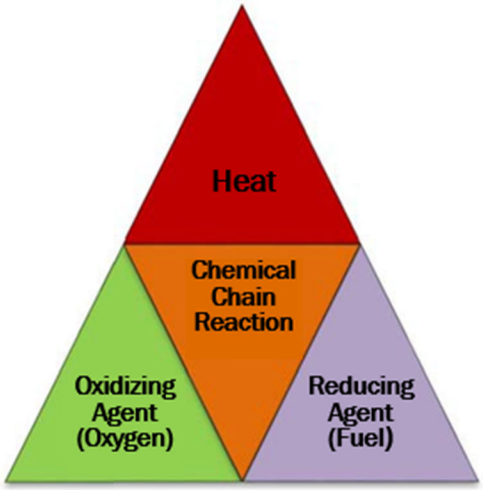
5.0 LANDFILL FIRE CHARACTERISTICS, CAUSES, AND DETECTION

To understand landfill fires, the basic principles of combustion need to be known. Once these principles are understood, a closer look can be taken at the two main types of landfill fires: surface fires and subsurface fires. Surface fires are the most abundant and burn between the surface and one foot below ground, where there is fuel and oxygen. Subsurface fires smolder below ground and can be found up to 40 feet below the surface (Palmer, 2006).

5.1 COMBUSTION BASICS

According to the manual *Essentials of Fire Fighting*, fire is a rapid chemical reaction that gives off energy and products of combustion that are very different in composition from the fuel and oxygen that are combined to produce them. Although the terms combustion and fire are used interchangeably, fire is technically a form of combustion. Four elements are necessary for combustion to occur, shown visually in the fire tetrahedron (**Exhibit 5-1**) below.

Exhibit 5-1. Fire Tetrahedron



A fire will not occur without each element in place. Once a fire is engaged, the removal of one of these elements will extinguish the fire. Each of the elements is discussed below, as described in *Essentials of Fire Fighting* by the International Fire Service Training Association (IFSTA).

Oxidizing agents are materials that yield oxygen or other oxidizing gases during a chemical reaction. These oxidizers are not combustible by themselves but will support combustion when combined with a fuel. Oxygen is the most common oxidizer, but others may include bromine, chlorine, nitrates, and permanganates, among others (IFSTA, 1998). Normal air consists of 21% oxygen. At 70° Fahrenheit, combustion can be supported by as low as 14% oxygen. Research has shown that as temperatures in a compartment fire increase, lower concentrations of oxygen are needed to support flaming combustion.

Fuel is the material or substance being oxidized or burned in the combustion process. Most contain carbon along with combinations of hydrogen and oxygen. Key to the combustion process is the physical state of the fuel and its distribution. While fuel can be found in any of the three states of matter (solid, liquid, or gas), to burn, fuels normally need to be in the gaseous state. Fuel gases are evolved from solid fuels by pyrolysis, which is the chemical decomposition of a substance through the action of heat. As solid fuels are heated, combustible materials are driven from the substance. With sufficient fuel and heat, the process of pyrolysis (the chemical decomposition of a substance through the action of heat) generates enough burnable gases to ignite if the other components of the fire tetrahedron are present. Shape and size (surface-to-mass ratio) affect the ability of a fuel to ignite. For example, a log with a higher surface-to-mass ratio will require more energy to burn than boards, sawdust, and sanding dust (IFSTA, 1998).

Heat is a large driving factor in determining when a fire will begin when the other fire tetrahedron components are present. Heat will initiate the pyrolysis reaction causing the release of flammable vapors from the fuel source. Heat is a form of energy and as stated above, the more energy present in a fuel, the more readily it will ignite. When sufficient energy has been input into the fuel (which varies on the fuel's surface-to-mass ratio) ignition occurs and the fire begins.

Once ignition occurs, the chain reaction begins. Burning produces more heat which causes the release of gases from the fuel. The fuel is oxidized producing more heat. This chain reaction keeps building on itself like a revolving door and causes the fire to grow.

Common heat sources in landfills are typically limited to chemical reactions producing heat or biological activity within the organic material present in the landfill. Bacteria that are continuously digesting waste give off heat. When the landfill does not have adequate pathways to dissipate this heat, it can build up and eventually reach the materials' (fuel) flash point.

Landfills have two "hot" periods of aerobic decay, which unfortunately coincide with elevated oxygen levels. These hot periods typically occur around 5 years after the waste has been placed, but the time varies based on the materials. Very few fires (less than 5% of reported landfill fires) are caused by spontaneous ignition; typically, fires are fueled by something such as a gasoline-soaked rag or batteries short-circuiting causing a spark. More commonly, a direct heat source (i.e., hot coals from a charcoal grill) is mistakenly placed in the landfill. This can occur when a previously ignited fuel is placed in a landfill while it still has heat or very small embers on or within the fuel source (Foss-Smith, 2013).

5.2 LANDFILL FIRE CHARACTERIZATION

The two basic types of landfill fires – surface and subsurface – are derived, managed, and extinguished with differing strategies and timeframes. Although all fires are unique, they will be characterized as a surface fire or a subsurface (underground) fire. Within these broad categories, incident levels based on the response to manage the fire are also characterized.

5.2.1 Surface Fires

Surface fires are the most abundant and burn between the surface and one foot below ground, where there is fuel and oxygen. The best response is to address landfill fires immediately to limit the spread of the fire. As evidenced by local fires within Iowa, a fire at the working face may cause extensive damage even to newly constructed (empty) landfill cells.

Figure 5-1. Surface Fire

5.2.1.1 Characteristics

Surface fires generally exhibit the following characteristics:

- The burning material is usually recently buried or uncompacted waste.
- The fire is on or near the ground surface.
- The smoke from a surface fire is usually characterized by white smoke, which indicates a lower-temperature fire.
- The surface fire is typically located at slopes or grade breaks, where compaction and depth of soil are less than the main landfill area.

It should be noted that surface fires can be intensified by the presence of methane.

5.2.1.2 Causes

Surface fires can be caused by one or more of the following:

- Hot loads (dumping of undetected smoldering material)
- Reactive materials such as sawdust, magnesium chloride, fly ash, and aluminum dross
- Combustion of methane in LFG control or venting systems
- Human error (careless smoking at the landfill)
- Construction and/or maintenance activities (compactor friction with waste, welding, sparks, etc.)
- Spontaneous combustion (oily rags, bacterial decomposition, reactive substances)
- Deliberately set fires (arson)
- Lightning strike

5.2.1.3 Detection

Surface fires are typically easy to detect based on the presence of white or black smoke and flame.

5.2.2 Subsurface Fires

Subsurface fires smolder below ground and can be found up to 40 feet below the surface (Palmer, 2006). They pose a significant problem for a landfill as they are more difficult to detect, extinguish, and even locate compared to surface fires. There must be a reasonable suspicion that a smoldering event is occurring within the landfill to initiate further investigation. Subsurface fires can burn for periods of years and have the potential to break the surface and cause a surface fire.

Figure 5-2. Subsurface Fire

5.2.2.1 Characteristics

Subsurface fires are generally characterized by the following:

- The burning material is below the ground surface.
- The burning material may be months or years old.
- An underground fire is likely more difficult to extinguish than a surface fire.
- An underground fire can create large voids causing cave-ins at the surface.
- An underground fire can damage liners, leachate collection systems, and other structural components.

5.2.2.2 Causes

The most common cause of subsurface fires is the increase in oxygen content in the landfill, which increases aerobic bacterial activity, resulting in areas of elevated temperatures. These so-called “hot spots” come into contact with pockets of methane gas and result in a fire. Increased oxygen content is most often caused by increased negative pressure due to the overpull of an LFG collection system. Air or oxygen intrusion into the waste mass can occur through fissures or other features including nearby extraction wells. With the addition of oxygen, the subsurface fire has all four components of the fire tetrahedron and poses a more serious risk of ignition.

5.2.2.3 Detection

Subsurface fires have been detected by observance of one or more of the following (Palmer, 2006):

- Substantial settlement of areas within the landfill over a short period of time

- Smoke or smoldering odor emanating from an LFG extraction system or from the landfill
- Elevated levels of carbon monoxide (CO)
    - 100-1,000 ppm is considered suspicious
    - Over 1,000 ppm indicates active combustion
- Combustion residue (soot) in extraction wells or headers
- Increase in gas temperature in the gas extraction system (above 140° F)
- Temperatures above 170° F

Complex methods of fire detection of subsurface landfill fires exist, including graphic scanning. However, in an online questionnaire through Solid Waste of North America (SWANA), detection methods were typically much simpler. The survey included all 50 states as well as 100 hard copies distributed to landfills not included in the database. The survey included the fire type and specific operating parameters of the landfill. Thirty-seven responses were received, and the results are summarized in **Table 5-1** below (Moqbel, 2009). Any of these occurrences could be a sign that a subsurface fire is taking place.

Table 5-1. Subsurface Landfill Fire Detection Methods

Method of Detection	%
Smoke or steam	59
LFG-Related: Elevated temperature, interruption of flow, smoke, flames from the leachate collection system during maintenance	13
Sudden depressions or sinkholes	13
Surface cracking of daily cover	10
Elevated levels of carbon monoxide	5

6.0 LANDFILL FIRE MANAGEMENT

6.1 FIRE INCIDENT TYPES

Five different incident types are established by the NIMS and can be used to determine the response required for a landfill fire. A sixth type (Type 0) has been added by Todd Thalhamer, Hammer Consulting Services, to address the small fires handled by operators. All fires are unique, and some may require special actions to minimize damage. landfill fires, in general, are Type 0, 5, 4, or 3 incidents, but it would be possible for a large fire to be classified as Type 2. Type 1 incidents are not anticipated at the landfill and are included for informational purposes only. The levels are summarized in **Table 6-1** in order of relevance to the landfill. These incident types are based on ICS-

400: Advanced ICS for Command and General Staff, Complex Incidents and MACS for Operational First Responders.

Table 6-1. Fire Incident Type Descriptions

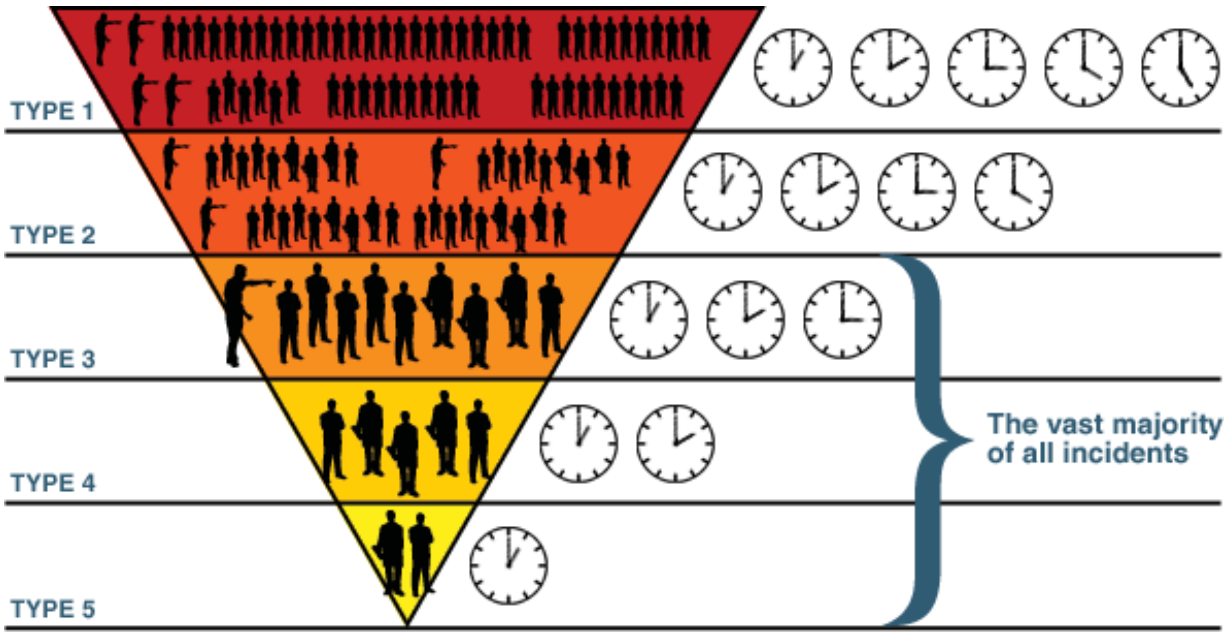
Incident Type by Relevance	Description and Summary Management Activities
Type 0*	• Operational in nature • Handled by the landfill operator • 0 – 2 hours of suppression activities • $ - Low associated cost
Type 5	• Incident handled with one or two single resources and up to six personnel. • Command and general staff positions (other than the IC) are not activated. • No written IAP is required. • Additional resources and 911 called. • The incident is contained within the first operational period (a personnel shift) and often within an hour to a few hours after resources arrive on scene (1 business day). • $$ - Relatively low cost
Type 4	• Command staff and general staff functions are activated only if needed. • Several resources are required to mitigate the incident, including a task force or strike team. • The landfill administrator (manager, supervisor, or designee who has responsibility for the incident) may have briefings and ensure the complexity analysis and delegation of authority is updated. • No written IAP is required but a documented operational briefing will be completed for all incoming resources. • The role of the landfill administrator includes operation plans outlining objectives and priorities. • 8 – 24 hours of suppression activities • $$$ - Relatively high cost
Type 3	• When incident response requirements exceed capabilities, the appropriate ICS positions should be added to match the complexity of the incident. • Some or all of the command and general staff positions may be activated, as well as division/group supervisor and/or unit leader level positions. • Develop formal written IAP • Up to one week of suppression activities • $$$$ - High cost

Incident Type by Relevance	Description and Summary Management Activities
Type 2	• This type of incident extends beyond the capabilities for local control and is expected to go into multiple operational periods (multiple personnel shifts). A Type 2 incident may require a response from regional and/or national resources, to effectively manage the operations, command, and provide general staffing. • Most or all of the command and general staff positions are filled • A written IAP is required for each operational period • Many of the functional units are needed and staffed • More than several weeks of suppression activities • $$$$$ - Very high cost
Type 1	• Not anticipated to have a landfill fire event of this level and is included here for information purposes only. • This type of incident is the most complex, requiring national resources for safe and effective management and operation. • All command and general staff positions are filled. • Requires an extensive number of operations personnel. • Additional branches of the ICS need to be established. • A written IAP is required for each operational period. • The landfill administrator will have briefings and ensure that the complexity analysis and delegation of authority are updated. • Use of resource advisors at the incident base is recommended. • There is a high impact on the local jurisdiction, requiring additional staff for office administrative and support functions.

*Added by Todd Thalhamer, Hammer Consulting Services.

Exhibit 6-1 is a graphic representation of the incident types from FEMA's Emergency Management Institute (EMI).

Exhibit 6-1. Incident Type Magnitude of Resource and Length



6.1.1 General Fire Response Plan

Each fire can more easily be managed if the steps below are followed, and good judgment is used when making decisions. The most crucial aspect of effective fire management is to remain calm so that the successful initiation of these steps occur.

- Evacuate the area of all non-essential personnel. Alert all other employees and activate the fire alarm system if one is in place.
- Once clear, the fire needs to be assessed to decide whether it can be effectively managed by site personnel. If the answer is no, or even maybe, call 911 and request assistance from the fire department.
- Be clear when explaining the nature of the fire to the fire department. Include known details regarding possible causes, where the fire is located (on-site structure, vehicle, or landfill), what the fuel is, whether it is a surface or subsurface fire, and if it poses a spreading risk. These details will allow firefighters to respond appropriately.
- Begin initiating communication up the chain of command. Notify the site commander or the IC by phone or in person.

- If site personnel choose to fight the fire, never do so alone. Always let someone know your plan of action. Be sure personnel are using the appropriate PPE as identified in this Plan.
- When fighting a fire, always consider your safety over the loss of property or equipment.
- If a fire has outside energy sources, like electricity or landfill gas, these utilities should be shut down or isolated immediately (see locations shown in **Appendix H-3** and **Appendix H-6**).
- If the fire is small, extinguish it with the proper fire extinguisher. Always maintain an escape path in case you fail to extinguish the fire and need to vacate the area.
- Always avoid the smoke when around a fire. Smoke is toxic.
- Always work with the fire department once they arrive. If it is a structure fire, the fire department will handle all aspects of extinguishment.
- Prepare a fire incident report and submit it to the supervisor. Use an After-Action Report to review actions performed to determine potential improvements in response (See **Appendix F** for an example).
- Notify the Department at the appropriate time based on the incident type occurring.

6.1.2 Proper Use of Fire Extinguishers

Portable fire extinguishers offer a great first line of defense to prevent small fires from spreading. But not all fire extinguishers are created equally, and they must be used properly to be effective. The proper uses for each of the four classes of extinguishers are explained by the U.S. Fire Administration in **Table 6-2**. Some fire extinguishers are multipurpose. For example, an ABC fire extinguisher is effective for extinguishing general combustibles, liquids and grease, and electrical equipment fires. Selecting an inappropriate class of extinguisher can endanger you and others around you. Never use a Class-A fire extinguisher on an electrical or grease fire.

After determining the appropriate type of fire extinguisher, use the acronym P.A.S.S. to extinguish the fire:

Pull – Pull the pin. There is a small pin that prevents the fire extinguisher from accidentally being discharged. All you need to do is pull it out and continue to the next step.

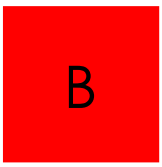
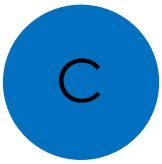
Aim – Aim the nozzle of the fire extinguisher low at the base of the fire.

Squeeze – Squeeze the trigger you just pulled the pin out of. Remember to squeeze it slowly and evenly, so the extinguisher is as effective as possible.

Sweep – Sweep the extinguisher from side to side to cover all areas where the fire may have spread.

Note: The typical handheld fire extinguisher provides between 10 and 20 seconds of operation. After discharging the extinguisher, reassess the area for smoldering material or residual fire.

Table 6-2. Fire Extinguisher Classes

Symbol	Use On:
	**Common materials such as:** Wood Cloth Rubber Paper Plastics
	**Flammable liquids such as:** Gasoline Paint remover Grease Oil Flammable Gases
	**Electrical Fires:** Live Electrical Equipment
	**Flammable metals such as:** Magnesium Sodium Potassium Titanium Zirconium

6.1.3 Type 0 Fires

Type 0 fires are typically small and easily handled by site personnel. However, one should always practice caution and follow the general procedure as described above. Small fires can grow into large problems if immediate and proper action is not taken. Small fires in bins, offices, vehicles, shops, and the working face are typically Type 0 fires.

Type 0 landfill fires typically consist of waste fires that are handled by site staff. These generally take less than two hours to suppress. In general, site personnel focus on extinguishment by separating the hot waste from the active working face and applying soil cover to extinguish the material. Refuse fires can pose significant health and safety risks; therefore, in addition to the general fire response plan procedures, the following actions must be performed:

Figure 6-1. Type 0 Landfill Fire
(Photo courtesy of Todd Thalmaher)

- Notify the Facility Supervisor, providing sufficient detail on the location and severity of the situation.
- Separate the waste from the current working face to avoid further spread.
- Avoid exposure to the smoke as smoke is toxic.
- If landfill staff mitigation efforts using heavy equipment may exceed 30 minutes, operators should obtain and use the appropriate PPE identified in this Plan.
- Place soil over the hot waste.
- Allow waste to remain covered and away from the working face for sufficient time to ensure that the waste is no longer hot.
- No IAP is needed.
- Upon completion of the incident, document a summary of the incident.

For all other fire types, landfill staff should be contacted immediately after contacting dispatch (911).

6.1.4 Type 5 Fires

Type 5 fires typically consist of waste fires that need one or two resources and up to six personnel to properly manage. These fires are characterized as being contained in a single business day. In general, the on-site personnel need to focus on containing the fire until the fire department has arrived. Refuse fires can pose significant health and safety risks so in addition to the general Type 0 procedures, the following actions must be performed:

Figure 6-2. Type 5 Landfill Fire
(Photo courtesy of Todd Thalmaher)

- Notify the Facility Supervisor or person in charge of the landfill at that time.
- Contact dispatch (911) to notify the Graettinger Fire Department. Communicate clearly what the hazard involves so responding personnel have as much information as possible. Dispatch will assign a common channel for responding personnel. Determine what common channel responding personnel are on and establish contact with responders.
- Begin the ICS (**See Section 3** and **Appendix A**) by notifying the IC or site commander.

- A formal IAP is not needed at this time.
- Always avoid the smoke and use face respirators with activated carbon filters as fumes may be toxic; assess whether your eyes or lungs are irritated.
- If landfill staff mitigation efforts using heavy equipment may exceed 30 minutes, operators should obtain and use the appropriate PPE identified in this Plan.
- If safe, remove equipment and vehicles from the fire area.
- Never drive a bulldozer directly over the fire.
- If it can be done safely, cover unburned and exposed waste with dirt.
- Dirt can be more effective than water. If water is used, typically less is more. Do not overuse water.
- Evaluate the situation and determine, based on specific circumstances, the best method for suppression.
- Prepare a fire incident report and submit it to the supervisor. Use an After-Action Report to review actions performed to determine potential improvements in response (See **Appendix F** for an example).

6.1.5 Type 4 Fires

Type 4 fires typically consist of waste fires that need more resources to be properly managed. These fires are characterized as requiring 8 to 24 hours of suppression activities. In general, the on-site personnel need to focus on containing the fire until the fire department has arrived. For these types of long-duration mitigation responses, the Landfill will contact heavy equipment contractors to perform primary mitigation efforts which would be supported as appropriate by landfill staff and equipment. The following actions must be performed:

- Notify the Facility Supervisor or person in charge of the landfill at that time.
- Contact dispatch (911) to notify the Graettinger Fire Department. Communicate clearly what the hazard involves so responding personnel have as much information as possible. Dispatch will assign a common channel for responding personnel. Determine what common channel responding personnel are using and establish contact with responders.
- Begin the ICS (See **Section 3** and **Appendix A**) by notifying the IC.
- A formal IAP is not needed at this time.
- Always avoid the smoke and use face respirators with activated carbon filters as fumes may be toxic; assess whether your eyes or lungs are irritated.

Figure 6-3. Type 4 Working Face Fire (Photo courtesy of Todd Thalhamer)

- Landfill operators assigned to mitigation activities should obtain and use the appropriate PPE identified in this Plan.
- If safe, remove equipment and vehicles from the fire area.
- Never drive a bulldozer directly over the fire.
- If it can be done safely, cover unburned and exposed waste with dirt.
- Dirt can be more effective than water. If water is used, typically less is more. Do not overuse water.
- If safe, construct a fire barrier with a bulldozer using borrow dirt.
- If the fire threatens to escape the landfill property, surrounding landowners should be notified.
- Evaluate the situation and determine, based on specific circumstances, the best method for suppression.
- Control site access to ensure the safety of responders, media, and curious onlookers.
- Prepare a fire incident report and submit it to the supervisor. Use an After-Action Report to review actions performed to determine potential improvements in response (See **Appendix F** for an example).

6.1.6 Type 3 Fires

Type 3 fires are medium-sized waste fires or large compost fires. These are characterized by fires being suppressed within one week. For these types of long-duration mitigation responses, the Landfill will contact heavy equipment contractors to perform primary mitigation efforts which would be supported as appropriate by landfill staff and equipment.

Figure 6-4. Type 3 Subsurface Fire (Photo courtesy of Todd Thalhamer)

Due to the extended timeline, the ICS protocol (See **Section 3** and **Appendix A**) must be properly initiated because planning will be the most important step to successful management of Type 3 fires. Larger fires have unique characteristics and there is not always a clear solution to suppression and extinguishment. Important questions should be assessed by key personnel to develop the IAP. These questions include:

- Is the fire smoldering or are large flames present?
- How much dirt is available and how quickly can it be applied?
- What fire barriers/containment structures are in place? What is available?
- Can oxygen be limited in the fire zone?

- Where is the smoke going? Who will it affect?
- Is landfill infrastructure (wells, liner, leachate collection system, etc.) being threatened?
- Is the fire near the surface?
- Are there risks of spreading off landfill property or developing into a Type 2 fire?

These questions can be essential in developing the proper suppression and extinguishing strategy. The applicable steps below must be followed in a timely manner.

- Notify the Facility Supervisor or person in charge of the landfill at that time.
- Contact dispatch (911) to notify the Graettinger Fire Department. Communicate clearly what the hazard involves so responding personnel have as much information as possible. Dispatch will assign a common channel for responding personnel. Determine what common channel responding personnel are using and establish contact with responders.
- Begin the ICS (See **Section 3** and **Appendix A**).
- Develop a formal written IAP.
- Always avoid the smoke and use face respirators with activated carbon filters as fumes may be toxic; assess whether your eyes or lungs are irritated.
- Landfill operators assigned to mitigation activities should obtain and use the appropriate PPE identified in this Plan.
- If safe, remove equipment and vehicles from the fire area.
- Never drive a bulldozer directly over the fire.
- If it can be done safely, cover unburned and exposed waste with dirt.
- Dirt can be more effective than water. If water is used, typically less is more. Do not overuse water.
- If safe, construct a fire barrier with a bulldozer using borrow dirt.
- If the fire threatens to escape the landfill property, surrounding landowners should be notified.
- Evaluate the situation and determine, based on specific circumstances, the best method for suppression.
- Control site access to ensure the safety of responders, media, and curious onlookers.
- Implement the IAP and update it during each operation period.
- Upon completion of the incident, document a summary of the incident. Use the After-Action Report to review actions performed to determine potential improvements in response (See **Appendix F**).

6.1.7 Type 2 Fires

Type 2 fires pose immediate health and safety issues and require a deep level of assessment and planning to prevent extensive impacts. Always call 911 immediately if a large surface or subsurface fire is detected. These fires may take up to two weeks to contain and many weeks to fully extinguish. Aggressive containment efforts are the most crucial step to implement and should be done quickly and concisely. For these types of long-duration mitigation responses, the Landfill will contact heavy equipment contractors to perform primary mitigation efforts which would be supported as appropriate by Landfill staff and equipment.

Figure 6-5. Type 2 Surface and Subsurface Fire in Panama
(Photo courtesy of Todd Thalhamer)

Because these fires have a longer firefighting and containment timeline, ICS becomes even more important with lower incident-type level fires. The team needs to develop a clear plan and strategy to contain and eventually extinguish the blaze. Water and foam application alone are typically ineffective in Type 2 fires.

Off-site impacts are a larger concern in Type 2 fires. Air quality can be severely impacted, and wind directions and smoke plumes should be tracked. This is needed if neighboring residents need to be contacted and made aware of adverse air quality conditions.

The same questions asked for a Type 3 fire should be reviewed for a Type 2 fire. These questions can be essential in developing the proper suppression and extinguishing strategy. The applicable steps below should be followed.

- Notify the Facility Supervisor or person in charge of the landfill at that time.
- Contact dispatch (911) to notify the Graettinger Fire Department. Communicate clearly what the hazard involves so responding personnel have as much information as possible. Dispatch will assign a common channel for responding personnel. Determine what common channel responding personnel are using and establish contact with responders.
- Begin the ICS (See **Section 3** and **Appendix A**).
- Develop a formal written IAP for each operational period.
- Always avoid the smoke and use face respirators with activated carbon filters as fumes may be toxic; assess whether your eyes or lungs are irritated.
- Landfill operators assigned to mitigation activities should obtain and use the appropriate PPE identified in this Plan.
- If safe, remove equipment and vehicles from the fire area.
- Never drive a bulldozer directly over the fire.
- If it can be done safely, cover unburned and exposed waste with dirt.

- Dirt can be more effective than water. If water is used, typically less is more. Do not overuse water.
- If safe, construct a fire barrier with a bulldozer using borrow dirt.
- If the fire threatens to escape the landfill property, surrounding landowners should be notified.
- Evaluate the situation and determine, based on specific circumstances, the best method for suppression.
- Control site access to ensure the safety of responders, media, and curious onlookers.
- Implement the IAP and update it during each operation period.
- Upon completion of the incident, document a summary of the incident. Use the After-Action Report to review actions performed to determine potential improvements in response (See Appendix F).

6.1.8 Type 1 Fires

It is anticipated that there would never be a Type 1 landfill fire event at the landfill, so this is included for information purposes only. Events of this magnitude are along the lines of Hurricane Katrina and are the most complex, requiring national resources. With Type 1 events, all command and general staff positions are filled, with an extensive number of operations personnel required. Often additional branches of the ICS need to be established. A written IAP is required for each operations period. The administrator will have briefings and ensure that the complexity analysis and delegations of authority are updated. Use of resource advisors at the incident command is recommended. In the event of a Type 1 event, there is also a high impact on the local jurisdiction, requiring additional staff for office administrative and support functions.

6.1.9 Cautions

Several points of this plan deem repetition. Safety is paramount. The goal of every employee and emergency responder is to return home after his or her shift(s). Landfill fires can quickly escalate so taking swift action, including calling 911, is needed to keep situations from becoming worse. In addition to swift action, other critical issues such as knowing that safety measures are in place, everyone is working towards the same goal with the same plan, and the needed resources are in place. These issues must be addressed prior starting attacks on larger fires. Keep in mind, landfill fires are not structure fires and cannot be treated as such. Landfill staff and emergency responders must work together to protect each other and attack the fire at the landfill with consideration to the special factors involved.

6.2 LANDFILL AND FIRE DEPARTMENT RESOURCES

Based on interviews with current Landfill staff, the internal resources listed in Table 6.3 are currently available in the event of a fire incident.

Table 6.3. Landfill Equipment Resources

Description	Fuel Type	Usage Notes
Logistical Equipment		
2000 Chevy Tahoe	Gas	Misc. 4x4
2008 Ford F150	Gas	Misc. 4x4
2014 Chevy 2500HD Pickup	Gas	Misc./Snow removal, 4x4
2023 Kubota RTV-1100CWH/HS	Diesel	Misc.
Case Skid Loader	Diesel	Misc.
1976 Motor Grader	Diesel	Grade roadways
1999 Case IH MX 120 with loader	Diesel	Mow grass
2019 International Semi Tractor	Diesel	Leachate tanker hauling
1986 Leachate Tanker (Trailer)	N/A	7,000 gallons
2019 MAC LLT Tanker Trailer	N/A	8,000 gallons
2019 Dodge Ram 2500	Gas	
2020 850L John Deere Dozer	Diesel	
2021 Grasshopper Lawn Mower	Gas	
1996 615C II Dirt Scraper	Diesel	
2018 John Deere 250G Excavator	Diesel	
1990 644E John Deere Payloader	Diesel	
Dirt Moving Equipment		
2019 963 Cat Track Loader	Diesel	
2023 Al Jon Compactor	Diesel	With push blade
2000 International Dump Truck	Diesel	6 cubic yards
1999 International Dump Truck	Diesel	
Fire Fighting Equipment		
Class B Foam		35 gallons
Class A Foam		85 gallons

The first responders have several resources already available to them in the event of a Landfill fire. These resources are summarized in **Table 6-4** to provide an understanding of what is available and what may need to be acquired.

Table 6-4. Fire Department Equipment Resources

Name	Tank Capacity (gallons)	Pump Rating (GPM)
First Out: Graettinger Volunteer Fire Department		
Pumper Truck	1,000	1,250
Pump Truck (doubles as Tanker)	1,500	1,000
Tanker	2,500	
Tanker	1,500	
Pickup Truck 4x4	250	
Side-by-Side	85	
Ground-Based Monitor Nozzles (2)		500
Class A Foam – on each pumper truck (30 gallons)		
Class A Foam – at fire station (45 gallons)		
Class A Foam – at Landfill (85 gallons)		
Foam Application Tools: Pro Pack, Inductor, Nozzles		
Second Out: Emmetsburg Volunteer Fire Department		
Pumper Truck	1,000	1,500
Pumper Truck	1,000	1,500
Pumper Truck	1,000	1,500
Tanker Truck	1,800	1,500
Pickup Grass Unit	400	50
Can Am ATV – Side-by-Side (high pressure with foam nozzle)	60	
Can Am ATV – Side-by-Side (high pressure pump)	60	
Third Out: Ruthven Volunteer Fire Department		
Main Pumper	1,000	1,250
Pumper Truck (dump capable)	1,250	1,250
Tanker Truck (dump capable)	2,000	
Tanker Truck	1,000	
Pickup Truck	250	
Can-Am Defender 4x4 UTV	75	
Can-Am Defender 4x4 UTV	75	
Fourth Out: Wallingford Volunteer Fire Department		
Engine 1	1,000	1,000
Engine 2	1,000	750
Tanker	1,500	
Chevy Grass Wildland Truck		

6.3 SUPPRESSION OF FIRES

Many factors should be considered in determining the appropriate method of extinguishment of a landfill fire including:

- Fuel/materials involved
- Wind conditions
- Location and source of ignition
- Surrounding system components
- Accessibility/availability of Class A foam, water, and soil
- Environmental impact
- Human safety
- Personnel/equipment resources available

There is not a single solution for all landfill fires and, even within a given situation, the extinguishment method may be modified based on the changing conditions at a particular time. To extinguish the fire, one method or a combination of several methods may be necessary. In a Type 3 or Type 2 incident, the approach may vary several times as it is determined what works best. A variety or "toolbox" of methods is provided below to help the landfill determine the best response.

6.3.1 Apply Cover

The application of a thick layer of low-permeability soil is often successful in suppressing a fire. This method is based on completely cutting off the fire from oxygen. The fire will slowly consume the remaining oxygen within the cell until it is gone, and the fire goes out. If available, clay is the preferred material since sandy soils will still allow the infiltration of oxygen. This method is best suited for surface fires where there is no air intrusion from below. Application of waste is not recommended because it may ignite, resulting in a surface fire. For vertical or otherwise steep surfaces, shotcrete may be effective (Ohio Environmental Protection Agency, 2011).

6.3.2 Water Supply

Water supply is important for both surface and subsurface fires for different reasons. Water, along with other measures, can be used to extinguish a surface fire. For subsurface fires, however, utilization of large amounts of water has been shown to be either ineffective or detrimental to fire extinguishing efforts.

The addition of water can enhance bacterial growth which can cause odor concerns while producing more heat. Applying large amounts of water can increase aerobic decomposition, resulting in elevated internal temperatures, making fire extinguishing efforts more difficult.

Large amounts of water also increase leachate volumes, which can overwhelm the leachate collection system. Also, large amounts of water can cause instability of the waste mass by increasing

pore pressure, resulting in slope failures. Large amounts of water also usually cause muddy and more difficult operational conditions.

In the case of a subsurface fire, water can be effective for dousing excavated smoldering material. When water is needed, a quick water supply (e.g., a 10,000-gallon tank) may be better than an unlimited water supply (e.g., municipal or well water supply). An elevated tank could fill a tanker truck in a matter of minutes while other sources may take hours. (Bolton, 1995)

Table 6-5 details site-specific water sources at the Landfill.

Table 6-5. Landfill Water Supply

Pond	Location	Depth	Average Fullness
Primary Pond	South central, Upper	15 feet	70%
Secondary Pond	South central, Lower	10 feet	70%
Tertiary Pond	Northeast	4 feet	30%

6.3.3 Foams

Foam can be an important tool for landfill fire suppression. Although water can be effective on Class A fires, its natural high surface tension creates limitations for cooling and penetrating some wood and paper fires. Water tends to "roll off" the surface, which limits its effectiveness. Foams, however, contain a surfactant that is designed to limit surface tension and thus stick to the surface it contacts. Foam can also make subsequent use of water more effective by enhancing the penetration of the foam-water combination compared to just water alone.

There are two types of firefighting foam: Class A, which coats and insulates fuels, protecting them from ignition, and Class B, which is used to extinguish fires involving flammable and combustible liquids and suppression of vapors. According to CalRecycle, Class B foam is not recommended for use at landfill fires since it is designed for covering over a spilled flammable liquid on a two-dimensional surface, thereby making it ineffective in a three-dimensional space (Palmer, 2006).

There are advantages and disadvantages to using foams on landfill fires. For example, Class A foam can be toxic to fish and other aquatic life. The IC will make the decision whether to use foam based on the site-specific situation. It is recommended that the Landfill purchase and store Class A foam. This material would then be readily accessible to fire departments responding to a fire at the Landfill. The Graettinger Fire Department typically has the following foam resources available:

- Class A – 30 gallons on each truck
- Class A – 45 gallons at the Fire Station
- Class A – 85 gallons at the Landfill

Over many years, there has been increased human health and environmental concerns about perfluoroalkyl and polyfluoroalkyl (PFAS and PFOS) substances, also known as "forever chemicals." These chemicals are used in a wide variety of manufactured materials and products. Studies have

shown that exposure to these chemicals could cause cancer and issues with reproductive systems and development.

There is concern that fire-fighting foams have PFAS and PFOS, but Class A foams are made from hydrocarbon-based surfactants and do not typically contain PFAS. However, Class B and A/B foams likely do include PFAS as a constituent. If Class A foam is to be purchased for fire mitigation activities, the Landfill and area fire departments should work with the vendor to understand the potential risks the product may pose to human health and the environment.

6.3.4 Excavation and Fire Break

Excavation of the hot waste can be done; however, exposing the hot material to the open air could cause flare-ups, worsening the situation. All efforts should be made to limit the addition of oxygen to the fire. Water, Class A foam, or other methods should be used in conjunction with excavation to form a fire break and to keep equipment cool. Typical fire breaks are soil or clay-filled trenches constructed ahead of the leading fire face (Ohio Environmental Protection Agency, 2011). Careful planning is necessary if the selected remedy is excavation and a fire break. Once the material is excavated, a hot zone must be available to move the material for either water or Class A foam to be applied to extinguish the fire. Collection of runoff from this area must be considered and controlled. Sufficient space must be available for the material to cool before moving it to a storage area until it can be placed back in a landfill cell.

6.3.5 Inert Gas Injection

This method requires a thorough knowledge of the location and extent of the fire, as well as the location of the liner systems and other landfill structural components. An inert gas, such as carbon dioxide or nitrogen, is injected to displace oxygen in the burning and surrounding waste mass, which isolates and smothers the fire. This method can be done by either injecting the inert gas around the perimeter of the fire or directly into the fire. It should be noted that this method will likely involve the use of heavy equipment at or near the surface above the fire, which could result in a surface cave-in. Surface air monitoring should also be established to evaluate the potential risk of escaping gases and its potential safety risk to human health.

6.3.6 Let it Burn / Do Nothing

This method is generally selected when there is a lack of funding for fire suppression. With this option, the fire may continue to burn for an extended period, which can lead to adverse air quality conditions and even lawsuits. Depending on the configuration of the landfill and the location of the fire, stability issues may result. Large voids can be formed when waste burns deep inside the landfill. Equipment passing over a large void may result in collapse causing injury to the operation and/or damage to equipment (Thalhamer, 2009).

6.3.7 Oxygen Injection

When fire suppression is not possible and limited resources are available, the fire can be accelerated to burn the material more quickly. Large fans can be used to introduce oxygen and accelerate the burn rate of material. This will limit the amount of time that toxic smoke is released into the air, as well as keep the fire's temperatures elevated. An elevated burning temperature

typically means more complete combustion and less harmful emissions. This method should only be done with the help of experts and when no other method seems feasible.

6.4 FACTORS TO CONSIDER

Factors to consider for extinguishment of landfill fires apply to both surface and subsurface fire types. The methods used to handle each fire will vary based on materials available, funds, and threats caused by the fire.

6.4.1 Wind and Weather

Wind and weather can increase the health hazards for firefighters, landfill staff, and other individuals both on and off-site. High wind speeds can cause the spread of a fire and hinder site communications and visibility. Shifting winds can cause smoke cover over command areas. Extreme cold or hot weather can cause health issues for firefighters.

6.4.2 Multi-Agency Response

A major landfill fire will likely require help from multiple sources, including state and federal agencies. Local fire departments will also likely be available. It should be noted, however, that most local fire departments do not have experience with landfill fires. This further necessitates communication and the ICS. It is always a good idea to consult experts when a large fire has developed as landfills pose unique threats that require alternative methods of firefighting.

6.4.3 Personnel Safety

Personnel Safety is addressed in Section 7.0 Health & Safety and Environmental Considerations.

6.4.4 Access and Maneuverability of Heavy Equipment

Heavy equipment will be needed to apply cover material and/or excavate and apply water or foam. However, it should be emphasized that subsurface fires usually cause the development of subsurface void spaces which may collapse under the weight of heavy equipment.

6.4.5 Logistics

Some of the items to be coordinated by the IC (See Section 3.1.4), include rotating personnel, compensating personnel for overtime activities, having sufficient volunteer firefighters and landfill staff available, monitoring health conditions, ensuring proper medical treatment is readily available, and keeping responders fed and hydrated.

6.4.6 Environmental Impact

Potential environmental impact on the community is addressed in Section 7.0 Health & Safety and Environmental Considerations.

6.4.7 Landfill Contents

The contents of MSW landfills are discussed in Section 2.0. While Household hazardous materials (HHM) are exempt from regulations and can be accepted by MSW landfills, many communities

implement regularly scheduled programs to collect HHM and keep it out of the landfill. Landfill staff and firefighters should be prepared to encounter fumes and smoke from HHM combustion. It should also be noted that some landfills have been operating since the mid-1970s, prior to regulations that prohibited or reduced the acceptance of hazardous materials.

6.5 SURFACE FIRES

Surface fires are usually suppressed by applying a layer of soil material. Although small amounts of water can help, large amounts of water are not recommended. Class A foam can be used along with or instead of water. It is recommended not to drive heavy equipment directly onto burning waste material.

6.6 SUBSURFACE FIRES

Subsurface fires pose significant problems in detecting, containing, and extinguishing the fire. Subsurface fires do not burn like a typical fire, but rather they smolder, emitting heat and slowly moving through the landfill cell. The smoldering will reduce waste volumes and cause significant settling and/or voids within the waste material, where equipment may later cause a collapse.

Methods of fighting subsurface fires differ from surface fires. They are typically suppressed by a cutoff barrier, which limits the spread of the fire, or oxygen-suppressing methods, such as applying impermeable soil cover to starve the smoldering fire of oxygen.

Excavation of the hot material and extinguishing it in a controlled location is also a viable method. However, this can be very expensive and time-consuming.

7.0 HEALTH & SAFETY CONSIDERATIONS

The health and safety of staff and responders is paramount in landfill fire situations. While landfill fires are not rare, landfill fires of a magnitude that require joint efforts for response are less common and therefore not necessarily understood by parties involved. Effective and safe response to landfill fires requires the consideration of multiple factors: potentially emitted gases, appropriate breathing protection, potential sinkholes, equipment risks/damage – the list goes on. This is why a unified command, working within the IC structure, is needed to pull the knowledge bases of the landfill and fire experts together to address these areas.

Landfill fires can cause many types of life and health-threatening conditions. These conditions must be identified, addressed, discussed with site personnel, and documented in a Health and Safety Plan that guides personnel in the event of a fire. A Health and Safety Plan for a landfill fire should address the following:

- Identification of potential exposures and site hazards
- Communications
- Hospital locations
- Emergency numbers
- Air sampling procedures

- Respiratory issues
- Personal Protective Equipment (PPE)
- Monitoring

7.1 POTENTIAL EXPOSURES AND SITE HAZARDS

Landfill fires, especially subsurface fires, can create many types of health-threatening conditions. In addition to heat, other combustion by-products including gases, vapors, and smoke will need to be monitored to ensure the safety of site personnel and neighboring communities. Exposure levels for firefighters, facility personnel, and the public will need to be minimized and monitored. Asthmatics are particularly susceptible to these compounds in the air and should take extra precautions or avoid the fire altogether.

Combustion by-products can be used to evaluate whether a landfill fire is present. Landfill fires emit air pollutants that can pose safety and environmental health threats. These pollutants include, but are not limited to, particulate matter, carbon monoxide, volatile organic compounds (VOCs) (e.g., benzene, and methyl-ethyl ketone), Polycyclic Aromatic Hydrocarbons (PAHs), semi volatile organic compounds (SVOCs), chlorinated dibenzo-p-dioxins, and chlorodibenzofurans (Martin et al. 2011; Stark et al. 2012; Szczygielski 2008; Bates 2004; Nammari et al. 2004; ATSDR 2001; Junod 1976).

Smoldering combustion at waste facilities has also been shown to increase the concentration in some VOCs (e.g., benzene and methyl-ethyl ketone) one to two orders in magnitude (U.S. EPA 1991; Martin 2012 et al; Paker et al 2002). In general, gas concentrations of some VOC emissions from Subtitle D landfills double with every 18°F of temperature increase (ATSDR 2001). Benzene and methyl-ethyl ketone are the two compounds that have consistently been found at elevated levels during landfill fire investigations. These compounds can be used to examine the likelihood of a landfill fire in conjunction with other parameters (Thalhamer 2011). Benzene has also been shown to be the largest emission compound (979.75 mg/kg) when household waste is burned (U.S. EPA 2002). Benzene has an odor threshold of 840 ppb and is described as a paint-thinner-like odor (ATSDR 2001).

Subsurface fires can also result in carbon monoxide (CO) levels over 50,000 parts per million (ppm). The Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for CO is 50 ppm, which means that a worker is prohibited from working in an environment of more than 50 ppm averaged over an 8-hour day. When CO displaces oxygen in the blood, the heart, brain, and other vital organs suffer. Prolonged CO exposure may result in permanent damage or even death.

According to the U.S. EPA, landfill fires and uncontrolled burning of residential waste are considered the largest sources of dioxin emissions in the nation. Although low concentrations of dioxins are naturally occurring, exposure to higher levels of dioxins has been linked to cancer, liver damage, skin rashes, and reproductive disorders.

Hydrogen sulfide gas has also been detected in landfill fire smoke. Health and safety risks associated with exposure to hydrogen sulfide range from nausea to death, depending on the concentration and exposure timeframe. Hydrogen sulfide will have a detectable odor (rotten eggs) as low as 0.01 – 1.5 ppm. The odor becomes offensive at 3 – 5 ppm and, at 30 ppm, its smell is

described as sweet or sickeningly sweet. The PEL for hydrogen sulfide is 20 ppm average over an 8-hour period and not to peak over 50 ppm.

Additional health and safety risks posed by landfill fires include burns and explosion hazards. Although not typical, subsurface fires have caused sinkholes at the surface posing a danger to firefighters, other personnel, and equipment. Rapid settlement over a short period may be an indication of a subsurface fire and a sinkhole risk in the immediate and adjacent areas.

7.2 HEALTH & SAFETY FOR RESPONDERS

The safety of fire responders is of paramount concern. The delegated HSO described in Section 3.2.1.6.2 will have overall responsibility for health and safety of all personnel on-site; however, the firefighting group will maintain responsibility for fire department personnel safety during the response. This section details the minimum equipment required for a landfill fire response, training for use of that equipment, and health monitoring activities.

7.2.1 Personal Protective Equipment (PPE)

Responding fire departments and outside government agencies will be responsible for provision, inspection, and maintenance of PPE required for their respective roles during the response. Contracted companies are responsible for providing their on-site personnel with appropriate PPE. PPE type use and condition is subject to inspection by the incident HSO. The Landfill is responsible for providing PPE for all personnel on-site.

7.2.1.1 PPE Compliance

This section is intended to provide information about PPE protection levels to ensure compliance with PPE requirements defined by the OSHA standard 29 CFR 1910 subpart H.

As required by the standard, PPE must be selected which will protect employees from the specific hazards they are likely to encounter during their work on-site.

Several factors should be taken into consideration when determining the appropriate PPE protection levels. The following questions should be used to verify the correct PPE that is needed for a situation.

- What hazards or potential hazards are present?
- Why are they hazardous and how will they cause injury to responders and staff?
- What needs to be protected and how will that be done?

Chemicals can be hazardous through contact, inhalation, or absorption through exposed skin. It is important to know the modes a chemical can enter your body so a barrier of PPE reduces the chance of contact. Some chemicals, such as a strong acid, will eventually corrode their way through PPE, so always ensure that the breakthrough time is longer than the work period or replace the PPE before this occurs.

It is important to match the PPE used with the job at hand. Fires are treated differently than chemical or biological spills. PPE should be durable and protect the employee from the hazards present in the work environment. Additionally, when working in hot conditions, it can be dangerous to wear a thick

layer of PPE for long periods. When using thick PPE in warm conditions, be sure to stay hydrated and take numerous breaks. Never remove this PPE until you are well away from the hazard.

At the beginning of an incident, responders should wear the highest levels of PPE because it is not possible to know what hazards are present and at what levels. When more information is known, PPE may be able to be downgraded to a lower protective level.

The following are guidelines that can be used to begin the selection of the appropriate PPE.

7.2.1.2 PPE Levels

PPE is divided into four categories based on the degree of protection required for a given situation. OSHA defines these categories and the PPE that may be needed (29 CFR 1910).

Level A is defined as having the highest risk for skin, respiratory and eye injuries. Protection is head to toe with the most durable and protective gear. Recommended Level A equipment is listed below.

- Positive pressure, full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
- Totally-encapsulating chemical-protective suit
- Coveralls
- Long underwear
- Gloves, outer, chemical-resistant
- Gloves, inner, chemical-resistant
- Boots, chemical-resistant, steel toe, and shank
- Hard hat underneath the suit hood
- Disposable protective suit, gloves, and boots (depending on suit construction, may be worn over a totally-encapsulating suit)

Level B is defined as having the highest risk for respiratory injuries from inhalation but with a lesser risk of skin injuries. The following is a guide for Level B equipment which is likely the suitable level for any person who may be directly exposed to the waste fire plume.

- Positive pressure, full-facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved)
- Hooded chemical-resistant clothing
- Long-sleeved jacket
- One or two-piece chemical-splash suit
- Disposable, chemical resistant overalls
- Gloves, outer, chemical-resistant

- Gloves, inner, chemical-resistant
- Boots, chemical-resistant, steel toe, and shank.
- Boot-covers, outer, chemical-resistant (disposable)
- Hard hat
- Face shield

Level C is defined as a situation where the concentrations and type of airborne substances are known, leading to the determination that air-purifying respirators are acceptable protection against fumes. This level would be appropriate after the plume has been characterized or when SCBA devices are not available. The following list is for the recommended Level C PPE.

- Full-face or half-mask, air purifying respirators (NIOSH approved)
- Hooded chemical-resistant clothing
- Coveralls
- One or two-piece chemical-splash suit
- Disposable, chemical resistant overalls
- Gloves, outer, chemical-resistant
- Gloves, inner, chemical-resistant
- Boots, chemical-resistant, steel toe, and shank
- Boot-covers, outer, chemical-resistant (disposable)
- Hard hat
- Escape mask
- Face shield

Level D is defined as a standard work uniform affording minimal protection which is typically used for nuisance contamination only. The following list is a guide to Level D equipment.

- Coveralls
- Gloves
- Boots/shoes, chemical-resistant, steel toe, and shank
- Boots, outer, chemical-resistant (disposable)
- Safety glasses or chemical splash goggles
- Hard hat
- Escape mask
- Face shield

7.2.1.3 PPE Applicability

Each Level (A, B, C & D) defined by OSHA gives very general situations for what type of PPE should be worn. However, in real-life situations, many different scenarios may lead to slightly different conditions. Below are examples of when each level should be used.

Level A protection should be used when:

- A hazardous substance is present and requires the highest level of skin, eye, and respiratory protection. This is based on the potential for harmful concentrations of toxics within the air where work is to be done.
- High potential for splashing or immersion in chemicals
- Toxic compounds are present that can be absorbed through the skin
- When operations must be conducted in a poorly ventilated and confined space where hazards are, or could be, present

Level B protection should be used when:

- Concentrations of compounds have been found that require very strong respiratory protection, but skin protection is of less concern
- When oxygen levels are under 19.5% (the threshold for potential dizziness)
- When vapors or fumes are present, and their identities have not yet been identified.

Level C protection should be used when:

- When fumes, vapors, or liquids do not pose significant risks when coming into direct contact with the skin
- Air contaminants are present but not identified or quantified, and an air purifying respirator is available
- Criteria for using an air-purifying respirator are met

Level D protection should be used when:

- There are no known or even potentially hazardous compounds in the air
- It is not expected that exposure to liquid hazards (spills, immersion, contact) is possible given the typical work duties. When duties change, PPE should reflect all potential hazards.

7.2.1.4 Landfill Fire PPE

In addition to the OSHA recommended PPE as defined by the exposure levels, landfill fires require a more specific set of guidelines than what is suggested by OSHA.

Landfill fire PPE should be used when personnel intend to enter the combustion zone or the gas plume to fight the fire or to sample air. Always wear, at a minimum, an air purifying respirator, steel-toed puncture resistant boots, and full sleeves. When entering an active fire zone, bunkering gear should be worn as described in the next paragraph (OSHA, 1994).

Fire resistant clothing (i.e., Nomex) gear typically is composed of pants, shirt or coat, neck, face and head covers, gloves, eye protection, and a helmet. All clothing must be tear resistant as well as withstand temperatures of 500 degrees for 5 minutes with no visible damage. The option should be explored to obtain sets of bunkering gear from local fire departments. More specifically, technical data on bunkering gear specifications are defined by the National Fire Protection Association (NFPA), which is generally stricter than OSHA standards.

Fire-resistant clothing is of utmost importance. It is recommended that the Landfill obtain multiple fire-resistant protective clothing sets to be used by the equipment operators in addition (or in place of when applicable) to the recommended PPE for Level C. Contact the area Fire Departments for assistance in evaluating the proper type of fire-resistant protective clothing for Landfill fires.

In addition to PPE, anyone on-site or in the vicinity of the fire should wear a reflective, highly visible vest to reduce the risk of not being seen by equipment operators. Additionally, if fighting the fire goes into the night, everyone should have a flashing light attached to their clothing.

7.2.1.5 Respiratory PPE – Fire Department

Fire department staff have extensive training for the proper use of their SCBA equipment. Fire mitigation efforts using SCBA equipment are limited by time, task, and air bottle supply. The duration for which fire department personnel can work will depend on their level of physical activity for the assigned task, as well as weather and site conditions. The Safety Officer will be responsible for working with all fire departments to monitor the health status of fire department staff engaged in mitigation efforts.

Fire departments have quick-fill air bottle stations which will be brought to the Landfill if a prolonged mitigation effort is expected. The ICS will determine when these resources need to be deployed.

Figure 7-1. Full Facial Masks

Figure 7-2. Organic Vapor Cartridges

7.2.1.6 Respiratory PPE – Landfill Operators

While Landfill operators are provided some level of protection from waste fire exposures when inside the cabin of heavy equipment, there are still potential exposure risks.

Operators responding to "flare-ups" (i.e., sudden events that produce light smoke or fire) at the working face typically mitigate these events before they generate large amounts of smoke. These "flare-up" events generally last less than 30 minutes. Therefore, this Plan is focusing on respiratory protection for operators who will be assigned direct fire mitigation responsibilities that are anticipated to last more than 30 minutes. If operators are performing mitigation efforts and it becomes apparent that activities will last longer than 30 minutes, staff should coordinate so that they can obtain the designated equipment and PPE to continue performing mitigation activities.

When operators are preparing to operate heavy equipment for direct fire mitigation activities, they should have and use the following PPE items:

- Steel-toed boots
- Fire-resistant clothing (seek advice from fire departments on recommended attire)
- Four-gas Meter
    - This device samples air and provides a visual and audible alarm if one of the following gases is detected at unacceptable levels. If the alarm goes off, operators should remove themselves from the active area and notify the Landfill Manager and Safety Officer.
        - Carbon monoxide (CO)
        - Hydrogen Sulfide (H_2S)
        - Oxygen (O_2)
        - Methane (CH_4)
- Powered Air Purifying Respirator (PAPR)
    - This device provides a powered air pump that pulls ambient air through cartridges and provides a steady flow of air to a hood that is worn by the operator. The PAPR provides enough airflow such that the operator does not need to be clean-shaven to maintain a good seal on the operator's face.
    - The PAPR has primary and backup batteries and should be used with high-efficiency particulate air (HEPA) and organic vapor cartridges.
    - This device needs to be used in combination with the four-gas meter to alert the operator if there are potentially dangerous gas levels in the operating area.

If the operator may leave the equipment and be exposed to contaminated air, it is recommended they have and use Level C PPE items which are identified in **Section 7.2.1.2**.

The following is a list of general performance standards for the PAPR cartridges recommended above.

- **HEPA (High Efficiency Particulate Air)**

- 99.7% minimum efficiency for all particulates

- Organic Vapors
  - Chlorine
  - Hydrogen chloride
  - Sulfur dioxide
  - Hydrogen sulfide
  - Hydrogen fluoride
  - Chlorine dioxide
  - Ammonia
  - Methylamine
  - Formaldehyde

The combination of the heavy equipment air filters (especially if an activated carbon filter is used), four-gas meter, and the PAPR device with proper cartridges provides the operator with an increased level of protection against potentially dangerous air emissions caused by the burning waste.

While having the PPE equipment is important, maintaining the equipment (i.e., including calibration) and training operators regularly on how to properly use it is also critical. It is recommended that the Landfill develop a respiratory protection plan that:

- Identifies specific four-gas meters, filters, cartridges, PAPRs, and ancillary equipment for purchase
- Establishes maintenance, storage, and inspection protocols
- Establishes training program on use of the equipment
- Establishes an initial and refresher training schedule
- Establishes respirator-clearance medical screening protocols
- Develops fit-test requirements for employees that may wear face respirators

7.2.1.7 PPE Training

The Landfill Manager is responsible for ensuring Landfill personnel are trained in the use and care of assigned PPE. The Landfill shall conduct annual medical clearance, training, and fit testing of personnel as required under 29 CFR 1910.134.

In addition to individual PPE training, Landfill staff will be trained in the use of fire extinguishers. Training will include proper placement of fire extinguishers (e.g., in each vehicle), routine inspection of extinguishers, and proper application of fire extinguishers. Landfill staff must be trained to understand the limitations of handheld extinguishing devices. More details on fire extinguisher use can be found in Section 6.1.2.

7.2.2 Health Monitoring

As part of the Landfill respirator program, staff whose duties require the use of a respirator will be medically cleared and monitored in accordance with OSHA requirements. During a response, the HSO will work with the County and other regulators to identify appropriate monitoring activities. In the event a health concern arises for any worker on-site during the response, the HSO will request support by contacting fire department staff or by calling 911.

7.2.3 Emergency Medical Service Locations

The location and directions to the nearest hospitals are provided in **Appendix E**. The Family Practice Clinic in Graettinger will serve as the primary medical facility for injuries and can be reached in approximately 3 minutes. Also, the Palo Alto County Health Systems is about 12 minutes from the Landfill. The University of Iowa Hospital is the state of Iowa's only burn treatment center. If a patient needs their expertise, it is likely that a life flight or ambulance from one of the hospitals would transport them to the burn treatment center.

7.2.4 Emergency Contacts and Numbers

A list of responders' and media contact information is provided in **Appendix B** and **Appendix C**.

7.3 AREA HEALTH AND SAFETY

While numerous health and safety concerns affect on-site responders during a Landfill fire, the primary threat to off-site personnel – the local population – is degraded air quality. In addition to particulate matter, burning of MSW is anticipated to release toxic chemicals. The Unified Command and HSO, in cooperation with other governmental agencies, are responsible for taking appropriate actions to safeguard the health and safety of those present at the Landfill that are not involved with the response as well as the surrounding population. Generally, firefighting efforts will occur from an upwind position. Responding personnel should remain out of areas containing heavy smoke.

7.3.1 Air Monitoring

The severity of the incident will determine the level of the ICS that is established. The IC will determine whose responsibility it is to contact the Iowa DNR Field Office #3 for further instruction on air quality monitoring. They will evaluate the situation and write down the sampling procedure which will be carried out by a contractor. As part of the ICS, the Palo Alto Emergency Manager will be involved to determine potential hazards before they occur. Additionally, the at-risk populations within proximity of the Landfill will need to be contacted (**Appendix D**). In the event the air monitoring triggers an alarm for potential health hazards, at-risk populations located the closest and downwind should be contacted first.

Extended response efforts for large fires may exceed the air monitoring capabilities of local resources. The County will contract for area air quality monitoring as needed in the event local resources cannot support the response.

7.3.2 Respiratory Issues

As previously discussed, air emissions from Landfill fires can pose serious health and safety risks not only to on-site personnel working to extinguish the fire, but also to people, pets, and livestock downwind of the fire.

The Graettinger Fire Department, Palo Alto Emergency Manager, and Iowa DNR Field Office #3 should be consulted to determine the appropriate level of respiratory protection necessary for specific on-site activities based on potential exposure and exposure timeframes. These may include identifying which activities (i.e., excavating dirt in borrow area, placing dirt on identified hot spots, providing water support, etc.) require disposable N95 dust masks, air purifying respirators (APR), powered air-purifying respirators (PAPR), self-contained breathing apparatus (SCBA), supplied air systems, or other respiratory protective equipment.

Personnel that may be exposed to emissions from the Landfill fire should not begin activities until respiratory protection is secured. At a minimum, N95 dust masks should be worn until the environment is determined to be safe or is found to require increased levels of respiratory protection. Respiratory personal protective equipment (PPE) requirements are discussed further in **Section 7.2.1.7.**

Respiratory protection measures may also be required for neighboring businesses and residents. These measures may require coordination with emergency management officials (i.e., Graettinger Police Department, Palo Alto Sherriff officials, Iowa State Troopers, Palo Alto Department of Health, etc.) to evacuate personnel from areas identified as at-risk of negative respiratory impacts. These people may need to be evacuated to a local hotel, shelter, or hospital.

The ICS will determine who is responsible for contacting at-risk populations within the areas identified as having potential negative respiratory impact. **Appendix D** provides contact information for identified facilities that may have at-risk populations (i.e., daycares, schools, adult care centers, hospitals, etc.) located within 5 miles of the Landfill.

7.3.3 Wind Patterns

The HSO is responsible for ensuring changes in wind direction are monitored during the response to facilitate proper air monitoring equipment placement. The HSO or their representative will establish a plan for communicating wind direction changes to responders that may put additional or different personnel at risk either on or off-site.

Exhibit 7-1 and **Table 7-2** below show historical wind patterns as determined by the Midwestern Regional Climate Center (Wind Rose from cli-MATE tool). Also included are possible impact zones based on wind directions. These entities should be kept in mind when assessing the smoke plume during a large Landfill fire. The winds near the Landfill vary greatly but come the most frequently and at the greatest speed from the south.

Exhibit 7-1. Spencer Wind Rose: January 2022 – December 2024

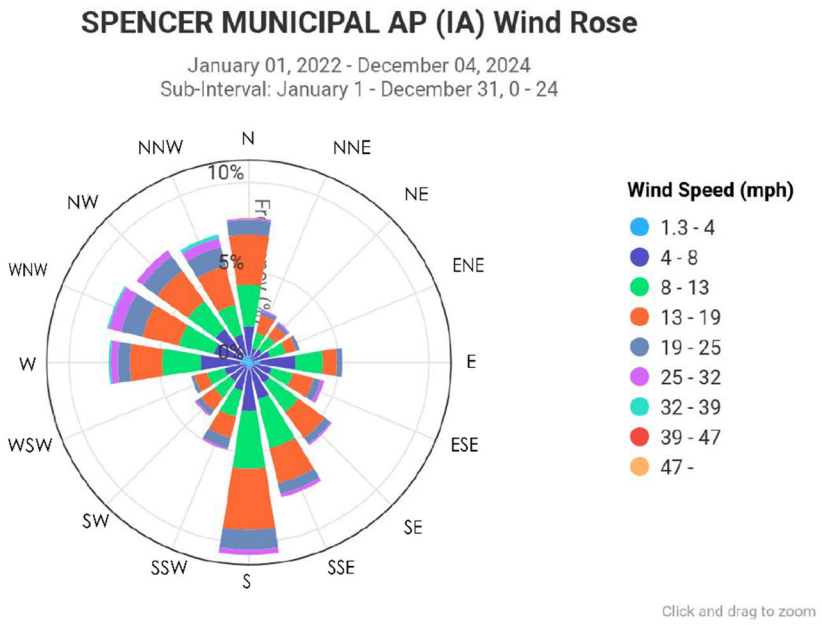


Table 7-2. Wind Direction and Possible Impact Zone

Wind Out of the	Average Speed (mph)	% Time from Direction	At-Risk Populations
S	12.3	10.8%	City of Graettinger and possibly the City of Wallingford
N	11.9	8.0%	Rural Populations and possibly the City of Emmetsburg
WNW	13.6	8.0%	Rural Populations and possibly the City of Osgood
SSE	11.3	7.7%	Rural Populations
W	11.6	7.7%	Rural Populations and possibly the City of Osgood
NW	12.4	7.7%	Rural Populations and possibly the City of Osgood
NNW	14.3	7.4%	Rural Populations and possibly the City of Osgood
SE	11.6	5.9%	Rural Populations
E	9.1	5.3%	Rural Populations
SSW	11.5	5.0%	Rural Populations
ESE	12.1	4.2%	Rural Populations
SW	11.1	3.9%	Rural Populations
WSW	9.8	3.4%	Rural Populations
NNE	11.5	3.0%	Rural Populations and possibly the City of Ruthven
NE	11	2.8%	Rural Populations and possibly the City of Ruthven
ENE	9.6	2.8%	Rural Populations and possibly the City of Ruthven
Calm	(<1.3%)	6.4%	
Average/Total	**11.1**	**100.0%**	

Notes:
1. For specific at-risk populations to contact, see **Appendix D**.
2. Wind noted as being out of the southwest is moving northeast.

7.3.4 Emergency Evacuation Policy

An evacuation plan provided by the Landfill Manager can be found in **Appendix G**.

7.4 ENVIRONMENTAL CONSIDERATIONS

Protection of the environment is a key component of the construction and operation of today's MSW sanitary landfills. When engaged in firefight, these areas need to be considered and protected. At the Landfill these areas include the Perkins Marsh State Game Management Area, the creek/drainage ditch that runs through the property, and several Conservation Reserve Program (CRP) acres on the east side of the property.

7.4.1 Stormwater Discharge Protection

The Landfill operates under NPDES General Permit for industrial sites and SWPPP. As such, stormwater generated at the working face is handled within the waste mass and treated as leachate. Stormwater run-off is diverted from the active Landfill and borrow areas when possible and routed to the stormwater sedimentation basin designed for a 24-hour, 25-year storm. Inundation with large quantities of foam and water may affect the ability of the leachate collection system to handle the flows. Water that is handled through the stormwater BMPs must not inundate the system and needs to meet required testing parameters.

7.4.2 Groundwater Protection

Federal and state code related to Landfill operations requires the protection of groundwater. As such, groundwater wells are installed around the perimeter of the Landfill and are monitored for several constituents typically twice per year. Efforts should be made to protect the well infrastructure but also, more importantly, groundwater quality. Foam and water runoff from the firefight should be contained as much as possible to prevent entry into the groundwater.

7.5 POST-INCIDENT MONITORING

Modern engineered landfills are designed to protect human health and the environment. The Landfill is monitored continuously through on-going operations from ambient methane testing, surface and groundwater testing, and visual inspections, to name a few methods. In the event of a Landfill fire, it is important to conduct further monitoring to determine if either air or water sources were affected.

7.5.1 Air Monitoring

From their inception, Landfill fires pose a concern for the potential hazards emitted due to burning waste. All landfills accept different items which, when combusted, emit a wide variety of toxic chemicals. It is imperative for the safety of all parties to know the potential hazards hidden within the Landfill fire smoke plume.

Monitoring is accomplished with a full spectrum of testing equipment. Organic compounds can be quantified using photoionization detectors, flame ionization detectors, or infrared ionization detectors, which will provide immediate feedback on the current concentrations. These tools quickly diagnose potential organic air hazards.

When a fire is expected to burn for more than one week, it is recommended to use an air pump to extract smoke samples for volatile organic compounds (VOCs) measurements with an ionization detector and to limit personal exposure. Ionization detectors work by detecting the signature of electrons that escape compounds when exposed to temperatures. All organic compounds have a unique signature based on their previous bonding. It is important to know the ionization energy for the detector being used. Any compound with a first or second ionization energy above that range cannot be measured. A typical rule of thumb is that a concentration of above 5 ppm should be viewed as concerning.

Particulate matter (PM) will also be present when a Landfill fire occurs. PM can be measured using a real-time aerosol monitor. These are limited to quantification of PM and cannot distinguish between chemical or inert particulates. Aerosol monitors work by measuring how much light is reflected or blocked by the particles within the air. This is accomplished by an optical sensor and a small infrared beam. Typical PM concentrations are measured in milligrams per cubic meter (mg/m3) and should be considered a concern when they rise 3 mg/m3 above the typical background levels.

When contaminants are known or suspected to be within the Landfill where the fire is burning, colorimetric tubes can be used for further investigation. Each type of tube is compound-specific and will confirm the presence of the chemical and if its current concentration exceeds the recommended exposure limit. Colorimetric tubes may be of use for measuring hydrogen sulfide, carbon monoxide, hydrogen chloride, and vinyl chloride.

Technologies used in real-time air monitoring are always changing and improving both in ease of use and accuracy. It is recommended that the best available technology be used to ensure that the public is properly informed about any potential toxic substances within the fire smoke plume (Agency for Toxic Substances and Disease Registry) (ATSDR, 2001).

7.5.2 Environmental Monitoring

Air emissions are not the only environmental concern when facing Landfill fires. In many cases, health issues are realized when runoff or smoke generated from the fire or firefighting is transported by wind, surface water, or groundwater into nearby residential neighborhoods. When people or other organisms uptake or inhale these chemicals, adverse health conditions may arise. Children, elderly, or immunosuppressed people are more susceptible to damage caused by exposure. These risks must be considered when developing a plan. Proper firefighting techniques and Landfill practices (i.e., water, foam, and runoff collection) should limit the impact of these issues. Samples should also be taken before any liquid is discharged from runoff containment areas. Samples of groundwater down gradient of the fire should be taken more frequently until the contamination levels due to the fire have been quantified (ATSDR, 2001).

8.0 COMMUNICATIONS

Communications are key in every aspect of effectively managing a fire incident. They start with the first call from the working face reporting the situation and continue through the call to the fire department(s) and other county departments. Continued communication is critical as responders and staff are engaged in firefighting and essential in keeping the public informed of the situation.

When emergency dispatch receives a call from an individual reporting a suspected fire in the vicinity of the Landfill, dispatch will notify the Graettinger Fire Department. Emergency dispatch should then contact the Landfill Manager or, if the Landfill Manager is not available, the Landfill Technician. The Landfill Manager – or a staff member the Landfill Manager assigns – will be responsible for contacting additional Landfill employees and County resources as necessary.

Depending on the size of the fire and the proximity to population centers, the occurrence of a Landfill fire will generally involve support services, such as contractors, regulators, laboratories, and the press.

Of primary importance is a list of contacts to notify in the event of a fire including:

- Incident Commanders and Group Leaders
- Fire Department(s)
- At-risk Populations
- Government Agencies
- Support Services
- Local Media

In the event of a major fire, off-site communications should be routed through the ICP. The structure of the ICP is discussed in **Section 3.2.2.4**. Routing all off-site communications through the ICP reduces confusion which ensures clear communication and efficient firefighting efforts.

8.1 INTERNAL COMMUNICATION

Communication is critical between branches of the IC. **Appendix B** provides emergency contact information for several key personnel and agencies that may be involved in a fire incident. From the onset of – and throughout – the incident, it should be verified that appropriate personnel are listed.

It is imperative that emergency responders from different departments can communicate with each other in addition to the Landfill staff. Common communication sources should be verified (radios and frequencies that allow joint communication) as part of pre-planning efforts. The availability of dedicated channels for certain activities (i.e., tendering water, etc.) can also be beneficial.

8.2 FIRE DEPARTMENT COMMUNICATION

It is important to establish communication among support personnel. On-site communications apply to the personnel at the site who are involved in the fire extinguishment effort (either directly or operating as on-site support). In general, the personnel involved will include the IC, Command and General Staff personnel, and assigned Operational team members. ICS Form 205 can be used to facilitate the assignments of communication equipment.

The Graettinger Volunteer Fire Department uses citizen band radios that can communicate directly with the Landfill's Motorola two-way citizen band radios.

The Graettinger Volunteer Fire Department uses radios issued to firefighter personnel. Each Fire Department vehicle also is equipped with a radio. Landfill staff have access to three portable radios and one stationary radio at the scalehouse. The Landfill's compactor and the track loader are fitted with radios as well.

Incidents that directly engage two-way users will be assigned to use the designated citizen band channel. Alpha Wireless has indicated that, since everyone can access Channel 8, that channel will be used moving forward to communicate during emergency events.

When the Graettinger Fire Department is dispatched to the Landfill, dispatch establishes a specific frequency which responding units will use to coordinate with dispatch. In the case of a long duration event or assigning/managing specific activities (i.e., water shuttling, etc.), specific tactical channels

can be established. The event channels and tactical channels allow all first responders within range of the signal to directly communicate. The Graettinger Fire Department will serve as air traffic communications controller communicating directly with Landfill staff.

The IC will be responsible for issuing and posting the communication channel outside the Landfill so that incoming firefighters are aware of the channel. The IC will also be responsible for assigning radio channels for Landfill staff and contractors if they are different than the channel assigned to firefighters. The posting of this information should clearly differentiate which channel is assigned to firefighters and which channel is assigned to Landfill staff and contractors.

Additional radios may be available for distribution by fire departments or can be purchased from Alpha Wireless in Spencer.

Alpha Wireless

706 Grand Ave

Spencer, Iowa 51301

800-722-2263

8.3 REGULATORY AGENCY NOTIFICATION

Regulatory agencies will have different requirements for involvement and communication. Upfront and open communication to determine their expectations will streamline the information transfer process.

In the event of a Landfill fire, it is important to consider the laws and regulations regarding such events. Landfill fires are classified as an emergency and will not necessarily be heavily influenced by administrative code. There are still measures that should be followed to reduce the fire's impact on surrounding areas. If the fire does result in a documented violation of the Clean Air Act or the Clean Water Act, it is within the jurisdiction of the EPA to enforce penalties.

Once the fire type has been identified, emergency response parties have been contacted, and fire management strategies have been initiated, the Palo Alto Emergency Manager must be contacted. If appropriate, the Palo Alto Emergency Manager will contact the Emergency Response Unit of the DNR. Based upon the unique characteristics of the situation, the Emergency Response Unit will provide advisement as necessary concerning fire response activities.

Per Emergency Planning and Community Right-to-Know Act, a qualified contractor must be retained to perform air monitoring during the fire event. The contractor carries out the DNR's sampling methodology requirements. Typically, the State of Iowa Hygienic Laboratory is retained as the contractor for these services. The State of Iowa Hygienic Laboratory has the capability to measure the key parameters that are known to cause health problems, including:

- Particulate Matter (PM)
- Sulfur Dioxide (SO_2)
- Carbon Dioxide (CO_2)
- Methane (CH_4)

- Nitrogen Dioxide (NO_2)
- Carbon Monoxide (CO)
- Lead (Pb)
- Hydrogen Sulfide (H_2S)
- Air Toxics
- Dioxin

The agency responsible is required to provide the necessary information for the public to make an informed decision about vacating until the air quality improves. Depending on the situation, varying air monitoring requirements may be involved. For example, if the Landfill has been known to accept asbestos, monitoring for asbestos fibers will be a priority. In any Landfill fire, particulates typically present the highest priority. Some fires will require notifying the EPA for further suggestions on air quality monitoring and public health.

After the DNR has been notified, it is important to notify the Palo Alto Environmental Health Department about DNR air monitoring requirements so that they can perform their own air monitoring themselves if they have the capabilities. They will be the agencies responsible for making suggestions regarding PPE (i.e., respirators) and what the public should know about the potential health risks.

When fighting a fire, water will inevitably be used, but more is not always better. Consideration needs to be given to the leachate collection system and its ability to handle additional leachate generated by excess water running through the system. The Landfill has a leachate lagoon which has a truck loadout station. If the system is overwhelmed, the lagoon could overflow and discharge into the environment. This is a violation of the Clean Water Act, and the Landfill will be held responsible. In a firefighting situation, left unwatched, the gallons of flow per day could greatly increase over what is typical. Under Stormwater General Permit Number 1, Part 3A, any water discharged due to firefighting activities is specifically exempt from permitting.

8.4 MEDIA COMMUNICATION

The media represents the communication link to the community and the public in general. It is best to work with the media and manage the information that is provided. Ideally, communications with the press should be handled by only the PIO (see **Section 3.2.2.5** for a full description of responsibilities). The PIO should be in direct contact with the ICP to ensure they receive accurate and appropriate information. The press may try to contact other city officials or fire department chiefs. It is imperative that those communicating with the press be limited to two or three people who are working out of the ICP and have a unified story. See **Appendix C** for a list of media contacts near the Landfill area.

Communications with the press may involve telephone calls, on-site interviews, and issuance of press releases. These should all be coordinated through the PIO. For large fires, it is critical that all agencies, contractors, Landfill representatives, and other involved parties speak with one voice through the PIO. Those providing information to the press must provide accurate details concerning the situation.

Keep in mind that if a location for media is not provided, they will try to find their way on-site to capture video. Therefore, it is also important to establish and maintain site security during

firefighting activities. Interested parties as well as support personnel should check in at the ICP before entering the site and before leaving the site.

8.5 CUSTOMER COMMUNICATION

The ability of the facility to provide uninterrupted services will depend on the detailed nature and extent of the fire event. Type 0 and Type 5 fires may not cause any interruption, Type 4 fires may cause temporary interruptions, and Type 3 and 2 may cause more noted interruptions. Upfront communication about the fire and its impact on regular business hours will lessen customer frustration and prevent additional on-site traffic.

8.6 PUBLIC RELATIONS

Public relations are important to manage throughout a Landfill fire event. It is imperative that appropriate, direct, and accurate communications are released on a regular basis through the DOC. Any communications or interviews provided by the joint ICs should be coordinated to provide a unified message. Staff and response personnel on-site should be directed to not provide statements or information to the media or the public. Staff should direct questions to the DOC. The DOC should never respond to questions for which he does not know the answers. It is preferable for the DOC to reply, "I will be happy to check on that and get back to you" than give an inaccurate response.

9.0 LANDFILL FIRE MINIMIZATION

While included as the last section in this Plan, minimizing fire risks is extremely important. Many steps can be taken to reduce the risk and extent of Landfill fires. While the risk of fire can never fully be eliminated, following the practices below will ensure greater protection.

9.1 MONITORING

Continued facility monitoring allows quick identification of occurrences outside of the norm. Reducing tunnel vision on-site is beneficial for many areas of health and safety.

9.1.1 Infrared Cameras

Infrared camera technology has become more mainstream in recent years and has been utilized at solid waste and recycling facilities across the United States. Having an infrared camera monitoring your incoming vehicles and operational areas allows for early detection of elevated temperatures on a vehicle and/or within the waste.

Early detection provides Landfill staff with additional time to make intentional decisions about how to handle the event, such as directing vehicle traffic to a designated area (i.e., clay covered portion of the active face, parking lot area, etc.) and determining where to dump and extinguish the load.

Infrared cameras have also been utilized at the working face and closed portions of landfills. The infrared cameras can monitor these areas 24/7 and provide notice if a fire is detected. Early fire detection and warning can help keep the fire small, thereby requiring fewer resources to respond. Depending on visibility from major thoroughfares, a fire could be burning for a long time before

anyone notices its presence. The longer the fire burns, the greater the cost of the extinguishment and restoration to pre-fire conditions.

The Landfill has a FLIR TG165-X thermal imaging camera that will be utilized to find hot spots in the waste mass.

9.1.2 Employee Visual Screening

Scalehouse attendants and operators have a good handle on day-to-day operations and can provide information about which loads have and have not yet arrived. Scalehouse attendants and operators are usually the ones who recognize early signs of something amiss (i.e., customer's waste load appears to be different or is emitting smoke, etc.).

Employee awareness as vehicles enter the property and proceed to the working face can provide for early detection and isolation of potential fire incidents. Alerting drivers and Landfill staff to a hot load allows staff to direct the vehicle to a designated location to safely tip the load. Fast action aids in keeping incidents to lower degrees of engagement.

9.2 OPERATIONS

Landfill staff are a key component to minimizing fire risks. Several pro-active operations and procedures are discussed below.

9.2.1 Landfill Policy

Landfills are highly regulated facilities with restrictions on the wastes that can be accepted. Utilizing Landfill policy to assist with handling of challenging items – lithium batteries, for example – can help lower the risk of Landfill fires. Policies can also explain handling procedures for materials that are safe to accept but may require special handling, such as immediate burial, to lower the risk of an incident.

9.2.2 Incoming Waste Inspections

Pursuant to Iowa Administrative Code (IAC) 567-113.8(1)"a", owners and operators of MSW landfills must implement a program at the facility for detecting and preventing the disposal of prohibited wastes. The program must include the following:

- Random inspections of incoming loads
- Records of any inspections
- Training of facility operators to recognize prohibited wastes

One of the prohibited wastes is identified as "hot loads." Hot loads are defined in IAC 567-113.8(1)"b"(8) to mean solid waste that is smoking, smoldering, emitting fumes or hot gases, or otherwise indicating that the solid waste is in the process of combustion or close to igniting. Ash that has not been fully quenched or cooled is considered a hot load. Such wastes may be accepted at the gate but shall be segregated and completely extinguished and collected in a manner as safe and responsible as practical before disposal.

It is not practical to inspect every load coming into the Landfill; however, familiarity with customers can help with identifying ('profiling') hot loads. Keeping records of inspections and noting when hot loads are brought into the facility may also help identify haulers disposing of hot loads. Hot load identification should also be part of the required training associated with waste screening procedures.

Scalehouse attendants and operators become very familiar with existing customers and the materials they deliver. As new waste streams are introduced, they must be evaluated for reactivity.

Understanding the incoming haulers and generators within the Landfill's service area also aids in determining which loads may need a closer look. Continued visual screening for signs of fire – namely smoke at the working face –will help reduce the potential for fires.

9.2.3 Waste Compaction

Hot spots are caused by pockets or voids in the waste that contain oxygen. The presence of methane in the pockets or voids increases the probability of subsurface fires. Compaction reduces the occurrence of voids or pockets. Compaction can be increased by uniformly spreading the waste and compacting it in layers no more than 2 feet thick. Flatter slopes generally allow a steel-wheeled compactor to travel faster, make more passes, and thereby achieve greater compaction with less operator effort.

9.2.4 Prohibit Smoking On-Site

Smoking should be restricted to areas away from the waste mass, Landfill infrastructure (i.e., LFG collection wells, etc.), places with combustible and flammable materials (i.e., fuel/oil tanks, maintenance shops, etc.), and locations where methane may migrate (i.e., buildings, ditches, etc.). Signage regarding smoking restrictions should be visible and readable.

9.2.5 Maintaining Good Site Security

One of the requirements for operating a MSW landfill is to control facility access. Pursuant to IAC 567- 113.8(3)"a", landfill owners and operators should use artificial barriers and/or natural barriers to secure the area. Barriers protect human health and the environment by controlling public access and preventing unauthorized vehicular traffic and illegal dumping. Maintaining good site security would include periodic inspections of the artificial barriers (e.g., fences) and natural barriers (e.g., ditches, trees, etc.) for repairs, routine maintenance, and evidence of unauthorized access.

To further improve site security, the Landfill has a camera system overlooking the scale and front gate as well as a security system through Knight Protection (Spencer, Iowa company).

9.2.6 Methane Gas Detection and Collection

As mentioned in Section 5.2, the presence of methane is a major contributor to landfill fires. The following measures are required at MSW landfills:

- Quarterly Methane Monitoring

Pursuant to IAC 567-113.9(2), owners and operators of MSW landfills must implement a routine methane monitoring plan to detect explosive levels of methane gas in facility structures and in migrating off-site in subsurface soils. If methane levels are detected above the threshold levels the Department must be notified and steps taken to protect human health and safety. In addition, measures must be implemented to remediate the methane exceedances.

Large landfills, those having a capacity of greater than 2.5 million megagrams and 2.5 million cubic meters, must install LFG collection and control systems. There are two ways to dispose of methane collected in the LFG:

- Flaring the gas – is a passive system in that there is no negative pressure applied to the collection system that collects the gas; the natural internal pressure of the gas forces the gas to the flare. Flaring the gas involves a controlled burning of the gas which converts methane to carbon dioxide.

- Gas-to-energy – using collected methane to generate electricity, heat, or steam. LFG is collected in gas wells with pumps placed and operated in a manner to collect gas produced by the landfill. It should be noted that, when operating an LFG collection system (Section 2.2.2.5), applying too much negative pressure ("overpulling") can pull oxygen into the waste mass, providing conditions necessary for an underground fire.

9.2.7 Use of Daily Cover

One of the stated purposes of daily cover is to reduce the occurrence of fires. Pursuant to IAC 567-113.8(2)"f"(1), at least a six-inch layer of soil material or an approved alternative daily cover is required to cover over the waste each day to control vectors, fires, odors, blowing litter, and scavenging. Alternative daily covers can include tarps, spray-on materials, processed construction and demolition waste, or other approved methods. The DNR can help determine if a specific material may be used as an alternative daily cover.

The Landfill is permitted to use Automobile Shredder Residue and Wire Shredder Residue as alternative daily covers (ADC).

9.2.8 Use of Intermediate Cover

Intermediate cover is required for areas that will not receive waste for extended periods but are not closing. Pursuant to IAC 567-113.8(2)"f"(2), active areas that have not or will not receive waste for at least 30 days must receive a 1-foot layer of compacted soil material or approved alternative cover and active areas that will not receive waste for at least 180 days must receive a 2-foot layer of compacted soil material or approved alternative cover.

9.2.9 Water Supply

As mentioned in Section 6.3.2, having an available and quick supply of water can be beneficial for firefighting applications. Although a municipal water supply may provide seemingly unlimited water, and a water well may be available at or near the site, these supplies often provide water at a lower flow rate. In determining which water supply to use, consider these factors: municipal water supply access point (i.e., fire hydrant), conditions around the access point that may impede operations (i.e.,

high vehicle traffic area, limited flat terrain, etc.), and the distance from and transportation paths to the Landfill.

On-site ponds or well systems can also serve as a water source but will require expensive, high-volume pump systems to be used to obtain a rapid water supply. For example, a well or pond system supplying 150 GPM would take over 30 minutes to fill a 5,000-gallon truck.

9.2.10 Equipment Inspection and Maintenance

A regular maintenance schedule and daily checks should be conducted by the equipment operators to ensure that fire hazards do not stem from the equipment. Waste buildup can be ignited by hot engine or exhaust conditions. Equipment should be inspected for the presence of waste and, if discovered, should be removed.

Proper maintenance of the air cleaning system can help prevent unnecessarily high equipment temperatures, which may increase the possibility of igniting waste. Machines should also be kept relatively free of dust which can be explosive in high volumes and under the right conditions (Bolton, 1995).

9.2.11 Active Face

There are several factors that determine the size of the working face including tonnages, vehicle traffic, equipment utilized, customers' ability to tip loads in the correct location, and fill progression planning. Along with those considerations, minimizing the active face area may lower the potential available fuel source and the amount of soil needed to be stockpiled for fire suppression.

9.2.12 Soil Stockpiles

When addressing a working face fire, soil is the first line of defense. A working face that is 100 ft by 100 ft requires a minimum of 185 cubic yards (cy) of soil to meet the daily cover requirement of six inches. Keeping sufficient soil on hand to address needs for both daily/intermediate cover as well as fire extinguishment will help reduce the potential for fire to spread.

9.3 TRAINING

This Plan is a continued work-in-progress document since site conditions, working locations, available equipment, and current personnel are always in flux. As such, periodic training updates and Plan updates are required.

9.3.1 New Hires

This Plan and the content therein should be familiar to all Landfill staff and potential emergency responders. It is recommended that senior staff review the plan with any new employees/volunteers. After the group training is performed, subsequent training/refreshers should be scheduled for every 3-5 years with both Landfill staff and emergency personnel to address staffing and operational changes.

9.3.2 Emergency Personnel

Fire personnel complete training regularly. Whether volunteer personnel choose to complete the Firefighting Basics course or go through Fire Fighter I and II, training will occur. As part of the initial orientation for new staff or volunteers, the contents of this Plan should be reviewed.

Plan reviews and updates should occur on the same 5-year schedule as training refreshers or as significant changes to staffing, facilities, or operations occur. Updates should occur a minimum of 3 months before the scheduled training update to allow for the included entities to review and provide input to the Plan and proposed updates.

9.3.3 On-Going Updates and Training

The Landfill is a dynamic operation with changes occurring over time. Given the potential for those physical changes, as well as changes in Landfill and emergency responders' staff, it is important to perform periodic updates to this Plan. Joint training should also be performed at that time to keep channels open between the different potential responding entities. Note updates in the Landfill master copy of the Plan as they occur. A full review/update of the Plan and joint training is recommended every three years.

10.0 GENERAL COMMENTS

The Plan and opinions expressed therein are based upon data obtained from Landfill staff and other persons familiar with the site and/or landfill fires. This Plan is intended to be used as a tool for assistance in training both facility staff and emergency responders on the basics of landfill and associated activity area fire events and risk minimization. Facilities are continually changing so the accuracy of provided information (i.e., maps, contact information, etc.) must be verified prior to use.

While SCS endeavors to ensure the accuracy and completeness of the information in this Plan, it is understood that SCS makes no claims or guarantees as to the accuracy or completeness or condition for a particular purpose.

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WHO 13 Des Moines. 2022. Cause unknown in metro landfill fire. Retrieved from https://who13.com/news/metro-news/cause-unknown-in-mertro-landfill-fire/

WHO 13 Des Moines. 2022. Firefighters battle windy conditions in metro landfill fire. Retrieved from https://who13.com/news/metro-news/firefighters-battle-windy-conditions-in-metro-landfill-fire/

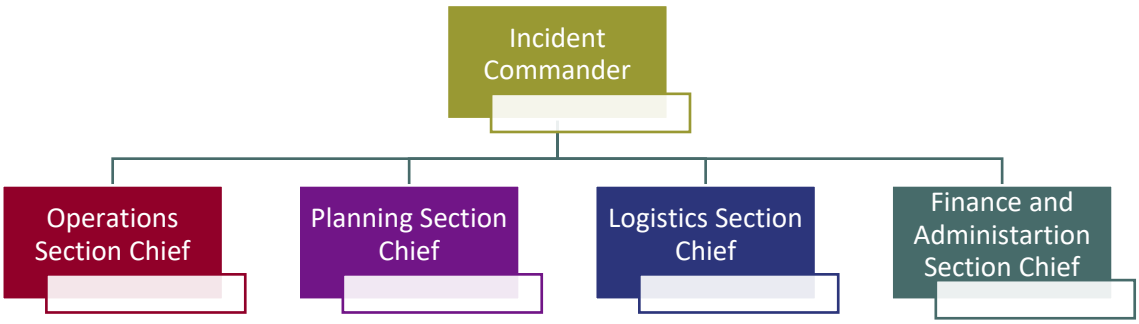
Appendix A

Incident Command Structure Organizational Charts

Appendix A-1

Simple Incident Command Structure Organizational Chart:

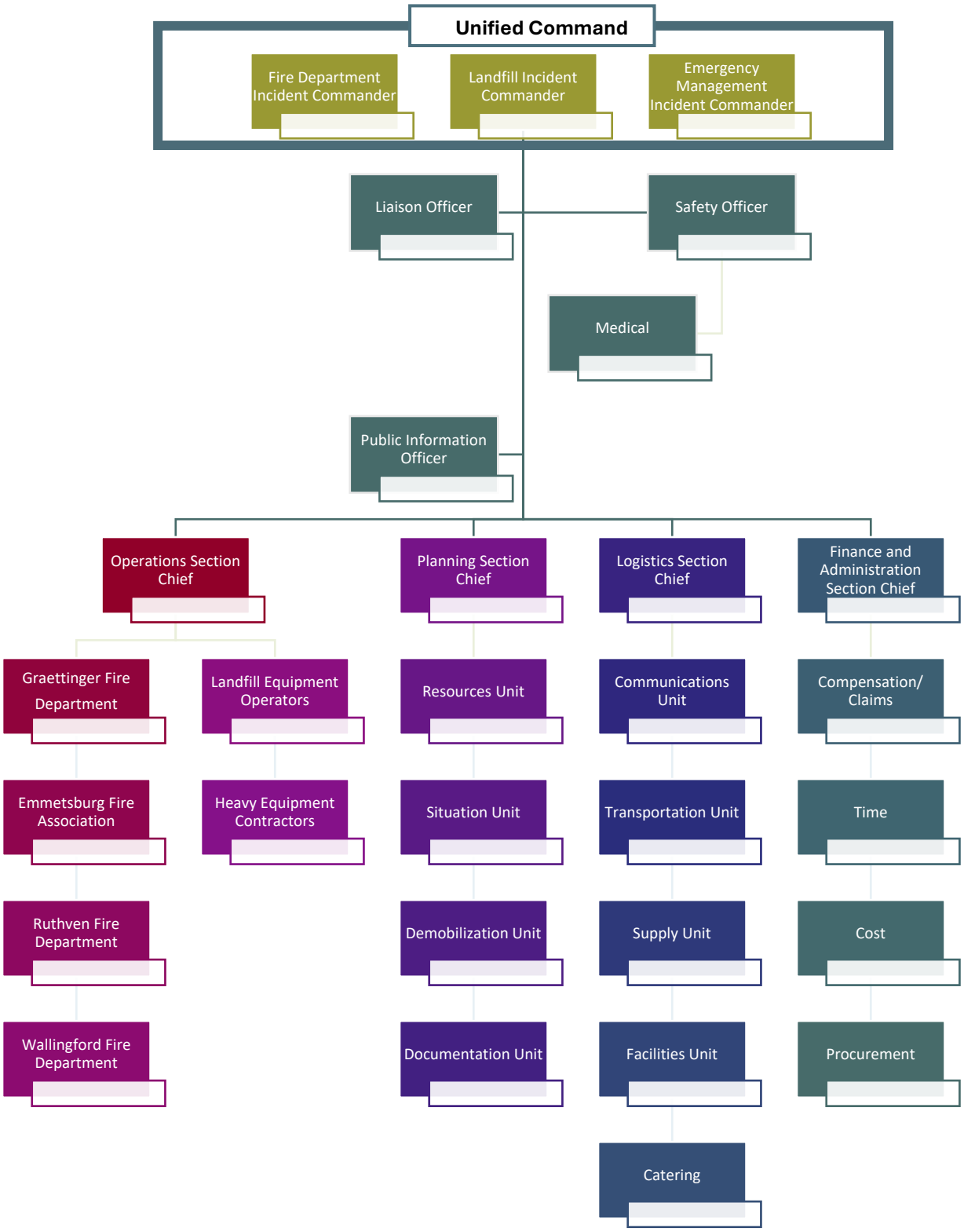
Used for Operational Fires


Incident Commander
Operations Section Chief
Planning Section Chief
Logistics Section Chief
Finance and Administartion Section Chief

Appendix A-2

Incident Command Structure Organizational Chart:

Modified as Required for Type 5 – Type 2 Fires


Unified Command
Fire Department Incident Commander
Landfill Incident Commander
Emergency Management Incident Commander
Liaison Officer
Safety Officer
Medical
Public Information Officer
Operations Section Chief
Planning Section Chief
Logistics Section Chief
Finance and Administration Section Chief
Graettinger Fire Department
Landfill Equipment Operators
Resources Unit
Communications Unit
Compensation/ Claims
Emmetsburg Fire Association
Heavy Equipment Contractors
Situation Unit
Transportation Unit
Time
Ruthven Fire Department
Demobilization Unit
Supply Unit
Cost
Wallingford Fire Department
Documentation Unit
Facilities Unit
Procurement
Catering

Appendix B

List of Contacts

Northern Plains Regional Landfill
Landfill Fire Risk Management Plan
Emergency Contact Summary
Mar-25

Role	Agency	Name	Title	Address 1	Address 2	Office Phone	Cell Phone	Fax	Email
Northern Plains Regional Landfill									
Landfill Manager	Northern Plains Regional Landfill	Dan Chism	Landfill Manager	3032 420th Ave	Graettinger, IA 51342	712-859-3185		712-480-3298	dchism@spenceriowacity.com
Administrative Assistant	Northern Plains Regional Landfill	Linda Schaller	Administrative Assistant	3032 420th Ave	Graettinger, IA 51342	712-859-3185	712-887-0591		lschaller@spenceriowacity.com
Operator II	Northern Plains Regional Landfill	Nathan Lawson	Operator II	3032 420th Ave	Graettinger, IA 51342	712-859-3185	712-200-4534		nlawson@spenceriowacity.com
Operator II	Northern Plains Regional Landfill	Wade Alesch	Operator II	3032 420th Ave	Graettinger, IA 51342	712-859-3185	712-260-1618		walesch@spenceriowacity.com
Operator I	Northern Plains Regional Landfill	Cody Hoffman	Operator I	3032 420th Ave	Graettinger, IA 51342	712-859-3185	712-480-0832		choffman@spenceriowacity.com
Landfill Operator	Northern Plains Regional Landfill	Nathan Adams	Landfill Operator	3032 420th Ave	Graettinger, IA 51342	712-859-3185	712-480-0955		adamsak@icloud.com
Landfill Operator	Northern Plains Regional Landfill	Jerald Lode	Landfill Operator	3032 420th Ave	Graettinger, IA 51342	712-859-3185	712-348-3303		jerryslade@gmail.com
Public Works Director	City of Spencer	Mark White	Public Works Director	418 2nd Avenue West	Spencer, IA 51301	712-580-7200 x 15		712-580-7236	mwhite@spenceriowacity.com
Assistant Public Works Director	City of Spencer	Mark Krieg	Assistant Public Works Director	418 2nd Avenue West	Spencer, IA 51301	712-580-7200 x 216			mkrieg@spenceriowacity.com
First Responders									
EMA	Palo Alto Emergency Management Agency	Kayla Hagen	Emergency Management	2002 10th St	Emmetsburg, IA 50536	712-852-3535 x 107	712-852-3535	712-852-3247	kayla.hagen@paloaltosheriff.com
Sheriff	Palo Alto County Sheriff	John D. King	Palo Alto Sheriff	2002 10th St	Emmetsburg, IA 50536	712-852-3535 or 911		712-852-3914	jking@paloaltosheriff.com
Iowa State Patrol	Iowa State Patrol - District 6	Matthew Williams	Commander	503 West 44th Street	Spencer, IA 51301	712-262-1424 or 911		712-262-1424	ispinfo@dps.state.ia.us
Fire Department	Graettinger Vol. Fire Department	Brad Anderson	Fire Chief	104 N. Washington Ave.	Graettinger, IA 51342	712-859-3742	712-859-3930		gfd@rvtc.net
Fire Department	Emmetsburg Vol. Fire Department	Judd Duhn	Fire Chief	1009 1/2 Grand Ave	Emmetsburg, IA 50536	712-852-4422	712-298-1680		
Fire Department	Ruthven Vol. Fire Department	Kevin Bates	Fire Chief	1202 Rolling Street	Ruthven, IA 51358	712-837-5450	712-260-4474		ruthvfd@ruthventel.com
Fire Department	Wallingford Vol. Fire Department	Jarrod Fischer	Fire Chief	101 St James Avenue	Wallingford, IA 51365	712-867-4585			wcfd@rvtc.net
Fire Department	Spencer Fire Department	Jesse Coulson	Fire Chief	10 Grand Avenue	Spencer, IA 51301	712-580-7240			jcoulson@spenceriowacity.com
Landfill Fire Response Experts									
Engineering	Landfill Fire Control Inc.	Dr. Tony Sperling	Landfill Engineering/Fire Control Expert	#8 - 1225 East Keith Road	North Vancouver, BC, Canada V7J 1J3	604-986-7723			sperling@sperlinghansen.com
Fire Fighting	Hammer Consulting Services	Todd Thalhamer	Landfill Fire Control Expert	8151 33rd Ave S	Bloomington, MN 55425	952-876-4040	530-391-2230		
Environmental Monitoring									
Air Monitoring	Clay County Dept of Health & Human Services		PPE Equipment Compliance	1900 North Grand Avenue, Ste E-8	Spencer, IA 51301	712-262-3586		515-564-4046	CClay01@dhs.state.ia.us
Air Monitoring	DNR Air Quality Bureau	Brian Hutchins	Compliance and Monitoring Supervisor	502 E 9th Street	Des Moines, IA 50319	515-681-3136		515-725-9501	Brian.Hutchins@dnr.iowa.gov
Air Monitoring	University of Iowa State Hygienic Lab	Dr. Michael Wichman	Program Coordinator	2490 Crosspark Road	Coralville, IA 52241	319-335-4500	800-421-4692	319-335-4555	michael-wichman@uiowa.edu
State/Regulatory Contacts									
IDNR	DNR Site Engineer	Mike Smith	Environmental Engineer	502 E 9th Street	Des Moines, IA 50319	515-229-8356			mike.smith@dnr.iowa.gov
IDNR Field Office	Iowa DNR Field Office # 3	Jennifer Christian	Supervisor	1900 North Grand Ave Ste E17	Spencer, IA 51301	712-262-4177		712-260-2554	jennifer.christian@dnr.iowa.gov
IDNR	DNR Air Quality Bureau	Brian Hutchins	Compliance and Monitoring Supervisor	502 E 9th Street	Des Moines, IA 50319	515-229-8356		515-725-9501	Brian.Hutchins@dnr.iowa.gov
EPA	EPA Region 7	24-hour Emergency		11201 Renner Blvd	Lenexa, KS 66219	913-281-0991	800-223-0425	913-551-7066	
IERC	Iowa Emergency Response Commission	Tracey Epps	Commission Administrator	7900 Hickman Rd, Ste 500	Windsor Heights, IA 50324	515-725-3231			tracey.epps@iowa.gov
City of Spencer Approved Contractors									
Demolition, Earthwork	BD Construction Services	Adam DeLoss	Owner	2410 West 11th St	Spencer, IA 51301	712-363-3877	712-363-1499	712-262-2561	delossjody@gmail.com
Excavation, Drainage	Larry Lair Excavating	Larry Lair	Owner	2533 HWY 4	Wallingford, IA 51365	712-209-4754	712-209-2185		
Heavy Equipment	B & B Farm Drainage	Brice Bodle	Owner	217 Davey Ave	Wallingford, IA 51365	712-260-4536	712-260-3918		
Demolition, Earthwork	Michaelson's, Inc.			901 3rd Ave	Armstrong, IA 50514	712-864-3640			
Heavy Equipment	Andy Manwarren			1508 Monroe St	Emmetsburg, IA 50536	712-852-3944			
Heavy Equipment	Schoon Construction, Inc.			1500 S 2nd St	Cherokee, IA 51012	712-225-5736			
Excavation, Drainage	King Construction			104 Main St	Wall Lake, IA 51466	712-664-2918			
Supply Support Services									
Hazardous Waste Transportation & Disposal	Tradebe Environmental Services, LLC	David Dubose	Technical Services Operations Manager	2900 Justin Drive, Ste D	Urbandale, IA 50322	800-388-7242			
Hazardous Waste Transportation	Clean Harbors Environmental Services, Inc.			4704 NE 22nd Street	Des Moines, IA 50313	515-802-3480			
Propane Supplier	MaxYield Cooperative			4498 Works Rd	Emmetsburg, IA 50536	712-454-1050			
Radios	Alpha Wireless			706 Grand Ave.	Spencer, IA 51301	800-967-1778			
Class A Foam (AR + AFFF)	Feld Fire Equipment	Greg Morris		113 Griffith Rd	Carroll, IA 51401	319-930-1775	712-792-3143	319-330-1775	giaequip@gmail.com
Engineering	Kruse, Kate, and Nelson	Jim Thiesse	Engineer	2303 W 18th St	Spencer, IA 51301	712-262-3468			
Sheriff	Palo Alto County Sheriff	John D. King	Palo Alto Sheriff	2002 10th St	Emmetsburg, IA 50536	712-852-3535 or 911		712-852-3914	mrouse@paloaltosheriff.com
Alternative Disposal Facility	Dickinson County Landfill	Josh Johnson	Landfill Manager	2575 190th St	Spirit Lake, IA 51360	866-909-4458	866-909-4458	712-338-2549	jjohns64@wm.com
Asphalt Shingle Processing	LL Pelling			1425 W Penn St	North Liberty, IA 52317	319-626-4600			
Personnel Support Services									
Catering	Birdies, Burgers, and Brews			701 Cedar Ave	Graettinger, IA 51342	712-859-3766			
Commodes	Boji Portable Toilets			PO Box 1312	Spencer, IA 51301	712-835-2018			
Medical Facilities									
Medical Care	Palo Alto County Health System			3201 1s Street	Emmetsburg, IA 50536	712-852-5500			

Appendix C

List of Media Contacts

Media Contacts									
Role	**Agency**	**Name**	**Title**	**Address 1**	**Address 2**	**Office Phone**	**Cell Phone**	**Fax**	**Email**
Radio - News	KILR 1070 AM, 95.9 FM, 97.3 FM	Matt Beaver	General Mgr	3875 150th St	Estherville, IA 51334	712-362-2644		712-362-5951	kilrradio@hotmail.com
Radio - News	KICD 1240 AM, 102.5 FM	Audrey McIrvin	Reporter	2600 Highway Blvd	Spencer, IA 51301	712-262-1240	712-580-1240		
Radio - News	KICD 1240 AM, 102.5 FM	Ben Lundsten	Reporter	2600 Highway Blvd	Spencer, IA 51301	712-262-1240	712-580-1240		
Radio - News	WHO 1040 AM			2141 Grand Ave	Des Moines, IA 50312	515-400-8087	515-284-1040		
Newspaper	Spencer Daily Reporter	Brad Hicks	Publisher GM	22 E. 4th St	Spencer, IA 51301	712-262-6610		712-262-3044	publisher@spencerdailyreporter.com
Newspaper	Emmetsburg Reporter-Democrat	Jerry Wiseman	Publisher GM	1122 Broadway Ste B	Emmetsburg, IA 50536	712-852-2323		712-852-3184	bbarrett@emmetsburgnews.com
Newspaper	Emmetsburg Reporter-Democrat	Kristin Grabinoski	Publisher GM	1122 Broadway Ste B	Emmetsburg, IA 50536	712-852-2323		712-852-3184	bbarrett@emmetsburgnews.com
Newspaper	Graettinger Times	Candace Terwillinger	News	102 E Robins Ave	Graettinger, IA 51342	712-859-3780		712-859-3039	grtimes@rvtc.net
Newspaper	The Ruthven Zipcode	Candace Terwillinger	News	102 E Robins Ave	Graettinger, IA 51342	712-859-3780		712-859-3039	grtimes@rvtc.net
Television	KTIV-DT1 NBC	Diane Castillo	News Director	2929 Signal Hill Dr	Sioux City, IA 51108	712-226-5480		712-239-3025	ktivreception@ktiv.com
Television	KPTH-DT1 FOX, KPTH-DT3 CBS	Kathan Jager	General Mgr	100 Gold Cir	Dakota Dunes, SD 57049	712-277-3554	605-979-5020	712-255-5250	kkjager@sbgtv.com
Television	KTIN-DT1 PBS			6535 Corporate Dr	Johnston, IA 50131	515-725-9800			

Appendix D

List of At-Risk Populations

At-Risk Populations

Facility Name	Phone Number	Address	Miles from Landfill	Direction
Graettinger/Terril High School	712-859-3286	400 W Lost Island St., Graettinger, IA	1.8	N

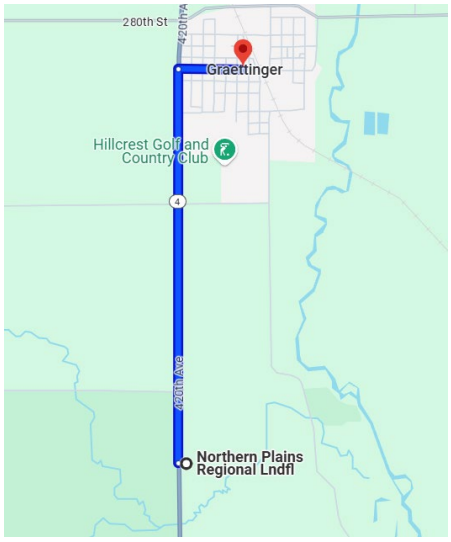
Note: Emmetsburg is approximately 6.5 miles south/southeast of the Landfill and has additional at-risk populations, nursing homes, assisted living facilities, and hospitals. However, smoke plumes are not anticipated to affect areas outside of a five-mile radius of the Landfill. The Landfill's nearest residents should be contacted if smoke plumes may affect their homes or properties.

Appendix E

Directions to Emergency Medical Services

In the event of a medical emergency, call 911. In the event of a non-life threatening injury that needs medical attention, transport the individual to the Family Practice Clinic in Graettinger.

Map and Directions to the Nearest Medical Facility



Northern Plains Regional Lndfl
3032 420th Ave, Graettinger, IA 51342

Head north on IA-4 N/420th Ave toward 300th St

2.1 mi

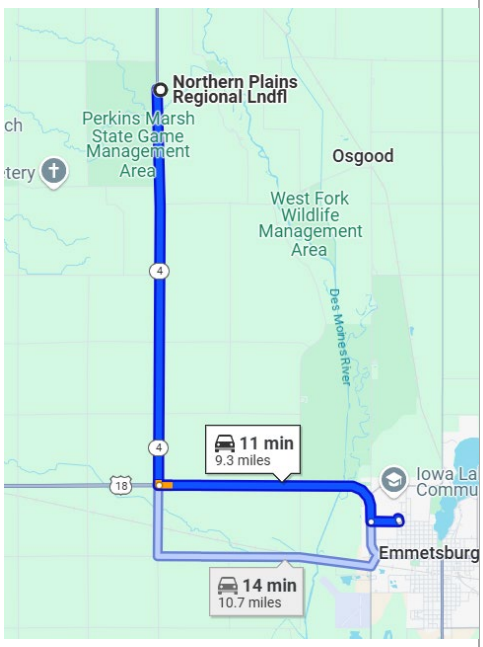
Turn right onto W Robins Ave
Destination will be on the left

0.3 mi

Family Practice Clinic - Graettinger
109 W Robins Ave, Graettinger, IA 51342

Nearest Hospital Address:
Family Practice Clinic
109 W Robins Ave
Graettinger, IA 51342
712-859-3131

Map and Directions to the Nearest Hospital



Northern Plains Regional Lndfl
3032 420th Ave, Graettinger, IA 51342

- Head south on IA-4 S — 5.6 mi
- Turn left onto US-18 E — 3.3 mi
- Turn left onto 1st St — 0.4 mi
- Turn left — 200 ft
- Continue straight — 49 ft
  - Destination will be on the right

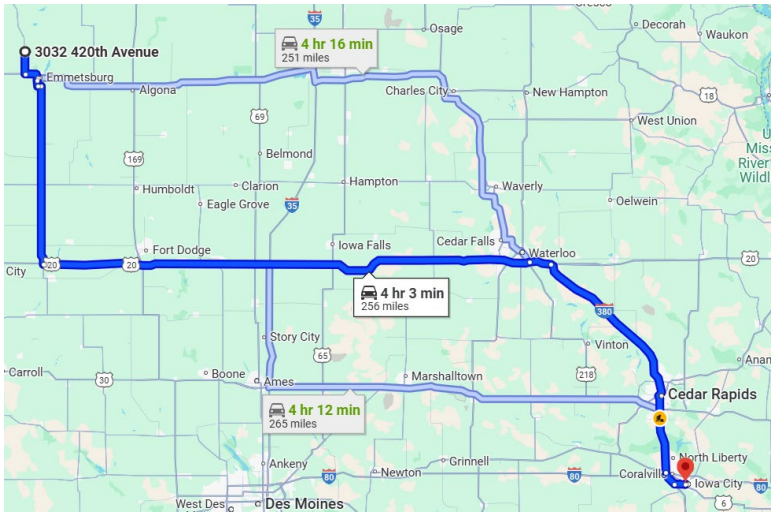
Palo Alto Cnty Health System
3201 1st St, Emmetsburg, IA 50536

Nearest Hospital Address:
Palo Alto County Health Systems
3201 1st St, Emmetsburg, IA 50536
712-852-5500

Burn Treatment Center

The University of Iowa's Burn Treatment Center is the only certified burn treatment center in Iowa. If a patient needs their expertise, it is likely that a life flight or ambulance from one of the hospitals above would transport them to the burn treatment center.

Map and Directions to the Nearest Burn Treatment Center



3032 420th Ave
Graettinger, IA 51342

- Get on US-20 E in Calhoun County from IA-4 S
  1 hr 2 min (56.8 mi)
- Follow US-20 E and I-380 S to County Rd F46/Melrose Ave in Iowa City. Take exit 93 from US-218 S
  2 hr 52 min (196 mi)
- Follow Melrose Ave to your destination
  8 min (3.0 mi)

200 Hawkins Dr
Iowa City, IA 52240

Nearest Burn Treatment Center:
University of Iowa Health Care – Burn Treatment Center
200 Hawkins Dr, Iowa City, IA 52240
319-356-2496

Appendix F

Sample After-Action Report

DUBUQUE FIRE

Address:_____ CAD:_____
Incident Date:_____ Review Date:_____
Companies Involved:_____

Dispatch Information: (audio if possible)

First-on-Scene Officer:
What did you see?

What did you think about it? Familiar or Not? [Situation →Understanding →Action]

What did you do? (Urgent needs).

Thoughts on Support of the Initial Company's Actions
(Did other responders know the plan?)

Audio / Video File Names:

Individual Company Early Focus:

Additional Concerns Later in the Event: Comparison of Actions vs Outcomes:

Attack:
Vent:
Search:
Other:

Educate with Operational Evaluation: Did we meet the Mission?

(Protect, Educate, and Assist with Pride, Skill, and Compassion)

Safe – _____
Aggressive – _____
Focused – _____
Effective – _____
Thorough – _____
Yardstick – _____

Lessons Reinforced: (Training or SOG needed?)

Audio / Video File Names:

Appendix G

Emergency Evacuation Plan

NPRL Emergency Evacuation Policy

Approved: February 27, 2025

Northern Plains Regional Landfill
3032 420th Ave
Graettinger, Iowa 51342
712-859-3185

Evacuation Plan Purpose

The purpose of an evacuation plan is to provide coordinated procedures for any disaster that occurs within the building requiring all employees and guests to evacuate.

Evacuation Plan Policy

Department Directors will provide a copy of the Evacuation Plan and conduct training of this plan to all employees under their supervision and for all buildings within which they work. Department Directors will have all employees sign an agreement page post-training.

Evacuation Plan Procedures

Listed below are the actions you should take when you hear an alarm, see or smell smoke, or receive any other indicator of an event requiring building evacuation.

Primary area of refuge for scalehouse staff: cold storage building (headcount area)

Primary area of refuge for maintenance shop: cold storage building (headcount area)

Primary area of refuge for all other staff: cold storage building (headcount area)

Secondary area of refuge: South of scale

If there is a fire in the gate/scalehouse or the maintenance building:

1. Stop what you are doing and exit the building via the nearest exit.
2. If you have an office door, close it when you leave, but do not lock it. Closing the door often helps prevent the fire from spreading.
3. Dial 911 and say, “This is a fire emergency at the landfill, 3032 420th Ave in Graettinger”
4. Fire extinguishers are located near building exits. If you are trained in using a fire extinguisher and the fire is still small, use the fire extinguisher to control the fire until the fire department arrives. Remember always to call 911 before trying to fight the fire. If you need two fire extinguishers, the fire is already out of control, and you must evacuate now!

5. Proceed to the area of refuge: Cold storage building. Do not leave the area of refuge until a headcount has been conducted and you are dismissed by your supervisor. (Department Director, Supervisor or Sweeper will have a list of all employees and their contact information with them at the area of refuge).
6. Report any missing or injured person to the on-scene Fire Department personnel or Incident Commander.
7. Do not re-enter the building until the Fire Department personnel or an Incident Commander have given permission to do so. (In case of a drill, this will be done by your safety committee representative).
8. If the building is to remain off-limits for more than an hour, obtain information from your supervisor on where you should report to work for the remainder of the day, and when and how you will be notified of the building's reopening. Provide current contact information. (Secondary area of refuge is south of scale).
9. Complete an incident log, in detail, of the events.

If there is a fire in the pit:

1. Stop what you are doing and have everybody evacuate the area.
2. Rope-off or otherwise close affected area. Do not allow anyone to re-enter. Do not allow further dumping.
3. Extinguish the fire with dirt.
4. Dial 911 and say, "This is a fire emergency at the landfill, 3032 420th Ave in Graettinger" if the fire cannot be extinguished.
5. Report any missing or injured persons to your supervisor, the on-scene Fire Department personnel, or Incident Commander.
6. Complete an incident log, in detail, of the events.

Employee Responsibilities:

1. Know the locations of emergency and secondary exits for all the buildings that you work in.
2. Know the locations of fire extinguishers.
3. Sign evacuation training roster in acknowledgement of all policies and procedures and in agreement to follow said policies and procedures.
4. Participate in evacuation drill training.
5. Notify supervisor of any physical challenges that require assistance during evacuations.
6. Assist visitors with evacuations.
7. For employees who manage cash, lock cash drawer before evacuating.
8. Report to the area of refuge, check-in, and wait for permission to re-enter the building.
9. Complete incident report.

Department Directors and Supervisor Responsibilities:

1. Provide all employees under your supervision with a copy of the building evacuation plan for all buildings within which they work.
2. Conduct hands-on training to all employees (including summer staff, new employees, and long-term employees) on the evacuation plan for all buildings within which they work.
3. Participate in annual evacuation drills.
4. Conduct a de-brief meeting with all employees under your supervision on the results of all evacuations.
5. Make appropriate accommodation for all employees who may require assistance during evacuations. If any employee has any limitation that might interfere with speedy and safe evacuation from a facility during an emergency, they may voluntarily notify their supervisor or department head/elected official and communicate their specific needs. This information will be limited to those with a need to know. (Note: Ask human resources or risk management about acceptable questions to ask employees).
6. During an evacuation, go to the area of refuge and ensure that all employees within your department are out of danger by performing a headcount.
7. If you cannot account for the whereabouts of any employees during the headcount, notify the Fire Department personnel or Incident Commander on-scene.
8. Assign floor sweepers. Floor sweepers are responsible for ensuring an orderly evacuation of all persons from designated areas of the building.

Sweeper Responsibilities:

1. Notify all people in your office to evacuate (employees and guests alike). If you see flames or smoke, you need to evacuate at once. You are only required to tell people to evacuate one time, then you must evacuate.
2. Verify lunchrooms and bathrooms are evacuated.
3. If able, close, but do not lock the doors. Closing the doors often helps slow the spread of the fire. (Note: some interior doors may need to be locked if cash-handling protocols require it)
4. Proceed to the area of refuge.
5. Assist Department Director or Incident Commander in conducting a headcount. Verify each employee's location via two-way radios. Notify Department Director or Incident Commander of any people unaccounted for.

Evacuation Debrief

	Yes	No	Comments
Did all employees respond immediately to the alarm?			
Did employees return to their individual workstations to collect personal items before exiting?			
Were there guests in the building at the time of the alarm? Number of building guests?			
Did all employees/guests arrive at the correct area of refuge for the headcount?			
Did the supervisor have a checklist of all employees at the area of refuge?			
Did all employees check in and wait for the all-clear from the fire department or Incident Commander before re-entering the building?			
Was there a designated sweeper? Who?			
Were all office doors shut but not locked?			
Were bathrooms, lobby, and conference rooms swept?			

Names of employees involved in the evacuation:

_____

_____

What went right?

_____

_____

What could be improved upon?

_____

_____

Appendix H

Site Maps

Appendix H-1

Landfill Site Vicinity Map

Appendix H-2

General Landfill Site Map

Appendix H-3

Landfill Infrastructure

Appendix H-4

Graettinger Hydrants

Appendix H-5

Landfill Water Sources

Appendix H-6

Landfill Electric Panel Locations

SCALE
0 4000 8000

LEGEND

PROP APPROXIMATE PROPERTY BOUNDARY

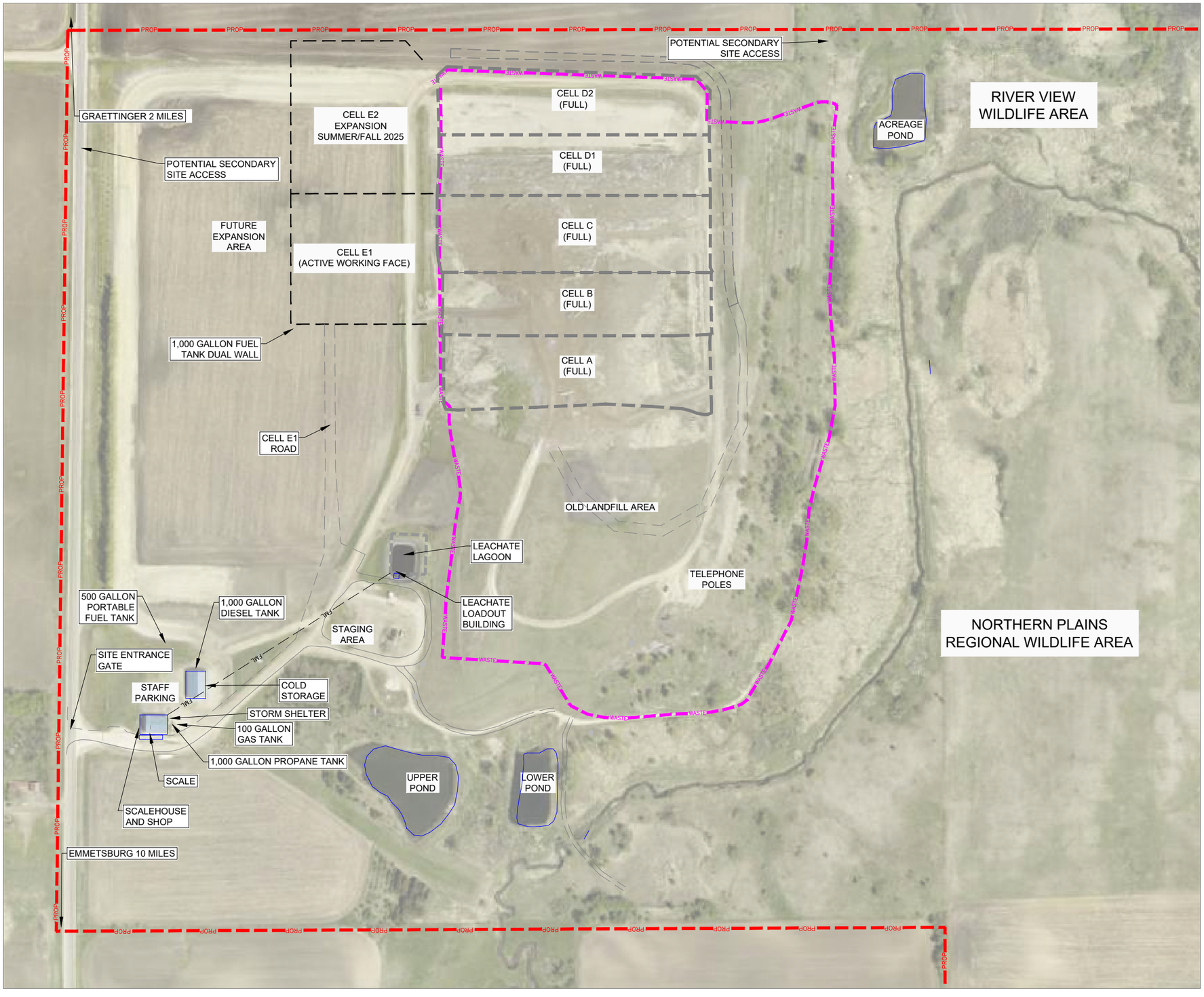
REVISION:	DATE:	DESCRIPTION:
1		
2		
3		
4		

CITY OF SPENCER
GRAETTINGER, IOWA
PROJECT NO. 27224589.00
DRAWING DATE: AUGUST 2017

SITE VICINITY MAP

SCS ENGINEERS
1690 All State Court - West Des Moines, Iowa - 50265
Phone: 515-631-6160 - www.scsengineers.com

FIGURE
H-1



SCALE
0 4000 8000

LEGEND

- PROP — APPROXIMATE PROPERTY BOUNDARY
- WASTE — APPROXIMATE EXISTING WASTE BOUNDARY
- EXISTING CELL BOUNDARY
- FUTURE CELL BOUNDARY
- BUILDING
- GRAVEL ROAD
- PAVED ROAD
- UNNAMED CREEK

REVISION:	DATE:	DESCRIPTION:
1		
2		
3		
4		

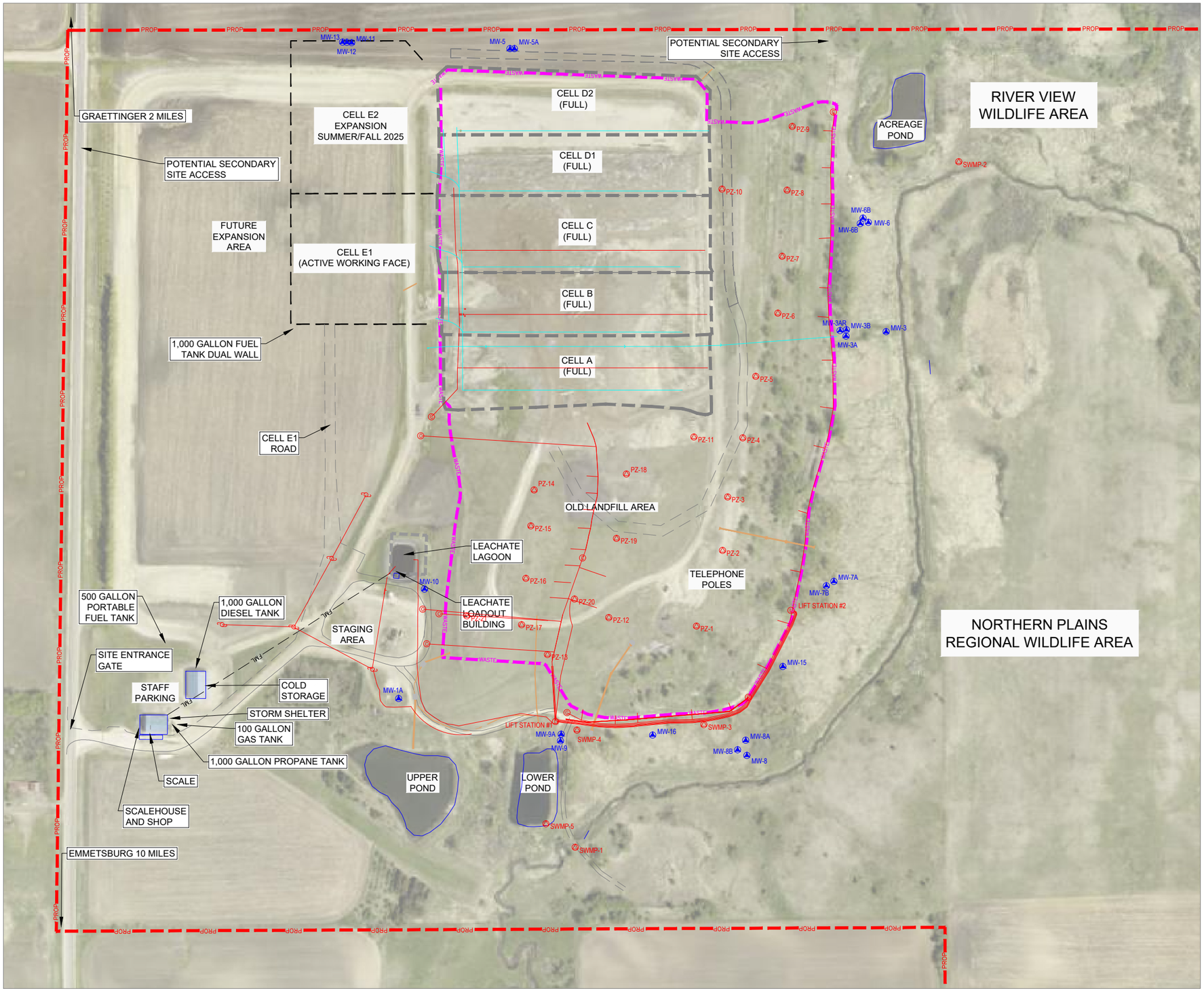
CITY OF SPENCER
GRAETTINGER, IOWA
PROJECT NO: 27224589.00
DRAWING DATE: MARCH 2025

LANDFILL SITE MAP

SCS ENGINEERS
1690 All State Court - West Des Moines, Iowa - 50265
Phone: 515-631-6160 - www.scsengineers.com

FIGURE
H-2

SCALE
0 4000 8000



LEGEND

- APPROXIMATE EXISTING WASTE BOUNDARY
- FML BOUNDARY
- APPROXIMATE PROPERTY BOUNDARY
- BUILDING
- GRAVEL ROAD
- PAVED ROAD
- CULVERT
- EXISTING CELL BOUNDARY
- FUTURE CELL BOUNDARY
- OVERHEAD ELECTRIC LINE
- BURIED ELECTRIC LINE
- LEACHATE PIPING (SOLID/PERFORATED)
- GROUNDWATER PIPING (SOLID/PERFORATED)
- MW-1 MONITORING WELL
- SWMP STORMWATER MONITORING POINT
- PZ LEACHATE PIEZOMETER
- UTILITY POLE

REVISION:	DATE:	DESCRIPTION:
1		
2		
3		
4		

CITY OF SPENCER
GRAETTINGER, IOWA
PROJECT NO: 27224589.00
DRAWING DATE: MARCH 2025

LANDFILL INFRASTRUCTURE

SCS ENGINEERS
1690 All State Court - West Des Moines, Iowa - 50265
Phone: 515-631-6160 - www.scsengineers.com

FIGURE
H-3

SCALE
0 300 600

LEGEND

- WATER TOWER LOCATION
- PRIMARY HYDRANT (#6 BELOW TOWER)
- SECONDARY HYDRANT (8 INCH MAIN)

REVISION:	DATE:	DESCRIPTION:
1		
2		
3		
4		

CITY OF SPENCER
GRAETTINGER, IOWA
PROJECT NO: 27224589.00
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GRAETTINGER HYDRANT LOCATIONS

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FIGURE
H-4

SCALE
0 200 400

LEGEND

LANDFILL OWNED WATER SOURCES

NOTE: LANDFILL HAS PLEDGED TO KEEP ACCESS TO PONDS IN REASONABLE CONDITION AND PLOWED IN THE WINTER. MAINTENANCE CAN BE PERFORMED BY LANDFILL EQUIPMENT BEFORE USE IF NEEDED.

REVISION:	DATE:	DESCRIPTION:
1		
2		
3		
4		

CITY OF SPENCER
GRAETTINGER, IOWA
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LANDFILL WATER SOURCES

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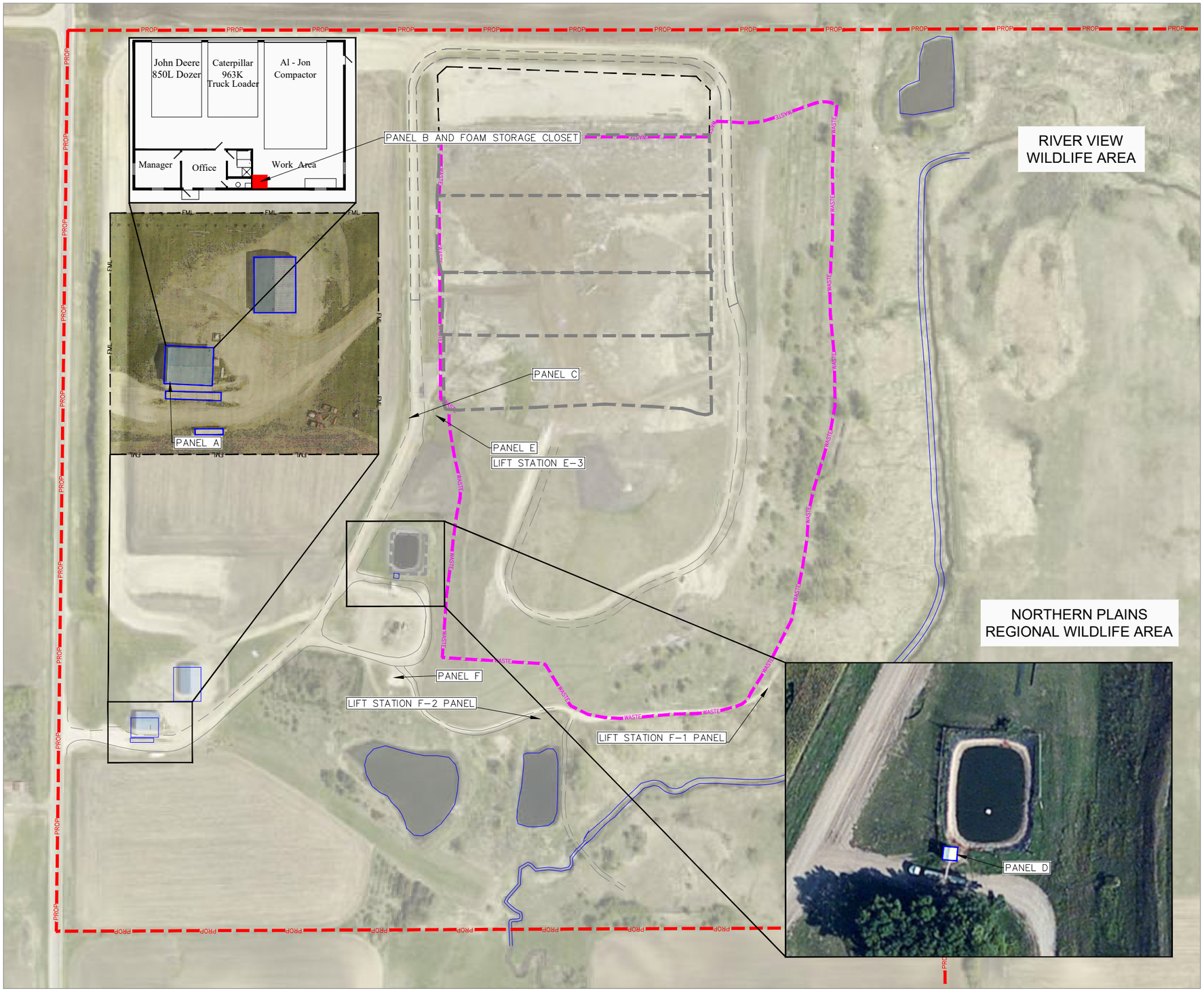
FIGURE
H-5

SCALE
0 4000 8000



PROP APPROXIMATE PROPERTY BOUNDARY
WASTE APPROXIMATE EXISTING WASTE BOUNDARY
EXISTING CELL BOUNDARY
FUTURE CELL BOUNDARY
PAVED ROAD
UNNAMED CREEK

LIST OF ELECTRIC PANELS	
PANEL ID	PANEL FUNCTION
A	MAIN POWER SUPPLY
B	SCALEHOUSE BUILDING POWER
C	LIFT STATION 3 POWER
D	LEACHATE LOADOUT BUILDING POWER SUPPLY
E	LIFT STATION E-3 POWER SUPPLY
F	LIFT STATIONS F-1 AND F-2 POWER SUPPLY

REVISION: 1 2 3 4
DATE:
DESCRIPTION:

CITY OF SPENCER
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LANDFILL ELECTIC PANEL LOCATIONS

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FIGURE
H-6