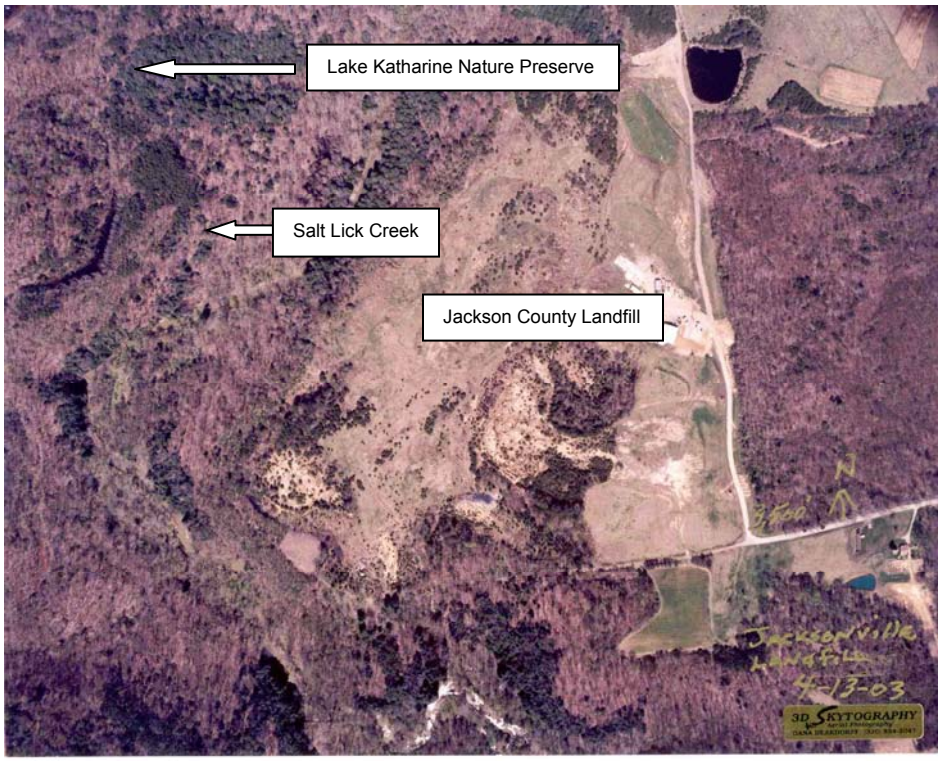
PREFERRED PLAN

FOR THE REMEDIATION OF THE JACKSON COUNTY LANDFILL CITY OF JACKSON, JACKSON COUNTY, OHIO



Ohio Environmental Protection Agency
Division of Environmental Response and Revitalization
Southeast District Office
February 2015

Ohio Environmental Protection Agency Division of Environmental Response and Revitalization, ARCA Section, Remedial Response Program			Preferred Plan For Remediation of the Jackson County Landfill City of Jackson, Jackson County, Ohio		
The Remedial Response Process					
(1) Preliminary Assessment & Site Inspection	(2) Remedial Investigation (RI) & Feasibility Study (FS)	(3) Remedy Selection (Preferred Plan & Decision Document)	(4) Remedial Design (RD)	(5) Remedial Action (RA)	(6) Remedy Operation & Maintenance (O&M)

Ohio EPA Announces Preferred Plan

This Preferred Plan identifies the preferred remedial alternative for the cleanup of the contaminated soil, ground water, sediment and surface water at the Jackson County Landfill and provides the rationale for this preference. It also includes summaries of other remedial alternatives evaluated for use at this site.

Ohio EPA will select a final remedy for the site after reviewing and considering all information submitted during the public comment period for this Preferred Plan. Ohio EPA may modify the preferred remedial alternative or select another alternative presented in this Preferred Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the remedial alternatives presented in this Preferred Plan.

Ohio EPA is issuing this Preferred Plan in a manner consistent with Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). It summarizes information found in detail in the remedial investigation and feasibility study reports and other documents contained in the administrative record file for this site. Ohio EPA encourages the public to review these documents to gain a better understanding of the site and the activities that have been conducted at the site.

Public Comment Period: February 17, 2015 – April 17, 2015. Ohio EPA will accept written comments on the Preferred Plan during the public comment period.

Public Meeting: Ohio EPA will hold a public meeting to explain the Preferred Plan. Oral and written comments will be accepted at the meeting. The meeting will be held on April 9, 2015 at 6:00 pm at the Jackson County City Council Chambers, located at 199 Portsmouth Street, Jackson, Jackson County Ohio 45640.

Additional Information: The Preferred Plan and related documents concerning the Jackson County Landfill are available at the Ohio EPA Southeast District Office located at 2195 E. Front St., Logan, Ohio 43138, or on the Ohio EPA webpage at the following link: http://epa.ohio.gov/derr/EnvironmentalResponseandRevitalization.aspx#113282715-whats-new. The Preferred Plan is also available at the information repository located at the Jackson County Library, 21 Broadway Street, Jackson, Ohio 45640, (740) 286-4111, Monday & Wednesday 10 am – 6 pm; Tuesday & Thursday 10 am - 8 pm; Friday 10 am - 5 pm and Saturday 10 am –2 pm. Contact Site Coordinator Dustin Tschudy at (740) 380-5253 or via email at dustin.tschudy@epa.ohio.gov if you have questions about environmental conditions at the site, want to review or receive a copy of the complete Preferred Plan, or have comments on it.

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1.0 EXECUTIVE SUMMARY

This Preferred Plan summarizes information on the range of remedial alternatives evaluated, identifies Ohio EPA's preferred remedial alternative, and explains the reasons for selection of the preferred remedial alternative. The Preferred Plan, which forms the basis for the Decision Document (*i.e.*, the final remedy decision), is based on: a remedial investigation (RI) report, approved April 29, 2009; a feasibility study (FS) report approved June 15, 2010 (prepared by Goodyear Tire and Rubber Company); and the July 6, 2012 Ohio EPA approval of Goodyear's request for an exemption pursuant to Ohio Revised Code (ORC) 3734.02(G) with respect to several landfill capping requirements.

The major health and environmental risks of this site primarily result from potential future use scenarios. At present, the landfill does not meet Ohio's laws and regulations pertaining to proper closure and there is a risk from the presence and migration of soil gas, some of which contains high concentrations of methane. The primary contaminants of concern (COCs) at the site are shown in **Table 3: Contaminants of Concern and Remediation Levels** in this Preferred Plan. Additional details concerning the health risks associated with each primary COC are located in **Appendix A**.

Ohio EPA's preferred remedial alternative should yield a permanent solution for risks associated with the contaminated media at the site. The expectations for the preferred alternative include:

- Reduction of human health risks to within or below acceptable limits, and protection of human health and the environment from exposure to COCs, which are above acceptable limits in the ground water, soil and surface water.

- Short and long-term protection of public health and the environment.

- Compliance with applicable or relevant and appropriate requirements (ARARs) through the completion of a landfill cap and the collection and appropriate treatment of landfill leachate and soil gas.

- Cost-effectiveness and limitation of expenses to what is necessary to achieve the preferred alternative expectations.

The major components of the preferred remedial alternative include: landfill capping, ground water monitoring, and collection of the leachate for off-site disposal.

Ohio EPA finds that these measures will protect public health and the environment by reducing risk to acceptable levels once the remedial action objectives have been achieved.

2.0 SUMMARY OF SITE CONDITIONS

2.1 Site History

The Jackson County Landfill site is located in a mixed area of residential properties and undeveloped rural land primarily used for hunting. The site is approximately 24 acres in size

and is located at 1841 Smith Bridge Road (County Road 60), Jackson, Ohio, as shown in **Figure 1 Site Location Map** and **Drawing 2 Site Map with Test Pit Results and Extent of Waste**. Salt Lick Creek is present west and north of the landfill and Lake Katharine State Nature Preserve is located on the west side of Salt Lick Creek. Private land abuts the landfill on the southeast side. This private land is used by an excavating company for the storage and repair of equipment and by a private hunting club. There is a maintenance garage, used by the excavating company, located approximately 50 feet southeast of the landfill property line. The private hunting club's lodge is also southeast of the landfill located approximately 100 feet from the property line. The hunting lodge is occupied most weekends by the members. In addition, there is a storage shed located approximately 60' from the landfill property line. Although none of these structures are occupied full time, the lodge is often occupied on the weekends.

A chronological list of owners, operators and/or disposers at the site property is shown in **Table 1: Owners, Operators and/or Disposers**.

TABLE 1: OWNERS, OPERATORS AND/OR DISPOSERS		
Owners, Operators and/or Disposers	**Property Usage**	**Period**
Donald Jenkins	Owner and operator	April 1970 - March 1972
J. Gregory Fields (Sanitation Commercial Services)	Owner	March 1972 - present
J. Gregory Fields (Sanitation Commercial Services)	Operator	March 1972 - September 1987
Goodyear Tire & Rubber Co. (Goodyear)	Disposer	Approximately 1974 - 1980
Shawn and Melissa Sexton	Owners	March 15, 1999 to present

Note: this is not an exhaustive list; other disposers may be identified.

Between approximately 1974 and 1980, the owner/operator of Jackson County Landfill accepted and disposed of approximately 5,772 drums that contained contaminants from Goodyear including, but not limited to, acetone, polyester resin mixture, cyclohexanone, dichloromethane, isobutyl alcohol, methylethylketone (MEK), methyl isobutyl ketone, toluene, xylene and waste styrene mixture. The landfill permanently ceased accepting waste in approximately September 1987. However, the landfill was never properly closed, nor was the minimal cap which was placed on the waste, maintained. As a result, there have been releases of hazardous wastes occurring since at least 1996. In 1996, Ohio EPA found elevated concentrations of ammonia, iron, nickel, and lead above water quality criteria in leachate originating at the landfill. In addition, three volatile organic compounds (VOCs) – benzene, xylene and 1,2,4-trimethylbenzene were found. The benzene was detected above both the screening criteria and its maximum contaminant level (MCL). The detection of these compounds and metals indicated that constituents were being released into the environment from the landfill.

Prior enforcement activities associated with the site include Director's Final Findings and Orders (DFFOs) issued August 20, 1987 ordering the proper closure of the landfill, ground water monitoring, and abatement of leachate at the Jackson County Landfill. When the DFFOs were not followed, additional enforcement was taken by the Ohio Attorney General's

Office against Sanitary Commercial Services/Mr. J. Gregory Fields. This enforcement case was settled with a Consent Decree dated February 16, 1999 issued by the United States District Court for the Southern District of Ohio, Eastern Division. The Consent Decree required Sanitation Commercial Services, Inc., et. al. to pay $ 225,000 into a trust fund for the purpose of closure and post-closure care of the Jackson County Landfill. However, due to the disposal of hazardous waste at a landfill constructed for the acceptance of solid waste and the extensive leachate problem which exists, it was determined that a Remedial Investigation and Feasibility Study (RI/FS) should be conducted in order to investigate, and evaluate cleanup options for properly closing, the landfill.

On August 16, 2005, Goodyear and Sanitation Commercial Services entered into DFFOs for the completion of a RI/FS for the Jackson County Landfill. This Preferred Plan describes the findings from the RI/FS and proposes a remedy based on these findings.

On December 8, 2011, Goodyear submitted a request to Ohio EPA for an exemption from landfill capping requirements pursuant to ORC 3734.02(G). Upon review of the request for an exemption, Ohio EPA found that Goodyear had made a technical demonstration that an exemption from certain capping requirements was unlikely to adversely impact human health, safety or the environment. Accordingly, Ohio EPA approved Goodyear's exemption request on July 6, 2012. The exemption allows the following modifications as part of the remedy:

- Regrade and use existing soils that have been shown through testing to have the required permeability as the minimum 18-inch thick soil barrier;
- Flexibility on placing the soil cap above all areas of waste placement due to constraints such as the slope along the western landfill boundary which will make it impracticable for the soil cap to be placed in some areas;
- Since the existing soil cover may be used instead of off-site borrow soil, pre-construction permeability testing for the soil will not be needed. Goodyear is expected to perform tests on borrow soils if needed to supplement the existing soil cover.
- The existing soil cover will not need the same testing and specification requirements as a recompacted soil barrier, so these testing and specification requirements are not required. As an alternative, Goodyear would develop construction quality controls, for Ohio EPA approval, during remedial design.
- The cap protection layers are expected to be 24 inches instead of the 30-inch freeze protection requirement. This is due to the fact that the average soil temperatures in the area of the Jackson County Landfill do not warrant a 30-inch thick cap layer for freeze protection.

2.2 Site Characteristics

Pursuant to the 2005 RI/FS DFFOs Goodyear completed RI/FS activities and submitted RI and FS reports, which were approved by Ohio EPA DERR on April 29, 2009 and June 15, 2010 respectively. The RI/FS activities identified the nature and extent of contamination at the site, and developed alternatives to address the contamination and site specific conditions.

Additionally, the data obtained were used to conduct a baseline risk assessment, which is an evaluation of the site risks to human health and the environment. The RI and FS reports contain more detailed information. These reports, along with other site-related materials, are

located in the information repository at the Jackson County Library and at Ohio EPA's Southeast District Office in Logan, Ohio.

The RI report, prepared by Goodyear's consultant, Parsons, between July 7, 2007 and April 29, 2009, indicated that:

- The landfill wastes cover approximately 24 total acres with an additional one acre area, located just beyond the landfilled waste, filled with foundry sand (see **Drawing 2**).

- The landfill cover and the thickness of the cover material were evaluated. The cover thickness varies from less than 12" to over 60" thick (see **Drawing 3**).

- The soils outside of the landfill boundary were impacted with metals above action levels. The metals that were above action levels were: aluminum, arsenic, iron, manganese, thallium, vanadium, and zinc (see **Drawing 4**).

- Ground water contamination has been located at three different zones, defined by the depth of the ground water zone below ground surface. The shallow upper zone, located in the Massillon Sandstone, is monitored by two wells, MW-6 and MW-9S. The shallow intermediate zone, most likely the Sciotoville Shale formation, is monitored by five wells, MW-2, MW-4, MW-6I, MW-7 and MW-9I. The third zone, referred to as the deep zone, is the Sharon Conglomerate and is monitored by seven wells, MW-1, MW-2D, MW-3, MW-5, MW-6D, MW-7D and MW-9D. The monitoring wells range in depth between 17 feet and 172 feet below ground surface. VOCs and metals were detected in all three ground water zones. However, while there were seven different VOCs found in ground water above their respective action levels; only vinyl chloride and tetrachloroethylene exceeded their MCLs. In addition, there were nine different metals detected above the action level. Of the detected metals, only arsenic and mercury were found above their MCL. There have been no interim or removal actions completed on the ground water plume (see **Drawing 5**).

- Soil gas (air present in soil) sampling found an extensive number of VOCs as well as methane being released to the atmosphere. As the air migrates or travels in the subsurface along lines of least resistance it will move to locations where it can be released to the atmosphere. On the Jackson County Landfill, soil gas has been visible as air bubbles appearing in puddles of water which have accumulated on the land surface. There were 22 VOCs detected above their respective action levels in the soil gas samples which were collected. In addition, methane, an explosive gas, was detected in 13 out of 20 samples. The concentrations of methane ranged from a low of 2.6% to a high of 71% by volume of the sample. The greatest risk from methane is posed by the potential migration of the gas into a building where it can build up and cause an explosion. Sample GS-17 was collected adjacent to the storage shed; methane was detected at 48% by volume in this sample. The sample collected closest to the maintenance garage, GS-03, detected methane at 54% by volume. However, samples collected directly below the hunting lodge were non-detect for methane although one sample collected below the garage detected methane at 2.6 % by volume (see **Drawing 9**).

- Leachate was sampled at 14 seeps. In addition to analyzing the leachate, the amount of leachate flowing from the landfill was also measured. There were four VOCs, one semi-volatile organic compound (SVOC) and 14 metals found above the action level. The quantity of leachate water ranged from a low of 0.83 gallons per minute (gpm) [1,195.2 gallons per day] to a high of 6.53 gpm [9,403.2 gallons per day] (see **Drawing 7**).

- Sediment (soil which is under water) was sampled at the leachate seeps and at four locations where the leachate flows off-site, referred to as ditches. The leachate sediment contained six metals above action levels while the ditch sediment samples contained one SVOC and five metals above action levels (see **Drawings 6 & 8**).

2.3 Summary of Site Risks

As part of the RI/FS, an Ecological Risk Assessment was conducted by Goodyear and approved by Ohio EPA on March 12, 2009. A human health baseline risk assessment was conducted by Goodyear and approved by Ohio EPA on April 6, 2009 (see Section 2.3.2). The baseline risk assessment evaluated current and potential risks to human health as the result of exposure to COCs present at the site. The results demonstrated that the existing COCs in environmental media pose or potentially pose unacceptable risks under a hypothetical future residential use scenario. The Ecological Risk Assessment indicated a potential risk to ecological receptors sufficient to trigger the need for remedial actions. Information on the primary COCs can be found in **Appendix A**.

2.3.1 Risks to Human Health

The baseline risk assessment for human health is an estimate of the likelihood of health problems occurring if no cleanup action is taken at the site. To estimate baseline risk, a four-step process is undertaken.

Step 1. Analyze Contamination: The concentrations of COCs at the site, as well as past scientific studies on the effects these COCs have had on people, are reviewed. Comparisons of site-specific concentrations of COCs and concentrations reported in past studies help determine which COCs are most likely to pose the greatest threat to human health.

Step 2. Estimate Exposure: The different ways that people might be exposed to the COCs (exposure pathways), the concentrations that people might be exposed to, and the potential frequency and duration of the exposure are evaluated. A reasonable maximum exposure scenario is calculated, which portrays the highest level of human exposure that could reasonably be expected to occur.

Step 3. Assess Potential Health Dangers: The information from Step 2 is combined with data on the toxicity of each COC to assess potential health risks. Two types of risk are considered: cancer risk and non-cancer hazards. The likelihood of cancer resulting from a site is expressed as an upper bound probability of 1 in 100,000, or 1x 10^{-5}. In other words, for every 100,000 people that could be exposed, one extra case

of cancer may occur as a result of exposure to site COCs. For non-cancer health effects, a hazard index (HI) or hazard quotient (HQ) is calculated (quotient refers to the effects of an individual COC, whereas index refers to the combined effects of all of the COCs). The key concept here is that a "threshold level" (measured as an HQ or HI of 1) exists below which non-cancer health effects are no longer expected.

Step 4. Characterize Site Risk: A determination is made as to whether site risks are great enough to cause health problems for people at or near the site. The potential risks from the individual pathways are added up to determine the total cumulative risk to human health.

A human health risk assessment for the site was prepared to evaluate potential adverse impacts to human health posed by COCs in soil, ground water, seep water (leachate), soil gas, sediment, and in the following exposure pathways: current and future on-site recreational users – adults and children, future commercial workers, future construction workers, hypothetical future residents, and hypothetical future ground water users. If site-specific data were not available, standard defaults were used.

Recreational Use

The risk assessment calculations show that the total cancer risk and total hazard index resulting from exposure to COCs including aluminum, arsenic, barium, cadmium, iron, manganese, mercury, thallium, vanadium, benzene, benzo(a)pyrene, 1,4-dichlorobenzene and Polychlorinated Biphenyls [PCBs] (Aroclors 1242, 1248, 1254 and 1260) in soil, sediment, and seep water for a current/future adult recreational user were calculated to be 8.7×10^{-6} and 0.1 respectively. Both the total cancer risk and the total hazard index level are below the target cancer risk level of 1×10^{-5} and target hazard level of 1. Therefore, exposure to the contaminants in soil, sediment and seep water should not result in adverse health effects for the current/future adult recreational user.

The risk assessment calculations show that the total cancer risk and total hazard index resulting from exposure to COCs including aluminum, arsenic, barium, cadmium, iron, manganese, mercury, thallium, vanadium, benzene, benzo(a)pyrene, 1,4-dichlorobenzene and PCBs (Aroclors 1242, 1248, 1254 and 1260) in soil, sediment, and seep water for a current/future adolescent recreational user were calculated to be 1.2×10^{-5} and 0.5, respectively. The total cancer risk is just slightly above the target cancer risk level of 1×10^{-5} while the total hazard index level is below the target hazard level of 1.

Commercial Use

The risk assessment calculations show that the total cancer risk and total hazard index resulting from exposure to contaminants of concern including aluminum, arsenic, iron, manganese, thallium, vanadium, benzene, trichloroethene, vinyl chloride, cis-1,2-dichloroethene, tetrachloroethylene, xylenes, etc. in soil, soil gas, and ground water for a future commercial worker were calculated to be 9.5×10^{-6} and 0.8, respectively. The total cancer risk and total hazard risk are both below the target cancer risk level of 1×10^{-5} and the target hazard level of 1. Therefore, potential exposure to chemicals in soil and ground water for future commercial use should not result in adverse health effects for this category of receptor.

Construction Worker

The risk assessment calculations show that the total cancer risk and total hazard index resulting from direct contact to contaminants of concern including aluminum, arsenic, barium, iron, lead, manganese, mercury, thallium, vanadium, benzene, trichloroethene, vinyl chloride, cis-1,2-dichloroethene, tetrachloroethylene, etc. in soil and ground water for a future construction worker were calculated to be 6 x 10^{-7} and 16, respectively. The total cancer risk is below the target cancer risk level of 1 x 10^{-5}; however, the total hazard index exceeds the target hazard level of 1. The primary COCs associated with the exceedance for this receptor are aluminum and manganese detected in soil and the pathway of concern is inhalation of particulates during construction activities. The highest concentration of aluminum was detected at sampling location B-2 at a depth of 0-2 feet and the highest concentration of manganese was detected at sampling location B-4 at a depth of 1-2 feet.

Residential Use

The risk assessment calculations show that the total cancer risk and total hazard index resulting from direct contact to COCs including aluminum, arsenic, iron, manganese, thallium, vanadium, benzene, tetrachloroethylene, trichloroethene, vinyl chloride, cis-1,2-dichloroethylene, ethylbenzene, xylene, etc. in soil, soil gas and ground water for a future hypothetical adult resident were calculated to be 3 x 10^{-5} and 3, respectively. Both the total cancer risk and the total hazard index exceed the target cancer risk level of 1 x 10^{-5} and the target hazard level of 1. The primary COCs associated with the exceedance for this receptor population are benzene and xylene detected in soil gas and the pathway of concern is inhalation of volatiles from soil in an enclosed space.

The risk assessment calculations show that the total cancer risk and total hazard index resulting from direct contact to COCs in soil and ground water for a future hypothetical child resident were calculated to be 2.0 x 10^{-5} and 5, respectively. Both the total cancer risk and the total hazard index exceed the target cancer risk level of 1 x 10^{-5} and the target hazard level of 1. The primary COCs associated with the exceedance for this receptor population are xylenes (detected in soil gas), and arsenic and iron (detected in soil). The pathway of concern is inhalation of volatiles from soil in an enclosed space along with the incidental ingestion of soil.

Ground Water Use

The risk assessment calculations show that for a future hypothetical adult resident the total cancer risk and total hazard index resulting from ingestion of ground water are 3 x 10^{-4} and 13, respectively. Both the total cancer risk and total hazard index exceed the target cancer risk level of 1 x 10^{-5} and the target hazard level of 1. When the risk from drinking ground water is added to the risk from soil exposure for a hypothetical adult resident, the total risk for a hypothetical adult resident increases to 3 X 10^{-4} for total cancer risk and 16 for total hazard index.

The risk assessment calculations show that for a future hypothetical child resident who ingests ground water the total cancer risk and total hazard index are 1 x 10^{-4} and 31, respectively. Both the total cancer risk and total hazard index exceed the target cancer risk levels of 1 x 10^{-5} and the target hazard level of 1. The primary COCs associated with this exceedance are PCE, vinyl chloride, arsenic, antimony, cobalt, iron, manganese and mercury. For a hypothetical future child resident who ingests ground water and is also exposed to contaminated soil, the risk increases to 1 x 10^{-4} for cancer risk and 36 for total hazard index.

These risks and hazard levels indicate that there is a potential risk to children and adults from direct exposure to contaminated soil and ground water. These risk estimates are based on current and future reasonable maximum exposure scenarios and were developed by taking into account various conservative assumptions about the frequency and duration of an individual's exposure to the soil, ground water and seep water, as well as the toxicity of the chemicals of concern including aluminum, manganese, benzene, xylenes, arsenic, iron, tetrachloroethylene, vinyl chloride, antimony, cobalt and mercury.

2.3.2 Risks to Ecological Receptors

An Ecological Risk Assessment (ERA) was conducted as part of the RI at the site. The ERA was conducted in order to assess potential impacts of COCs on ecological receptors (non-human, non-domesticated species) at the site. Specifically, a Level I scoping ERA determined that based on the history of activities at the site and the surrounding land use, the site has the potential to pose a risk to ecological receptors. Thus, a Level II screening ERA was conducted. The Level II ERA for the site includes a comparison of site-specific data to screening benchmark values and the identification of relevant and complete exposure pathways between each medium of concern and ecologically significant receptors for the site COCs.

For the chemicals that exceed the screening benchmark values and where a completed exposure pathway exists, a Level III baseline ERA was conducted. The approach for the Level III baseline ERA consisted of the calculation of HQs using site-specific exposure factors, chemical-specific and species-specific toxicity values and representative endpoint species. Upon completion of the Level III baseline ERA for the site, the following COCs in various media were determined to pose a potential risk to ecological receptors:

- **Soils/Sediments:** aluminum, antimony, barium, cadmium, cobalt, iron, lead, manganese, mercury, nickel, selenium, thallium zinc, cyclohexane, isopropylbenzene, methylcyclohexane, benzaldehyde, naphthalene, polychlorinated biphenyls (PCBs) – Aroclors 1232, 1242, 1248, 1254, and 1260.

- **Surface Water:** aluminum, barium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, silver, vanadium, zinc, chloroethane, chloromethane, cyclohexane, methylcyclohexane, xylenes, 2,4,6-trichlorophenol, anthracene, benzaldehyde, caprolactam, carbazole, dibenzofuran, di-n-butyl phthalate, fluoranthene, pyrene, PCBs – Aroclors 1232, 1242, 1248, 1254, and 1260.

3.0 REMEDIAL ACTION OBJECTIVES

An FS was conducted by Goodyear to define and analyze appropriate remedial alternatives. That study was conducted with Ohio EPA oversight and was approved on June 15, 2010.

As part of the RI/FS process, remedial action objectives (RAOs) were developed in accordance with the NCP, pursuant to the federal Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 U.S.C. §9601 et seq., as amended,

and U.S. EPA guidance. The RAOs are goals that a remedy should achieve in order to ensure protection of human health and the environment.

The RAOs for the site include:

TABLE 2: REMEDIAL ACTION OBJECTIVES	
Landfill Cover	
Human Health and Ecological Risk	Prevent exposure (i.e. incidental ingestion) to soil with concentrations of chemicals of concern (COCs) in excess of risk based standards or calculated site background concentrations. See Table 3: Contaminants of Concern and Remediation Levels for Soil (Human). Prevent direct contact with contaminated surface soils and consumption of contaminated food. See Table 3: Contaminants of Concern and Remediation Levels for Soil (Ecological).
Ground Water	
Human Health Risk	Prevent direct contact and ingestion of ground water with concentrations of COCs in excess of risk based standards, background levels or Maximum Contaminant Levels. See Table 3: Contaminants of Concern and Remediation Levels for Ground Water (Human).
Soil Gas	
Human Health Risk	Prevent exposure (i.e. inhalation) to soil gas with concentrations of COCs in excess of risk based standards. See Table 3: Contaminants of Concern and Remediation Levels for Soil Gas (Human).
Leachate	
Ecological Risk	Prevent direct contact with contaminated seeps/surface water containing contaminant levels that exceed the Remediation Levels listed in Table 3: Contaminants of Concern and Remediation Levels for Seep Water (Ecological).

Many of the remediation levels (RLs) for protection of human health were established using the acceptable excess lifetime cancer risk and non-cancer hazard goals identified in the DERR Technical Decision Compendium (TDC) document "Human Health Cumulative Carcinogenic Risk and Non-carcinogenic Hazard Goals for DERR Remedial Response and Federal Facility Oversight," dated August 21, 2009. These goals are given as 1×10^{-5} (i.e., 1 in 100,000) excess lifetime cancer risk and a Hazard Index (HI) of 1, and were established using the default exposure parameters provided by U.S. EPA or site-specific information. This TDC can be found at http://www.epa.ohio.gov/portals/30/rules/riskgoal.pdf. Some of the RLs were established through a determination of the site-specific background concentration of the chemical of concern. The ground water RLs are based either on the legally permissible level for a drinking water supply (the Maximum Contaminant Level or MCL), on a calculated level for the protection of human health, or on a site specific background concentration.

The Ecological Preliminary RLs are either from established Ohio EPA Surface Water Criteria, a calculated site-specific background level unique to this site, or from an established literary source.

The numerical RLs for the site are shown below in **Table 3: Contaminants of Concern and Remediation Levels**.

Table 3: Contaminants of Concern and Remediation Levels				
Media (Pathway)	**Contaminant of Concern**	**Maximum Level Detected** *(Location/Date)*	**Remediation Levels**	**Target Level Basis**
Soil (Human)	Aluminum	8,970 mg/kg *(Boring B-2; 12/13/06)*	8,270 mg/kg	Calculated Site Background
	Arsenic	11.9 B mg/kg *(seep soil 10-1; 1/11/07)*	8.8 mg/kg	Calculated Site background
	Manganese	5,860 J mg/kg *(seep soil 22-3; 1/11/07)*	678 mg/kg	Calculated Site background
	Iron	757,000 mg/kg *(seep soil 10-1; 1/11/07)*	25,245 mg/kg	Calculated Site background
Ground Water (Human)	Tetrachloroethylene	0.015 mg/l *(MW-6D; 3/20/08)*	0.005 mg/l	MCL
	Vinyl Chloride	0.0025 mg/l *(MW-6D; 3/20/08)*	0.002 mg/l	MCL
	Arsenic	0.020 mg/l *(MW-4; 3/28/07)*	0.010 mg/l	MCL
	Antimony	0.0023 mg/l *(MW-7; 3/18/08)*	0.006 mg/l	MCL
	Cobalt	0.284 mg/l *(MW-2; 3/27/07)*	0.317 mg/l	Calculated Human Health level
	Iron	69.5 mg/l *(MW-4; 3/28/07)*	115.650 mg/l	Calculated Site background
	Manganese	18.8 mg/l *(MW-2; 3/27/07)*	3.252 mg/l	Calculated Site background
	Mercury	0.0122 J mg/l *(MW-1; 3/27/07)*	0.002 mg/l	MCL
Soil Gas (Human)	Benzene	1,700 $\mu g/m^3$ *(GS-08; 3/30/2007)*	1,133 $\mu g/m^3$	Calculated Human Health Level
	Xylenes	56,000 $\mu g/m^3$ *(GS-08; 3/30/2007)*	40,000 $\mu g/m^3$	Calculated Human Health Level
Soil (Ecological)	Cadmium	8.7 mg/kg *(seep soil 10-1; 1/11/07)*	4 mg/kg	Efroymson, 1997a*
	Chromium	35.5 mg/kg JE 22 *(boring B-3; 12/12/06)*	26 mg/kg	Eco SSL for avian invertivores
	Cobalt	25.1 mg/kg JE54 *(boring B-3 12/12/06)*	120 mg/kg	Eco SSL for avian invertivores

	Lead	37.4 mg/kg JS72 *(boring B-3; 12/12/06)*	40.5 mg/kg	Efroymson, 1997a
	Manganese	5,860 mg/kg J *(seep soil 22-3; 1/11/07)*	678 mg/kg	Site-specific calculated background value
	Selenium	4.6 mg/kg B *(seep soil 10-1; 1/11/07)*	0.52 mg/kg	Terrestrial plant benchmark value (Efroymson, 1997c)#
	Thallium	10.2 mg/kg B G *(seep soil 10-2; 1/11/07)*	1.3 mg/kg	Maximum detected site-specific background value
	PCBs	230 µg/kg *(seep soil 8-2; 1/16/07)*	0.0003 mg/kg	Soil invertebrate benchmark value (Efroymson, 1997b)**
Seep Water (Ecological)	Aluminum (total)	219,000 µg/l *(Seep-03; 10/19/06)*	53,259 µg/l	Site-specific calculated background value
	Barium – (total)	6,180 µg/l *(Seep-03; 10/19/06)*	220 µg/l	Ohio EPA Surface Water Criteria (OMZA)
	Barium – dissolved	380 µg/l (*Seep 9; 1/15/07)*	85.3 µg/l	Ohio EPA Surface Water Criteria (OMZA)
	Cobalt - total	262 µg/l *(Seep-03; 10/19/06)*	42.5 µg/l	Site-specific calculated background value
	Copper – total	327 J µg/l *(Seep-03; 10/19/06)*	27.5 µg/l	Ohio EPA Surface Water Criteria (OMZA)
	Copper - dissolved	10.4 B µg/l *(Seep 5; 1/16/07)*	27 µg/l	
	Iron – total	1,260,000 µg/l *(Seep-03; 10/19/06)*	115,650 µg/l	Site-specific calculated background value
	Iron – dissolved	51,900 µg/l *(Seep 6; 1/17/07)*	5,990 µg/l	Maximum detected site-specific background value
	Lead – total	336 µg/l *(seep-03; 10/19/06)*	32.8 µg/l	Ohio EPA Surface Water Criteria (OMZA)
	Lead - dissolved	Non-detect	25.9 µg/l	
	Manganese – total	17,400 J µg/l *(seep-03; 10/19/06)*	3,252 µg/l	Site-specific calculated background values
	Manganese – dissolved	2,480 J µg/l *(seep-6; 1/17/07)*	1,759 µg/l	
	Mercury – total	1.9 µg/l *(seep-5; 1/17/07)*	0.91 µg/l	Ohio EPA Surface Water Criteria (OMZA)
	Mercury - dissolved	0.25 µg/l *(seep-5; 1/16/07)*	0.77 µg/l	
	Vanadium	467 µg/l *(seep-03; 10/19/06)*	44 µg/l	Ohio EPA Surface Water Criterion (OMZA)
	Zinc – total	1,360 µg/l *(seep-03; 10/19/06)*	355 µg/l	Ohio EPA Surface Water Criteria (OMZA)
	Zinc - dissolved	61.8 µg/l *(seep-5; 1/16/07)*	347 µg/l	

	Xylenes	100 µg/l *(seep-2; 1/18/07)*	27 µg/l	Ohio EPA Surface Water Criteria (OMZA)
	Di-n-butyl-phthalate	10 µg/l *(seep-2; 10/19/06)*	1 µg/l	Efroymson, 1997a
	PCBs	0.24 µg/l *(seep-4; 1/17/07)*	0.001 µg/l	Ohio EPA Surface Water Criteria (OMZA)

*Efroymson, et. al., 1997a. Preliminary Remediation Goals for Ecological Endpoints.
**Efroymson, et.al., 1997b. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 revision.
#Efroymson, et.al., 1997c. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision.

4.0 SUMMARY OF REMEDIAL ALTERNATIVES

A total of seven remedial alternatives were considered in the FS, as identified in **Table 4: Summary Description of Remedial Alternatives** below. A brief description of the major features of each of the remedial alternatives follows. More detailed information about these alternatives can be found in the FS. The proposed remedy in this Preferred Plan includes modifications pursuant to the ORC 3724.02(G) exemption approved on July 6, 2012.

Alternative	Table 4: Summary Description of Remedial Alternatives
1	**No Action** – site conditions remain unchanged
2 a	**Soil Cap with Leachate Treatment in on-site Wetlands** – existing soil cap would be enhanced with additional soil; leachate would be treated in a created wetland on-site; landfill gas would be vented; ground water would be monitored.
2 b	**Soil Cap with Leachate collection and Offsite Leachate Disposal** - existing soil cap would be enhanced with additional soil; leachate would be collected and transported to off-site treatment facility; landfill gas would be vented; ground water would be monitored.
3 a & Modified 3 a	**Geomembrane Cap system with Leachate treatment in on-site Wetland** – existing landfill cap would be reworked, and a geomembrane cap system would be placed over current soils; leachate would be directed to a created wetland on-site; landfill gas would be vented; and ground water would be monitored.
3 b & Modified 3 b	**Geomembrane Cap system with Leachate collection and Offsite Leachate Disposal -** existing landfill cap would be reworked, and a geomembrane cap system would be placed over current soils; leachate would be collected and transported to off-site treatment facility; landfill gas would be vented; and ground water would be monitored.
4 a & Modified 4 a	**Dual Layer Cap with Leachate Treatment in On-site Wetland** – a dual layer cap system would be placed over the existing soil cover

	after it has been recompacted and regraded for proper drainage; leachate would be treated in a created wetland on-site; landfill gas would be vented; and ground water would be monitored.
4 b & Modified 4 b	**Dual Layer Cap with Leachate collection and Offsite Leachate Disposal** - a dual layer cap system would be placed over the existing soil cover after it has been recompacted and regarded for proper drainage; leachate would be collected and transported to off-site treatment facility; landfill gas would be vented; ground water would be monitored.

4.1 No Action Alternative

The "no action alternative" is a required remedial alternative. The NCP requires evaluation of a no action alternative to establish a baseline for the comparison of other remedial alternatives. Under this option, no remedial activities or monitoring are conducted at the site. Potential exposure to contaminated media is not controlled or prevented. There are no costs associated with this remedy since there is no action to be taken.

4.2 Remedial Alternatives

The FS proposed six potential active remedial alternatives for the Jackson County Landfill. The alternatives vary based on possible capping enhancements and the proposed treatment alternative for the leachate. All alternatives with an "a" designation propose treatment of the leachate in an on-site constructed wetland. All "b" alternatives propose the collection and transportation of the leachate to an off-site location for treatment and proper disposal. All of the alternatives include several common elements. In order to minimize duplication of the same information, all of the common elements are summarized here rather than under each different alternative.

Landfill Gas: Pipe vents (approximately one per acre) will be installed within the landfill limits to passively vent gas from the landfill. Whether there is a need to burn the soil gas will be evaluated during the design, along with any applicable permitting requirements.

Access: Gates will be installed at the access roads and fences will be extended approximately 20 feet on each side to limit human access to the property. Warning signs will be installed around the landfill as determined in the remedial design. The gates will comply with the requirement of Ohio Administrative Code (OAC) 3745-27-11(H)(7) to block the access road from unauthorized entry to the Site.

Institutional Controls: Institutional controls and land use restrictions following the Ohio Uniform Environmental Covenants Act (UECA) of 2004 will be implemented to prohibit residential occupation of the Site. The restrictions also will prohibit the use of ground water beneath the landfill for potable and/or agricultural purposes. Lastly, the restrictions will prohibit building or placing any permanently occupied structure on the landfill itself.

Maintenance: The cap system will be maintained and monitored in accordance with the Operation and Maintenance Plan prepared during remedial design to meet the requirements of OAC 3745-27-12, 3745-27-14, and 3745-27-19 for ground water monitoring, explosive gas monitoring, post-closure care, surface water management, and leachate management.

Ground Water: An active ground water treatment system is not being proposed. Instead, the ground water below the site will be monitored to evaluate the ground water quality and natural attenuation of contaminants over time after the landfill cap is installed until the ground water RLs listed in Table 3 are demonstrated to be met. The details of the ground water monitoring plan will be determined during the design phase of the remedy.

Alternative 2a: Soil Cap with Leachate Treatment in On-site Wetlands

In addition to the common elements listed above, this alternative consists of the repair of the existing soil cap to provide a minimum two foot thick compacted soil cover. After clearing and grubbing of the surface vegetation, the existing topsoil will be removed and set aside for reinstallation over the repaired cap. The existing cap soils will be regraded or supplemented to provide a minimum two foot thick soil cap with proper drainage. The existing surface of the cap will be recompacted. The entire surface may not require regrading or compaction if the existing grade and compaction meets design requirements. The capital cost estimate is based on the entire surface requiring regrading and compaction. In addition, the soil cap will be designed to provide a minimum of two feet of soil cover over the existing soil in the seep (leachate) flow channels on the landfill.

A leachate collection system will be installed to capture leachate from the landfill. The leachate will be pumped or transported by gravity, if possible, to an on-site constructed wetland for treatment. The required wetland area will be approximately 4 acres. The discharge from the wetland will flow to Salt Lick Creek. The inflow to the wetland will incorporate a holding/equalization structure to provide for minimum flow through the treatment wetland during periods of low flow. Additionally, a surface water pond may be added to provide water to maintain a minimum flow; the need for this potential element will be determined during design. After the holding/equalization structure, the leachate water will pass through a filter system to remove suspended solids before entering the treatment wetland. The filter system will serve to remove PCBs detected in the seep water. A tall fence will be installed around the treatment wetland to deter deer from grazing on the wetland vegetation.

It will take approximately five years to establish the wetland. Prior to the wetland becoming fully functional, the leachate will need to be collected and hauled off-site for proper treatment and disposal. The yearly estimated cost to haul the leachate off-site is $ 1,170,000. Note that the purpose of the cap under this alternative is to prevent direct contact with the waste. This proposed capping alternative will not prevent the development of leachate.

Estimated Capital Cost: $ 3,718,000
Estimated Annual O&M Cost: $ 1,372,000
Estimated Present Worth Cost of O&M: $ 8,171,000
Estimated Construction Time: 8 months

Alternative 2b: Soil Cap with Leachate Treatment with Offsite Leachate Disposal

In addition to the common elements listed above, Alternative 2b consists of the repair of the landfill cap in the same manner as described in alternative 2a. However, the proposed treatment of the leachate differs.

A leachate collection system will be installed to capture leachate from the landfill. The leachate will be pumped or transported by gravity to an on-site holding structure. Once the holding structure is full, or based on a pre-scheduled date, the leachate will be transported to the local publicly owned treatment works (POTW – wastewater treatment plant) for treatment and disposal. The estimated yearly cost for hauling the leachate is $ 1,170,000. Leachate will be collected and hauled from the site for 30 years. Note that the purpose of the cap under this alternative is to prevent direct contact with the waste. This proposed capping alternative will not prevent the development of leachate.

Estimated Capital Cost: $ 3,818,000
Estimated Annual O&M Cost: $ 1,332,000
Estimated Present Worth Cost of O&M: $ 20,477,000
Estimated Construction Time: 8 months

Alternative 3a: Geomembrane Cap with Leachate Treatment in On-Site Wetland

In addition to the common elements listed above, this alternative consists of placing a geomembrane cap system over the existing soil cap after it has been recompacted and regraded for proper drainage. The existing soil will be reworked and compacted to achieve a permeability of 1×10^{-6} cm/sec or as low of a permeability as can be reasonably achieved (goal of 1×10^{-6} cm/sec). Any added soil to this layer will be clay soil that can achieve a compaction of 1×10^{-6} cm/sec. The cap system will consist of (from bottom to top):

- A recompacted soil layer (soil already on site with additional soil added if needed to achieve minimum of 18 inch base) to serve as a bedding and low permeability layer.
- A geocomposite (consisting of a geonet and geotextile filters) to capture and transport venting gas to passive vents and to capture and transport leachate to a collection piping system.
- A 40 mil geomembrane liner.
- A geocomposite to collect and transport surface water infiltration to a perimeter drainage system.
- A 24 inch thick protective cover soil layer.
- A 6 inch thick topsoil layer (using existing topsoil and supplemented with additional soil as required).

The final surface grade will be designed to provide for surface drainage to eliminate any low lying areas on the cap that would retain surface water.

The leachate collection system is the same as described in alternative 2a except that the piping will be incorporated into the geocomposite system. It will take approximately five years to establish the wetland. Prior to the wetland becoming fully functional, the leachate will need to be collected and hauled off-site for proper treatment and disposal. However, the capping system for this alternative incorporates a geocomposite layer which will help prevent leachate. As a result, during the 5 years in which the wetland is becoming established, the cost for hauling the leachate off-site for treatment and disposal is estimated to be $ 272,500 per year instead of the estimated $ 1,170,000 as described in alternative 2a and 2b.

Estimated Capital Cost: $ 7,669,000
Estimated Annual O&M Cost: $ 453,500
Estimated Present Worth Cost of O&M: $ 3,130,000
Estimated Construction Time: 8 months

Subsequent to the submittal and approval of the FS, Goodyear evaluated a modification to alternatives 3a, 3b, 4a and 4b. The modification proposed the elimination of the Geosynthetic Gas Venting/Leachate Collection layer as proposed in the FS. The removal of this layer, which is not required by OAC 3745-27-08, results in an overall reduction in the amount of leachate which is generated and reduces the overall costs of these remedial alternatives by $ 588,000. Ohio EPA reviewed the proposed modification for these alternatives and agrees with Goodyear's changes. Therefore, Modified Alternatives 3a, 3b, 4a and 4b, which were not included in the original FS, are included within this Preferred Plan.

Modified Alternative 3a: Geomembrane Cap with Leachate Treatment in On-Site Wetland

In addition to the common elements listed above, this alternative consists of placing a geomembrane cap system over the existing soil cap after it has been recompacted and regraded for proper drainage. The existing soil will be reworked and compacted to achieve a permeability of 1 x 10–6 cm/sec or as low of a permeability as can be reasonably achieved (goal of 1 x 10–6 cm/sec). Any added soil to this layer will be clay soil that can achieve a compaction of 1 x 10–6 cm/sec. The cap system will consist of (from bottom to top):

- A recompacted soil layer (soil already on site with additional soil added if needed to achieve minimum of 18 inch base) to serve as a bedding and low permeability layer.
- A 40 mil geomembrane liner.
- A geocomposite to collect and transport surface water infiltration to a perimeter drainage system.
- A 24 inch thick protective cover soil layer.
- A 6 inch thick topsoil layer (using existing topsoil and supplemented with additional soil as required).

The final surface grade will be designed to provide for surface drainage to eliminate any low lying areas on the cap that would retain surface water.

It will take approximately five years to establish the wetland. Prior to the wetland becoming fully functional, the leachate will need to be collected and hauled off-site for proper treatment and disposal. During the 5 years in which the wetland is becoming established, the cost for hauling the leachate off-site for treatment and disposal is estimated to be $ 272,500 per year instead of the estimated $ 1,170,000 as described in alternative 2a and 2b.

Estimated Capital Cost: $ 7,081,000
Estimated Annual O&M Cost: $ 453,500
Estimated Present Worth Cost of O&M: $ 3,130,000
Estimated Construction Time: 8 months

Alternative 3b: Geomembrane Cap with Leachate Treatment at POTW

In addition to the common elements listed above, Alternative 3b consists of the same proposed capping alternative as described in Alternative 3a. The leachate collection system is the same as described in alternative 2b. In summary, the cap will consist of a new geomembrane capping system while the leachate will be collected on-site and transported to the local POTW for proper treatment and disposal. Note that the capping system for this alternative incorporates a geocomposite layer which will help prevent leachate. As a result, much less leachate is anticipated and the associated operation and maintenance costs are lower.

Estimated Capital Cost: $ 7,644,000
Estimated Annual O&M Cost: $ 433,500
Estimated Present Worth Cost of O&M: $ 3,071,000
Estimated Construction Time: 9 months

Modified Alternative 3b: Geomembrane Cap with Leachate Treatment at POTW

In addition to the common elements listed above, Modified Alternative 3b consists of the same proposed capping alternative as described in Modified Alternative 3a. The difference between this alternative and alternative 3a is that the leachate will be collected and hauled off-site for treatment. Under this alternative, a wetland will not be established.

Estimated Capital Cost: $ 7,056,000
Estimated Annual O&M Cost: $ 433,500
Estimated Present Worth Cost of O&M: $ 3,071,000
Estimated Construction Time: 9 months

Alternative 4a: Dual Layer Cap with Leachate Treatment in On-site Wetlands

In addition to the common elements listed above, Alternative 4a consists of placing a dual layer cap system over the existing soil cover after it has been recompacted and regraded for proper drainage. The dual layer cap system would consist of (from bottom to top):

- A recompacted soil layer to serve as a bedding layer.
- A geocomposite (consisting of a geonet and geotextile filters) to capture and transport venting gas to passive vents and to capture and transport leachate to a collection piping system.
- An 18 inch thick clay layer compacted to a permeability of 1×10^{-6} cm/sec. A potential alternative to the clay layer will be a geosynthetic clay liner (GCL). The GCL would consist of a bentonite mat either separate or attached to the 40 mil geomembrane liner and would provide the same dual layer of low permeability protection as the clay layer and geomembrane. During the design phase, a final decision will be made on whether 18 inches of clay or the GCL will be used for the cap.
- A 40 mil geomembrane liner.
- A geocomposite to collect and transport surface water infiltration to a perimeter drainage system.

- A 24 inch thick protective cover soil layer (18 inch required with GCL).
- A 6 inch thick topsoil layer (using existing topsoil and supplemented as required).

The existing cap surface will be recompacted and then regraded or supplemented to provide proper drainage. No minimum thickness for this soil layer is required as long as the thickness provides adequate protection of the geofabrics against penetration from materials in the waste. The final surface grade will be designed to provide for surface drainage to eliminate any low lying areas on the cap that would retain surface water.

Under this scenario, the wetland will be constructed to treat leachate. See alternative 2a for details.

Estimated Capital Cost: $ 8,844,000
Estimated Annual O&M Cost: $ 431,250
Estimated Present Worth Cost for O&M: $ 3,034,000
Estimated Construction Time: 9 months

Modified Alternative 4a: Dual Layer Cap with Leachate Treatment in On-site Wetlands

In addition to the common elements listed above, Modified Alternative 4a consists of placing a dual layer cap system over the existing soil cover after it has been recompacted and regraded for proper drainage. However, as mentioned earlier, the **modified** alternatives 4a and 4b eliminate the installation of the Geosynthetic Gas Venting/Leachate Collection layer. The dual layer cap system would consist of (from bottom to top):

- A recompacted soil layer to serve as a bedding layer.
- An 18 inch thick clay layer compacted to a permeability of 1×10^{-6} cm/sec. A potential alternative to the clay layer will be a GCL. The GCL would consist of a bentonite mat either separate or attached to the 40 mil geomembrane liner and would provide the same dual layer of low permeability protection as the clay layer and geomembrane. During the design phase, a final decision will be made on whether 18 inches of clay or the GCL will be used for the cap.
- A 40 mil geomembrane liner.
- A geocomposite to collect and transport surface water infiltration to a perimeter drainage system.
- A 24 inch thick protective cover soil layer (18 inch required with GCL).
- A 6 inch thick topsoil layer (using existing topsoil and supplemented as required).

The existing cap surface will be recompacted and then regraded or supplemented to provide proper drainage. No minimum thickness for this soil layer is required as long as the thickness provides adequate protection of the geofabrics against penetration from materials in the waste. The final surface grade will be designed to provide for surface drainage to eliminate any low lying areas on the cap that would retain surface water.

Under this scenario, the wetland will be constructed to treat leachate. See alternative 2a for details.

Estimated Capital Cost: $ 8,256,000
Estimated Annual O&M Cost: $ 431,250
Estimated Present Worth Cost for O&M: $ 3,034,000
Estimated Construction Time: 9 months

Alternative 4b: Dual Layer Cap with Leachate Treatment at POTW

In addition to the common elements listed above, the capping alternative under this scenario is the same as the cap described for alternative 4a, above.

The leachate collection and treatment system is the same as described under alternative 2b.

Estimated Capital Cost: $ 8,816,000
Estimated Annual O&M Cost: $ 411,250
Estimated Present Worth Cost for O&M: $ 2,729,000
Estimated Construction Time: 9 months

Modified Alternative 4b: Dual Layer Cap with Leachate Treatment at POTW

In addition to the common elements listed above, the capping alternative under this scenario is the same as the cap described for modified alternative 4a, above.

Estimated Capital Cost: $ 8,228,000
Estimated Annual O&M Cost: $ 411,250
Estimated Present Worth Cost for O&M: $ 2,729,000
Estimated Construction Time: 9 months

5.0 COMPARISON AND EVALUATION OF ALTERNATIVES

5.1 Evaluation Criteria

Ohio EPA considers eight criteria, as outlined in the NCP, to evaluate the various remedial alternatives individually and against each other in order to select a remedy. A more detailed analysis of the remedial alternatives can be found in the FS report. The eight evaluation criteria are listed and discussed below.

1. Overall Protection of Public Health and the Environment - determines whether an alternative eliminates, reduces, or controls threats to public health and the environmental through institutional controls, engineering controls, or treatment.
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) - evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
3. Long-Term Effectiveness and Permanence – evaluates the ability of an alternative to maintain protection of human health and the environment over time.

4. Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment – evaluates the amount of contamination present, the ability of the contamination to move in the environment, and the use of treatment to reduce harmful effects of the principal contaminants.
5. Short-Term Effectiveness – evaluates the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
6. Implementability – evaluates the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
7. Cost – includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
8. Community Acceptance – considers whether the local community agrees with Ohio EPA's analyses and preferred alternative. Comments received on the Preferred Plan are an important indicator of community acceptance.

Evaluation Criteria 1 and 2 are threshold criteria required for acceptance of an alternative that has accomplished the goal of protecting human health and the environment and has complied with the law. Any acceptable remedy must comply with both of these criteria. Evaluation Criteria 3 through 7 are the balancing criteria used to select the best remedial alternative(s) identified in the Preferred Plan. Evaluation Criteria 8, community acceptance, is a modifying criterion that will be evaluated through public comment on the alternatives received during the comment period.

5.2 Analysis of Evaluation Criteria

This section examines how each of the evaluation criteria is applied to each of the remedial alternatives found in Section 4.2 and compares how the alternatives achieve the evaluation criteria.

Overall Protection of Human Health and the Environment

Evaluation of the overall protectiveness of the alternatives focuses on whether each alternative achieves adequate protection of human health and the environment and identifies how site risks posed through each pathway being addressed are eliminated, reduced or controlled by the alternative. This evaluation also includes consideration of whether the alternative poses any unacceptable short-term or cross-media impacts.

No Action Alternative: The "no action alternative" is not protective of human health and the environment. There are potential contaminants and exposures that need to be addressed. Because this alternative is not protective of human health and the environment it has been eliminated from consideration under the remaining seven criteria.

Alternative 2a: Exposure to soil gas and contaminated soil is eliminated. Ground water exposure is controlled through Use Restrictions and monitoring.

Alternative 2b: Exposure to soil gas and contaminated soil is eliminated. Ground water exposure is controlled through Use Restrictions and monitoring.

Alternative 3a & Modified Alternative 3a: Exposure to soil gas and contaminated soil is eliminated. Ground water exposure is controlled through Use Restrictions and monitoring.

Alternative 3b & Modified Alternative 3b: Exposure to soil gas and contaminated soil is eliminated. Ground water exposure is controlled through Use Restrictions and monitoring.

Alternative 4a & Modified Alternative 4a: Exposure to soil gas and contaminated soil is eliminated. Ground water exposure is controlled through Use Restrictions and monitoring.

Alternative 4b & Modified Alternative 4b: Exposure to soil gas and contaminated soil is eliminated. Ground water exposure is controlled through Use Restrictions and monitoring.

Compliance with ARARs

ORC 3734.02(G) is an ARAR. Accordingly, the issuance of the .02(G) Exemption renders the modified alternatives 3a,3b, 4a, and 4b ARAR compliant as to landfill capping design and is protective of human health and the environment.

Alternative 2a: Does not comply with the current landfill capping regulations but does comply with air pollution, prohibition against open dumping, well design, closure and explosive gas monitoring regulations.

Alternative 2b: Does not comply with the current landfill capping regulations but does comply with air pollution, open dumping, well design, closure and explosive gas monitoring regulations.

Alternative 3a & Modified Alternative 3a: With the issuance of the .02(G) Exemption, this modified alternative complies with capping ARARs. In addition, the location of the gas collection layer will be moved to accommodate the alternative capping design. This alternative complies with other applicable regulations including control of air pollution, open dumping, well design, closure and explosive gas monitoring regulations.

Alternative 3b & Modified Alternative 3b: With the issuance of the .02(G) Exemption, this modified alternative complies with capping ARARs. In addition, the location of the gas collection layer will need to be moved to accommodate the alternative capping design. However, OAC 3745-27-08(D)(27) does not require a specific location for this layer so moving it to accommodate an alternative capping design does not violate any ARARs. This alternative complies with other applicable regulations including control of air pollution, open dumping, well design, closure and explosive gas monitoring regulations.

Alternative 4a & Modified Alternative 4a: Complies with all applicable or relevant and appropriate requirements after the issuance of the .02(G) Exemption.

Alternative 4b & Modified Alternative 4b: Complies with all applicable or relevant and appropriate requirements after the issuance of the .02(G) Exemption.

Long-Term Effectiveness and Permanence

Alternative 2a: The source of the contaminants is not removed. Exposure to contaminants is controlled through a variety of mechanisms including an augmented soil cap, soil gas vents and management of the leachate through the creation of a wetland. However, long term maintenance is required. The wetland may need additional management as the efficiency of this remedy element is linked to the weather and adequate water.

Alternative 2b: The source of the contaminants is not removed. Exposure to contaminants is controlled through a variety of mechanisms including an augmented soil cap, soil gas vents and a leachate management system. However, long term maintenance is required. The leachate collection system must be carefully monitored to ensure that the collection system does not become too full.

Alternative 3a & Modified Alternative 3a: The source of the contaminants is not removed. However, the quality of the landfill cap should significantly reduce the quantity of leachate produced. Soil gas vents and a leachate management system included in the remedy will control exposure to these two potential sources of contaminants. Long term maintenance is required for all of the remedy components. The wetland may need additional management as the efficiency of this remedy element is linked to the weather and adequate water.

Alternative 3b & Modified Alternative 3b: The source of the contaminants is not removed. However, the quality of the cap should significantly reduce the quantity of leachate produced. Soil gas vents and the leachate management system included in the remedy will control exposure to these two potential sources of contaminants. Long term maintenance is required for all of the remedy components. The leachate collection system must be carefully monitored to ensure that the collection tank does not become too full.

Alternative 4a & Modified Alternative 4a: The source of the contaminants is not removed. However, the proposed landfill cap should result in the least amount of leachate produced compared to the other potential remedies. Soil gas vents and the leachate management system included in the remedy will control exposure to these two potential sources of contaminants. Long term maintenance is required for all of the remedy components. The wetland may need additional management as the operational efficiency of this remedy element is linked to the weather and adequate water.

Alternative 4b & Modified Alternative 4b: The source of the contaminants is not removed. However, the proposed landfill cap should result in the least amount of leachate produced compared to the other potential remedies. Soil gas vents and the leachate management system included in the remedy will control exposure to these two potential sources of contaminants. Long term maintenance is required for all of the remedy components. The leachate collection system must be carefully monitored to ensure that the collection tank does not become too full.

Reduction of Toxicity, Mobility or Volume by Treatment

Alternative 2a: Wastes are left in place so there is no reduction in volume, toxicity or mobility. However, the wastes are covered, the leachate is collected and transported to an on-site wetland, and the soil gas collection system is designed to prevent migration of the soil gas to an adjacent property. If the soil gas is flared, exposure will be prevented. Absent flaring, the soil gas is transferred from the soil to the atmosphere.

Alternative 2b: Wastes are left in place so there is no reduction in volume, toxicity or mobility. However, the wastes are covered, the leachate is collected and transported off-site to the local wastewater treatment plant and the soil gas collection system is designed to prevent migration of the soil gas to an adjacent property. If the soil gas is flared, exposure will be prevented. Absent flaring, the soil gas is transferred from the soil to the atmosphere.

Alternative 3a & Modified Alternative 3a: Wastes are left in place so there is no reduction in volume, toxicity or mobility. However, the wastes are covered, the leachate is collected and transported to an on-site wetland (Modified Alternative 3a produces significantly less leachate), and the soil gas collection system is designed to prevent migration of the soil gas to an adjacent property. If the soil gas is flared, exposure will be prevented. Absent flaring, the soil gas is transferred from the soil to the atmosphere.

Alternative 3b & Modified Alternative 3b: Wastes are left in place so there is no reduction in volume, toxicity or mobility. However, the wastes are covered, the leachate is collected and transported off-site to the local wastewater treatment plant (Modified Alternative 3b produces significantly less leachate) and the soil gas collection system is designed to prevent migration of the soil gas to an adjacent property. If the soil gas is flared, exposure will be prevented. Absent flaring, the soil gas is transferred from the soil to the atmosphere.

Alternative 4a & Modified Alternative 4a: Wastes are left in place so there is no reduction in volume, toxicity or mobility. However, the wastes are covered, the leachate is collected and transported to an on-site wetland, and the soil gas collection system is designed to prevent migration of the soil gas to an adjacent property. If the soil gas is flared, exposure will be prevented. Absent flaring, the soil gas is transferred from the soil to the atmosphere.

Alternative 4b & Modified Alternative 4b: Wastes are left in place so there is no reduction in volume, toxicity or mobility. However, the wastes are covered, the leachate is collected and transported off-site to the local wastewater treatment plant and the soil gas collection system is designed to prevent migration of the soil gas to an adjacent property. If the soil gas is flared, exposure will be prevented. Absent flaring, the soil gas is transferred from the soil to the atmosphere.

Short-Term Effectiveness

Alternative 2a: The greatest short term risk will be exposure to dust during the construction/augmentation of the soil cover. Dust can be controlled during construction. Gas vents will not provide immediate mitigation of gas migration and leachate may need to be temporarily collected until the wetland is constructed and fully operational. Construction workers may need to wear appropriate protective clothing or other protective gear during construction. Estimated construction time is eight months although the wetland may take up to five years to become established.

Alternative 2b: The greatest short term risk will be exposure to dust during the construction/augmentation of the soil cover. Dust can be controlled during construction. Gas vents will not provide immediate mitigation of gas migration. Construction workers may need to wear appropriate protective clothing or other protective gear during construction. Estimated construction time is 8 months.

Alternative 3a & Modified Alternative 3a: The greatest short term risk will be exposure to dust during the construction of the landfill cap. There is approximately six times more soil movement and dust generation expected with this alternative than with alternative 2a. However, dust can be controlled during construction. Gas vents will not provide immediate mitigation of gas migration and leachate may need to be temporarily collected until the wetland is constructed and fully operational. Construction workers may need to wear appropriate protective clothing or other protective gear during construction. Estimated construction time is nine months although the wetland may take up to five years to become established.

Alternative 3b & Modified Alternative 3b: The greatest short term risk will be exposure to dust during the construction of the landfill cap. There is approximately six times more soil movement and dust generation expected with this alternative than with alternative 2b. Dust can be controlled during construction. Gas vents will not provide immediate mitigation of gas migration. Construction workers may need to wear appropriate protective clothing or other protective gear during construction. Estimated construction time is nine months.

Alternative 4a & Modified Alternative 4a: The greatest short term risk will be exposure to dust during the construction of the landfill cap. There is approximately eight times more soil movement and dust generation expected with this alternative than

with alternative 2a. However, dust can be controlled during construction. Gas vents will not provide immediate mitigation of gas migration and leachate may need to be temporarily collected until the wetland is constructed and develops. Construction workers may need to wear appropriate protective clothing or other protective gear during construction. Estimated construction time is nine months although the wetland may take up to five years to become established.

Alternative 4b & Modified Alternative 4b: The greatest short term risk will be exposure to dust during the construction of the landfill cap. There is approximately eight times more soil movement and dust generation expected with this alternative than with alternative 2b. Dust can be controlled during construction. Gas vents will not provide immediate mitigation of gas migration. Construction workers may need to wear appropriate protective clothing or other protective gear during construction. Estimated construction time is nine months.

Implementability

Alternative 2a: All components of the remedy are well known and readily constructed. Materials required to construct the cap include approximately 20,000 cubic yards (CY) of fill to augment existing cover soil. Once constructed, the wetland is easy to operate, but it will require time to reach maturity. During the time needed for the wetland to mature, leachate may need to be collected and transported off-site for treatment. In addition, wetlands do not work as efficiently during colder weather. An NPDES permit is required for discharge from treatment wetlands. Long term sampling of the discharge will be required under NPDES permit.

Alternative 2b: All components of the remedy are well known and readily constructed. Materials required to construct the cap include approximately 20,000 CY of fill to augment existing cover soil. The leachate collection system does not require any special considerations other than a possible pumping system to the holding tank. Disposal at a POTW must be coordinated and preapproved. Sampling of leachate will be required to ensure that the leachate concentrations meet the POTW's limits.

Alternative 3a & Modified Alternative 3a: All components of the remedy are well known and readily constructed although the construction is more complex than for remedy 2a. Materials required to construct the cap include 20,000 CY of soil to augment the existing cover soil; 120,000 square yards (SY) of geocomposite for gas collection / leachate collection (not included in Modified Alternative 3a); 120,000 SY of 40 mil HDPE geosynthetic layer; 120,000 SY of geocomoposite for a drainage layer; 78,000 CY of protective cover soil and 19,400 CY of topsoil. Once constructed, the wetland is easy to operate but it will require time to reach maturity. During the time needed for the wetland to mature, leachate may need to be collected and transported off-site for treatment. In addition, wetlands do not work as efficiently during colder weather so additional maintenance may be needed. An NPDES permit is

required for discharge from treatment wetlands. Long term sampling of the discharge will be required under an NPDES permit.

Alternative 3b & Modified Alternative 3b: All components of the remedy are well known and readily constructed although the construction is more complex than for remedy 2b. Materials required to construct the cap include 20,000 CY of soil to augment the existing cover soil; 120,000 SY of material for the geocomposite for gas collection / leachate collection (not included in Modified Alternative 3b); 120,000 SY of 40 mil HDPE geosynthetic material; 120,000 SY of geocomposite material for drainage layer; 78,000 CY of protective cover soil and 19,400 CY of topsoil. The leachate collection system does not require any special considerations other than a possible pumping system to the holding tank. Disposal of the leachate at the POTW must be coordinated and preapproved. Sampling of the leachate will be required to ensure that the leachate concentrations meet the POTWs limits.

Alternative 4a & Modified Alternative 4a: All components of the remedy are well known and readily constructed although the construction is more complex than for remedy 3a. Materials required to construct cap include 10,000 CY of soil to augment existing cover soil; 120,000 SY of a geocomposite for gas collection / leachate collection (not included in Modified Alternative 4a); 58,000 CY of clean clay (1×10^{-6} permeability) or 120,000 SY of GCL – low permeability layer; 120,000 SY of 40 mil HDPE geosynthetic material; 120,000 SY of geocomposite material for drainage layer; 78,000 CY [or 58,000 CY with GCL] of protective cover soil and 19,400 CY of topsoil. Once constructed, the wetland is easy to operate, but it will require time to reach maturity. During the time needed for the wetland to mature, leachate may need to be collected and transported off-site for treatment. In addition, wetlands do not work as efficiently during colder weather so additional maintenance may be needed. An NPDES permit is required for discharge from treatment wetlands. Long term sampling of the discharge will be required under NPDES permit.

Alternative 4b & Modified Alternative 4b: All components of the remedy are well known and readily constructed although the construction is more complex than for remedy 3b. Materials required to construct cap include 10,000 CY of soil to augment existing cover soil; 120,000 SY of geocomposite for gas collection / leachate collection (not included in Modified Alternative 4b); 58,000 CY of clean clay (1×10^{-6} permeability) or 120,000 SY of GCL – low permeability layer; 120,000 SY of 40 mil HDPE geosynthetic material; 120,000 SY of geocomposite material for drainage layer; 78,000 CY [or 58,000 CY with GCL] of protective cover soil and 19,400 CY of topsoil. The leachate collection system does not require any special considerations other than a possible pumping system to the holding tank. Disposal at the POTW must be coordinated and preapproved. The leachate will be sampled to ensure that any chemicals in the leachate meet the POTWs limits.

Cost

The total cost of the potential remedies, including construction costs and the present estimated cost of operation and maintenance (O&M) [present worth costs are based on 30 years of O&M minus a discount rate of 5 % to account for the decreased value of the dollar in the future] are summarized below.

Alternative 2a: Total cost including capital construction costs and O&M is $ 11,889,000.

Alternative 2b: Total cost including capital construction costs and O&M is $ 24,295,000. This remedy is the most expensive alternative due to the very high O&M costs.

Alternative 3a: Total cost including capital construction costs and O&M is $ 10,799,000.

Modified Alternative 3a: Total cost including capital construction costs and O&M is $10,211,000.

Alternative 3b: Total cost including capital construction costs and O&M is $ 10,715,000. This remedy is ranked 3.

Modified Alternative 3b: Total cost including capital construction costs and O&M is $10,127,000. This remedy is the least expensive alternative.

Alternative 4a: Total cost including capital construction costs and O&M is $ 11,878,000.

Modified Alternative 4a: Total cost including capital construction costs and O&M is $11,290,000.

Alternative 4b: Total cost, including capital construction costs and O&M is $ 11,545,000.

Modified Alternative 4b: Total cost including capital construction costs and O&M is $10,957,000.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the responsiveness summary, which will be an attachment to the Decision Document that will be issued by the Director of Ohio EPA and will provide the formal remedy selection.

5.3 Summary of Evaluation Criteria

A summary of the evaluation of the site remedial alternatives is included in **Table 5: Evaluation of Site Remedial Alternatives**.

Table 5: Evaluation of Site Remedial Alternatives								
Remedial Alternatives	**Threshold Criteria**		**Balancing Criteria**					
	1. Protects Human Health & Environment	2. Compliance with ARARs	3. Long Term Effectiveness	4. Reduces Toxicity, Mobility and/or Volume by Treatment	5. Short Term Effectiveness	6. Implementable	7. Costs (Capital + O&M)	8. Community Acceptance
2a	■	□	◘	◘	◘	■	$11,889,000	
2b	■	□	◘	◘	◘	■	$24,295,000	
3a	■	■	■	◘	◘	■	$10,799,000	
Modified 3a	■	■	■	◘	◘	■	$10,211,000	
3b	■	■	■	◘	◘	■	$10,715,000	
Modified 3b	■	■	■	◘	◘	■	$10,127,000	
4a	■	■	■	◘	◘	■	$11,878,000	
Modified 4a	■	■	■	◘	◘	■	$11,290,000	
4b	■	■	■	◘	◘	■	$11,545,000	
Modified 4b	■	■	■	◘	◘	■	$10,957,000	
■ = Fully Meets Criteria ◘ = Partially Meets Criteria □ = Does Not Meet Criteria								

6.0 OHIO EPA'S PREFERRED REMEDIAL ALTERNATIVE

During the time when Ohio EPA was reviewing the possible clean-up alternatives, a modification to alternatives 3 and 4 was evaluated by Goodyear. On January 26, 2012, Goodyear submitted to Ohio EPA a proposal to modify alternatives 3a, 3b, 4a and 4b. The modification consisted of eliminating the Geosynthetic Gas Venting / Leachate Collection layer. Based on the analysis which was performed for this site, the removal of this layer results in less leachate being generated than when this layer is left in place. Ohio EPA's review of the modified alternatives found that the modification was beneficial for the site remedial alternatives. The elimination of this layer results in a decrease in the amount of leachate generated, resulting in a better environmental alternative and, ultimately, a slightly less expensive alternative as the modification resulted in a decrease of $ 588,000 compared with the original costs.

Based upon the selection criteria, the preferred remedial alternative for addressing the exposure pathways and the lack of an adequate cap at the Jackson County Landfill site is **Modified Alternative 3b**. Initially, this alternative did not fully comply with applicable ARARs, specifically, OAC 3745-27-08(D), (Sanitary Landfill facility construction). Goodyear submitted a request for an exemption from specific requirements of OAC 3745-27-08(D) in a letter

dated December 8, 2011. After evaluating the exemption request, and looking at the site specific conditions which exist at the Jackson County Landfill, the Director of Ohio EPA granted the exemption request on July 6, 2012.

Please note that the preferred remedial alternative can change in response to Ohio EPA's consideration of public comment or new information.

The preferred remedial alternative will achieve the goal of protecting human health and the environment while costing less than the other remedial alternatives. In addition, while Ohio EPA prefers natural alternatives such as a wetland for the treatment of leachate, the current modeling predicts that there will be insufficient leachate generated to maintain a wetland within a couple of years of cap construction. Therefore, the selected alternative includes the collection and off-site disposal of any generated leachate. The preferred alternative reduces risk within a reasonable time frame at less cost than any other combination of alternatives, and provides for long-term reliability of the remedy. However, if there is still a significant quantity of leachate being produced after the remedy has been operational for at least two years, then the wetland alternative will be reevaluated by Goodyear based on the environmental conditions which exist at that time. If the evaluation indicates that adequate conditions for a wetland exist and will be sustained over time, then with review and approval by the Ohio EPA, a wetland may replace the collection and hauling of leachate off site for disposal.

Based on information presently available, Ohio EPA believes the preferred remedial alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to balancing criteria in that it would: 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) use permanent solutions and alternative treatment technologies (*e.g.*, innovative) to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element.

Further description of each aspect of Ohio EPA's Preferred Remedial Alternative is contained in the following sections:

6.1 LANDFILL COVER

The preferred remedial alternative consists of placing a geomembrane cap system over the existing soil cap after it has been recompacted and regraded for proper drainage. The existing soil will be reworked and compacted to achieve a permeability of 1×10^{-6} cm/sec or as low of a permeability as can be reasonably achieved (goal of 1×10^{-6} cm/sec). Any added soil to this layer will be clay soil that can achieve a compaction of 1×10^{-6} cm/sec. The cap system will consist of (from bottom to top):

- A recompacted soil layer (soil already on site with additional soil added if needed to achieve minimum of 18 inch base) to serve as a bedding and low permeability layer.

- A 40 mil geomembrane liner.

- A geocomposite to collect and transport surface water infiltration to a perimeter drainage system.

- A 24 inch thick protective cover soil layer.

- A 6 inch thick topsoil layer (using existing topsoil and supplemented with additional soil as required).

The final surface grade will be designed to provide for surface drainage to eliminate any low lying areas on the cap that would retain surface water.

The cap system will be maintained and monitored in accordance with the O&M Plan prepared during remedial design to meet the requirements of OAC 3745-27-12, 3745-27-14, and 3745-27-19.

In addition to the cap system described above, gates will be installed at the access roads and fences will be extended approximately 20 feet on each side to limit human access to the property. Warning signs will be installed around the landfill as determined during remedial design.

Institutional controls and land use restrictions following the Ohio Uniform Environmental Covenants Act (UECA) of 2004 will be implemented to prohibit residential occupation of the Site. The restrictions will prohibit building or placing any permanently occupied structure on the landfill itself.

The performance standards are met when:

- Cap installation as described above is completed to prevent exposure to waste and migration of the chemicals of concern from the waste (See Drawings 2 and 3) to the surrounding environmental media. The cap will pass an Ohio EPA inspection to ensure that each improvement has been implemented.

- A long-term O&M plan for the cap is implemented to ensure that exposure to contaminated environmental media is prevented (See Table 2: Remedial Action Objectives) and the cap passes Ohio EPA inspections during the O&M period.

- Site access controls (*i.e.*, fencing and signage) to prevent exposure to contaminated media (See Table 2: Remedial Action Objectives) are established and pass periodic compliance inspections, until such time that such access controls are no longer necessary.

- Environmental covenants, including restrictions to prevent intrusive activities on-site, have been recorded in the Jackson County Recorder's Office and copies are provided to Ohio EPA. On-site intrusive activities could increase exposure to contaminated environmental media (See Table 2: Remedial Action Objectives).

6.2 GROUND WATER

The ground water will be monitored to ensure that the chemicals present in the ground water decrease over time with the goal of achieving drinking water standards for those chemicals with a drinking water standard, calculated health based clean-up standards for those chemicals without a drinking water standard or background concentrations for those chemicals which occur naturally. The current contaminants which exceed drinking water standards are: vinyl chloride, tetrachloroethylene, mercury and arsenic (See Table 3 Contaminants of Concern and Remediation Levels).

Institutional controls will be established on the Site to prevent extraction and use of ground water (except for investigative and cleanup purposes) to prevent exposure to contaminated ground water.

The performance standards are met when:

- A ground water monitoring program capable of detecting contaminant level trends is established. A ground water monitoring plan will be developed during the remedial design phase of the project and will remain in place until ground water at the Site achieves the RLs listed in Table 3 for a minimum of eight consecutive sampling events collected quarterly over a period of two years.

- Ground water sample analyses in all the monitoring wells in the Site monitoring well network (see Appendix B, Drawing 5) must meet the numerical performance standards in Table 3 before the ground water monitoring program can be terminated. The ground water must meet the RLs listed in Table 3 for a minimum of eight consecutive sampling events collected quarterly over a period of two years.

- Environmental covenants, including restrictions on the use of ground water, have been recorded in the Jackson County Recorder's Office and copies are provided to Ohio EPA. These covenants will remain until ground water at the Site achieves the RLs listed in Table 3 for a minimum of eight consecutive sampling events collected quarterly over a period of two years.

6.3 SOIL GAS

Elevated methane levels and a variety of VOCs have been detected in the soil gas on the property adjacent to the landfill (See Appendix B, Drawing 9). Pipe vents (approximately one per acre) will be installed within the landfill limits to passively vent gas from the landfill. Whether there is a need to burn the soil gas will be evaluated during the remedial design.

Institutional controls will be established on the Site property to control future construction of occupied structures, unless it can be documented that these structures meet applicable standards. This will help prevent exposure to contaminated soil gas and protect human health. Property owner concurrence will be necessary for establishment of the institutional controls.

The performance standard is met when:

- A soil gas collection system to prevent migration of soil gas, which contains contaminants exceeding the RLs listed in Table 3, to adjacent properties is installed. After the gas collection system is installed, the soil gas present in the area outside of the gas collection system must be sampled in order to demonstrate that the migration of contaminated soil gas to the adjacent property has been prevented by the soil gas collection system. A soil gas monitoring plan will be developed during the remedial design phase of the project to ensure continued compliance.

- Soil gas collection can be terminated when all soil gas monitoring points (See Appendix B, Drawing 9) are demonstrated to be below the values in Table 3 for a minimum of eight consecutive sampling events collected quarterly over a period of two years.

- Environmental covenants, including restrictions on the construction of occupied structures unless the indoor air in these structures can be demonstrated to meet the RLs listed in Table 3, have been recorded in the Jackson County Recorder's Office and copies are provided to Ohio EPA.

6.4 LEACHATE CONTROL

A leachate collection system will be installed to capture leachate from the landfill. The leachate will be pumped or transported by gravity to an on-site holding structure. Once the holding structure is full, or based on a pre-scheduled date, the leachate will be transported to the local POTW for treatment and disposal. The capping system for the preferred remedial alternative incorporates a geocomposite layer which will help prevent leachate. As a result, much less leachate is anticipated and the associated O&M costs are lower.

The performance standard is met when:

- The leachate collection system construction is completed such that leachate emanating from the landfill is collected and properly disposed of, which will prevent exposure to contaminants exceeding the RLs listed in Table 3.

- A leachate monitoring plan will be developed during remedial action. This plan will include periodic reporting of leachate generation amounts and leachate sampling results.

- Leachate sample analysis at the Site must be demonstrated to meet the numerical standards in Table 3 before the leachate monitoring program can be terminated.

- Evaluate and possibly install a wetland for the treatment of leachate if more leachate is generated than is currently predicted after the cap has been installed. If the wetland is a viable alternative, it will eliminate the need to collect, store and then transport leachate off-site for treatment and disposal.

7.0 GLOSSARY OF TERMS

Action Level	A concentration for a contaminant of concern that has been determined by regulation or through a risk assessment to be protective of human health or ecological receptors. This concentration value could be based on a preliminary remediation goal (PRG); a drinking water maximum contaminant level (MCL); or a background concentration (background).
Adsorb	The adhesion in an extremely thin layer of molecules (as of gases, solutes, or liquids) to the surfaces of solid bodies or liquids with which they are in contact.
Aquifer	An underground geological formation capable of holding and yielding water.
ARARs	Applicable or relevant and appropriate requirements. Those rules that strictly apply to remedial activities at the site or those rules whose requirements would help achieve the remedial goals for the site.
Baseline Risk Assessment	An evaluation of the risks to humans and the environment posed by a site in the absence of any remedial action, which also determines the extent of cleanup needed to reduce potential risk levels to within acceptable ranges.
Carcinogen	A chemical that causes cancer.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. 9601 et seq. A federal law that regulates cleanup of hazardous substances sites under the U.S. EPA Superfund Program.
Contaminants of Concern (COCs)	Chemicals identified at the site that are present in concentrations that may be harmful to human health or the environment.
Decision Document	A statement issued by the Ohio EPA giving the director's selected remedy for a site and the reasons for its selection.
Ecological Receptor	Animals or plant life exposed or potentially exposed to chemicals released from a site.
Environmental Covenant	A servitude arising under an environmental response action that imposes activity and use limitations and that meets the requirements established in ORC Section 5301.82.
Exposure Pathway	Route by which a chemical is transported from the site to a human or ecological receptor.
Feasibility Study	A study conducted to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision-maker and an appropriate remedy selected.
Final Cleanup Levels	Final cleanup levels identified in the Decision Document along with the RAOs and performance standards.

Hazardous Substance	A chemical that may cause harm to humans or the environment.
Hazardous Waste	A waste product listed or defined by RCRA that may cause harm to humans or the environment.
Human Receptor	A person/population exposed to chemicals released at a site.
Leachate	Water contaminated by contact with landfill wastes.
Maximum Contaminant Level (MCL)	The highest level of a contaminant that is allowed in a public drinking water supply. The level is established by U.S. EPA and incorporated into OAC 3745-81-11 and 3745-81-12.
NCP	National Oil and Hazardous Substances Pollution Contingency Plan, codified at 40 C.F.R. Part 300 (1990), as amended. A framework for remediation of hazardous substance sites specified in CERCLA.
O&M	Operation and maintenance. Long-term measures taken at a site, after the initial remedial actions, to assure that a remedy remains protective of human health and the environment.
Performance Standard	Measures by which Ohio EPA determines if RAOs are met.
Remediation Levels (RLs)	Initial clean-up levels that (1) are protective of human health and the environment and (2) comply with ARARs. They are developed early in the process (scoping) based on readily available information and are modified to reflect the results of the baseline risk assessment. They are also used during the analysis of remedial alternatives in the RI/FS.
Present Worth Cost	Estimated current cost, or value, of the future remedial costs to be expended, typically discounted at the current market rate. Provides a solid basis for comparing costs of each of the remedial alternatives.
RCRA	Resource Conservation and Recovery Act of 1976, codified at 42 U.S.C. 6901 et seq. (1988), as amended. A federal law that regulates the handling of hazardous wastes.
Remedial Action Objectives (RAOs)	Specific goals of the remedy for reducing risks posed by the site.
Remedial Investigation	A study conducted to collect information necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives.
Response to Comments	A summary of all comments received concerning the Preferred Plan and Ohio EPA response to the comments.
Site	A site is defined as the property which is being investigated and wherever the contamination from the property has come to be located. A “site” is not limited by property boundaries but includes wherever the waste from the property has migrated or been placed.

Water Quality Criteria	Chemical, physical and biological standards that define whether a body of surface water is unacceptably contaminated. These standards are intended to ensure that a body of water is safe for fishing, swimming and as a drinking water source. These standards can be found in OAC Chapter 3745-1.

APPENDIX A

Primary Contaminants of Concern

A total of 19 primary contaminants of concern (COCs) have been identified that pose the greatest potential risk to human health and the environment at this site. Details from the Agency for Toxic Substances and Disease Registry (ATSDR Toxicological Profiles are provided below on each primary COC (except for the information on methane)).

Aluminum is the most abundant metal in the earth's crust. It is always found combined with other elements such as oxygen, silicon, and fluorine. Aluminum as the metal is obtained from aluminum-containing minerals. Small amounts of aluminum can be found dissolved in water. Aluminum metal is light in weight and silvery-white in appearance. Aluminum is used for beverage cans, pots and pans, airplanes, siding and roofing, and foil. Aluminum is often mixed with small amounts of other metals to form aluminum alloys, which are stronger and harder. Aluminum compounds have many different uses, for example, as alums in water-treatment and alumina in abrasives and furnace linings. They are also found in consumer products such as antacids, astringents, buffered aspirin, food additives, and antiperspirants.
Antimony is a silvery-white metal that is found in the earth's crust. Antimony ores are mined and then mixed with other metals to form antimony alloys or combined with oxygen to form antimony oxide. Little antimony is currently mined in the United States. It is brought into this country from other countries for processing. However, there are companies in the United States that produce antimony as a by-product of smelting lead and other metals. Antimony isn't used alone because it breaks easily, but when mixed into alloys, it is used in lead storage batteries, solder, sheet and pipe metal, bearings, castings, and pewter. Antimony oxide is added to textiles and plastics to prevent them from catching fire. It is also used in paints, ceramics, and fireworks, and as enamels for plastics, metal, and glass.
Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic can combine with oxygen, chlorine and sulfur to form inorganic arsenic compounds. The main use of inorganic arsenic compounds is to preserve wood. Organic arsenic compounds are used primarily as pesticides. Breathing high levels of inorganic arsenic can cause throat and lung irritation. Ingesting high levels of arsenic can result in death, while at lower levels it can result in nausea, decreased red and white blood cell production, and damage to blood vessels. Skin contact can cause redness and swelling. Arsenic is a known human carcinogen.
Barium is a silvery-white metal which exists in nature only in ores containing mixtures of elements. It combines with other chemicals such as sulfur or carbon and oxygen to form barium compounds. Barium compounds are used by the oil and gas industries to make drilling muds. Drilling muds make it easier to drill through rock by keeping the drill bit lubricated. They are also used to make paint, bricks, ceramics, glass, and rubber. Barium sulfate is sometimes used by doctors to perform medical tests and to take x-rays of the gastrointestinal tract.
Benzene is a natural part of crude oil and gasoline. It evaporates quickly, dissolves lightly in water, and is highly flammable. It is in the top 20 chemicals for production volume in the U.S. It is used to help make plastics, resins, nylon, rubber, lubricants, dyes, detergents, drugs and pesticides. Breathing very high levels can result in death, while high levels can cause drowsiness, dizziness, headaches, tremors, and unconsciousness. Ingestion of high levels can cause vomiting, dizziness, convulsions, rapid heart rate and death. The major affect of benzene from long term exposure is on the blood. It causes harmful effects on bone marrow, and can cause a decrease in red blood cells leading to anemia and immune system issues. Benzene is a known human carcinogen.

Cadmium is a natural element in the earth's crust. All soils and rocks contain some cadmium. Most cadmium used in the U.S. is extracted during production of metals like zinc, lead and copper. It does not corrode easily and is used primarily in batteries, pigments, metal coatings and plastics. Breathing high levels can severely damage the lungs. Ingesting high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels can lead to a build up in the kidneys and subsequent kidney disease. Other long-term effects are lung damage and fragile bones. Cadmium is a known human carcinogen.
Chromium is an odorless and tasteless naturally occurring element found in rocks, animals, plants and soils. It can be liquid, solid or gas. The most common forms are chromium (0), also known as elemental chromium, used for steel-making, chromium (III), also known as trivalent chromium, and chromium (VI), also known as hexavalent chromium, used for chrome plating, dyes, pigments, leather tanning and wood preserving. Chromium (III) is an essential nutrient that helps the body use sugar, protein and fat. Breathing high levels of chromium (VI) can cause irritation to the lining of the nose, nose ulcers and breathing problems. Ingestion of chromium (VI) can cause irritation and ulcers in the stomach and small intestine, and anemia. Damage to the male reproductive system has been seen in animals exposed to chromium (VI). In workers, inhalation has been shown to cause lung cancer. U.S. EPA has determined that chromium (VI) compounds are a known human carcinogen.
Cobalt is a naturally occurring element found in rocks, soil, water, plants, and animals. It is used to produce alloys used in the manufacture of aircraft engines, magnets, grinding and cutting tools, artificial hip and knee joints. Cobalt compounds are also used to color glass, ceramics and paints, and used as a drier for porcelain enamel and paints. Radioactive cobalt is used for commercial and medical purposes. ^{60}Co (read as cobalt sixty) is used for sterilizing medical equipment and consumer products, radiation therapy for treating cancer patients, manufacturing plastics, and irradiating food. ^{57}Co is used in medical and scientific research. It takes about 5.27 years for half of ^{60}Co to give off its radiation and about 272 days for ^{57}Co; this is called the half-life.
Copper is a reddish material that occurs naturally in the environment, in rocks, soil, water, and at low levels in air, and is an essential element in plants and animals. Copper is used to make wire, plumbing pipes and sheet metal, and is combined with other metals to make brass and bronze pipes and faucets. Long-term exposure to copper dust can irritate the nose, mouth and eyes, and cause headaches, dizziness, nausea and diarrhea. Ingestion of high levels can cause nausea, diarrhea, vomiting and stomach issues. Very high levels can cause kidney and liver damage, and even death. U.S. EPA has not classified copper as a human carcinogen because there are no adequate human or animal cancer studies.
Di-n-butyl-phthalate is a manufactured chemical that does not occur naturally. It is an odorless and oily liquid that is colorless to faint yellow in color. It is slightly soluble in water and does not evaporate easily. Di-*n*-phtalate is used to make plastics more flexible and is also in carpet backings, paints, glue, insect repellents, hair spray, nail polish, and rocket fuel.
Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of the environment, but much of it comes from human activities including the burning of fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays, and was a common additive to gasoline in the U.S. until it was banned in 1996. The effects of lead are the same whether exposure is through ingestion or inhalation. It affects almost every organ in the body, though the main target is the nervous system. Long term exposure can result in decreased nervous system functionality, and it may cause weakness in fingers, wrists and ankles. Exposure to high levels can severely damage the brain and kidneys, and ultimately cause death. U.S. EPA has determined that lead is a probable human carcinogen.

Manganese is a naturally occurring metal that is found in many types of rocks. Pure manganese is silver-colored, but does not occur naturally. It combines with other substances such as oxygen, sulfur, or chlorine. Manganese can also be combined with carbon to make organic manganese compounds. Common organic manganese compounds include pesticides, such as maneb or mancozeb, and methylcyclopentadienyl manganese tricarbonyl (MMT), a fuel additive in some gasoline. Manganese is an essential trace element and is necessary for good health. Manganese can be found in several food items, including grains and cereals, and is found in high amounts in other foods, such as tea.

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white odorless liquid. If heated, it is an odorless, colorless gas. Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. The nervous system is very sensitive to all forms of mercury. High level exposure to metallic, organic and inorganic mercury can permanently damage the brain, kidneys and developing fetuses. Effects on brain functioning may result in irritability, tremors, vision or hearing changes, and memory problems. There are inadequate human cancer data available for all forms of mercury. U.S. EPA has determined that mercury chloride and methylmercury are possible human carcinogens.

Methane is a naturally occurring chemical compound with the chemical formula CH4. It is the simplest alkane, and the principal component of natural gas (about 87% by volume). It is flammable over a narrow range of concentrations (5–15%) in air. Methane is not toxic; however, it is extremely flammable and may form explosive mixtures with air. Methane is also an asphyxiant and may displace oxygen in an enclosed space. The concentration of methane where asphyxiation risk becomes significant is much higher than the 5–15% concentration that forms flammable or explosive mixtures. When structures are built on or near landfills, methane off-gas can penetrate the buildings' interiors and expose occupants to significant levels of methane.

Polychlorinated Biphenyls (PCBs) are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. Historically, PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are effective insulators. PCB manufacturing was stopped in the U.S. in 1977 because of evidence that they build up in the environment and can cause harmful health effects. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. Animals ingesting large amounts of PCBs for short periods had liver damage and some died. Animals ingesting smaller amounts over several weeks or months developed anemia; skin conditions; and liver, stomach, and thyroid gland injuries. U.S. EPA has determined that PCBs are a probable human carcinogen.

Selenium is a naturally occurring mineral element found in most rocks and soil. Most processed selenium is used in the electronics industry. But it is also used in the glass industry; as a component of pigments in plastics, paints, enamels, inks and rubber; in the preparation of pharmaceuticals; in pesticide formulations; in rubber products; and as a constituent of fungicides. Short-term exposure to high concentrations may cause nausea, diarrhea and vomiting. Chronic oral exposure to high concentrations of selenium compounds can produce selenosis, with symptoms such as hair loss, nail brittleness and neurological abnormalities. U.S. EPA has determined that one specific form of selenium, selenium sulfide, is a probable human carcinogen.

Tetrachloroethylene (PERC or PCE) is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal degreasing. It is a non-flammable liquid at room temperature and readily evaporates into the air. High concentrations of PERC can cause dizziness, headache, sleepiness, confusion, nausea, unconsciousness and death. The health effects of inhaling and ingesting low levels of PERC are not known. Results of animal studies involving high levels of PERC show that it can cause liver and kidney damage. The U.S. Department of Health and Human Services has determined that PERC may reasonably be anticipated to be a carcinogen.

Vinyl Chloride is a colorless gas that burns easily and that is not stable at high temperatures. It is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, trichloroethylene, and tetrachloroethylene are broken down. Vinyl chloride is used to make polyvinyl chloride (PVC), which is used to make a variety of plastic products including pipes, wire and cable coatings, and packaging materials. Breathing very high levels can cause you to pass out, while extremely high levels can cause death. Studies in workers who have breathed vinyl chloride over many years showed an increased risk of liver, brain and lung cancer, and some cancers of the blood. The U.S. Department of Health and Human Services has determined that vinyl chloride is a known human carcinogen.
Zinc, a bluish-gray shiny metal, is one of the most common elements in the earth's crust. It is found in air, soil, water and in all foods. Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass and bronze. Zinc combines with other elements to form zinc compounds including zinc chloride, zinc oxide, zinc sulfate and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dyes, wood preservatives, and ointments. Zinc is an essential element in our diet, but generally becomes harmful at levels 10-15 times the amount needed for good health. The ingestion of large does in a short period can cause stomach cramps, nausea, and vomiting. Taken longer term, it can cause anemia. Inhaling large amounts of zinc can cause a specific short-term disease called metal fume fever. Long-term effects of breathing zinc are unknown. Based on incomplete information from human and animal studies, U.S. EPA has determined that zinc is not classifiable as to its human carcinogenicity.

APPENDIX B