

Using Prescribed Fire to Manage the Fernald On-Site Disposal Facility Vegetated Cap – 17401

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ABSTRACT

The Fernald Preserve is a former uranium processing plant that underwent extensive remediation pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It is situated on a 425 ha (1,050 acre) tract of land, approximately 29 km (18 miles) northwest of Cincinnati, Ohio. Remedial activities and subsequent ecological restoration have converted the site from an industrial production facility to an undeveloped park, encompassing a series of wetlands, prairies, and forested communities. The remediation of buildings and soil contamination was completed in 2006, but aquifer remediation is ongoing. Since 2007, the site has been managed by the US Department of Energy (DOE) Office of Legacy Management. Portions of the site are open to the public, with approximately 11 km (7 miles) of walking trails that are open year-round and a visitors center.

Site remediation included the construction of an On-Site Disposal Facility (OSDF) for the long-term disposal of contaminated soil and building materials. The OSDF consists of eight disposal cells that encompass approximately 30 hectares (75 acres) on the eastern portion of the Fernald site. Cells are lined and capped, and each has a separate leak detection and leachate collection system. The integrated cap is vegetated with native grasses and forbs.

Management of the Fernald Preserve includes the monitoring and maintenance of ecologically restored communities and the vegetated OSDF cap, as required by the site's institutional controls plan. Prescribed burning is recognized as the preferred method for prairie management. Prescribed fire has been used at the Fernald site since 2009 for established prairies in restored areas, but not on the OSDF cap. Stakeholders had reservations regarding the safety of using prescribed fire on the OSDF cap. Because of that, vegetation on the cap was managed as a grassland community. It was mowed, raked, and baled to remove thatch, and promote the continued establishment of native grasses and forbs. Since agricultural use is restricted at the site, the resulting hay bales were kept on property and reused as organic matter and mulch. Over time, more hay bales were being generated in a season than were reused. Therefore in 2015, DOE decided to revisit stakeholder acceptance of prescribed fire on the OSDF cap.

Ongoing relationships with local stakeholders allowed for extensive discussions regarding the current management and proposed use of prescribed fire on the OSDF cap. The public was provided information about the planning and implementation of prescribed burns at the site and invited to observe the execution of a successful site burn. This approach led to stakeholder acceptance of DOE's proposal, and vegetation on the caps of cells 4, 5, and 6 was burned in late March 2016. The burn was successful and resulted in several benefits from a land stewardship and cost

perspective. This paper details the stakeholder engagement approach and the resulting benefits from the use of prescribed fire on the OSDF cap.

INTRODUCTION

The Fernald Preserve is situated on a 425-hectares (1050-acre) tract of land, approximately 29 kilometers (18 miles) northwest of Cincinnati, Ohio. The site is located near the unincorporated communities of Ross, Fernald, Shandon, and New Haven in Hamilton and Butler Counties, Ohio (Fig. 1). It was home to a uranium processing facility that was shut down in 1991. Since then, the site has undergone extensive remediation pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Remedial activities and subsequent ecological restoration have converted the site from an industrial production facility to an undeveloped park, encompassing wetlands, prairies, and forest. Remediated facility and infrastructure debris and soils were placed and enclosed within an On-Site Disposal Facility (OSDF) on the east portion of the site (Fig. 2). Upon completion of large-scale soil remediation and waste disposition in the fall of 2006, the site was successfully transitioned to the US Department of Energy (DOE) Office of Legacy Management. While remediation of buildings and soil contamination was completed in 2006, aquifer remediation is ongoing. Portions of the site have been opened to the public, with approximately 11 kilometers (7 miles) of walking trails and viewing areas open year-round and a visitor center. The OSDF is not accessible to the public. The current configuration of the Fernald Preserve is shown in Fig. 2.

OSDF CAP MANAGEMENT

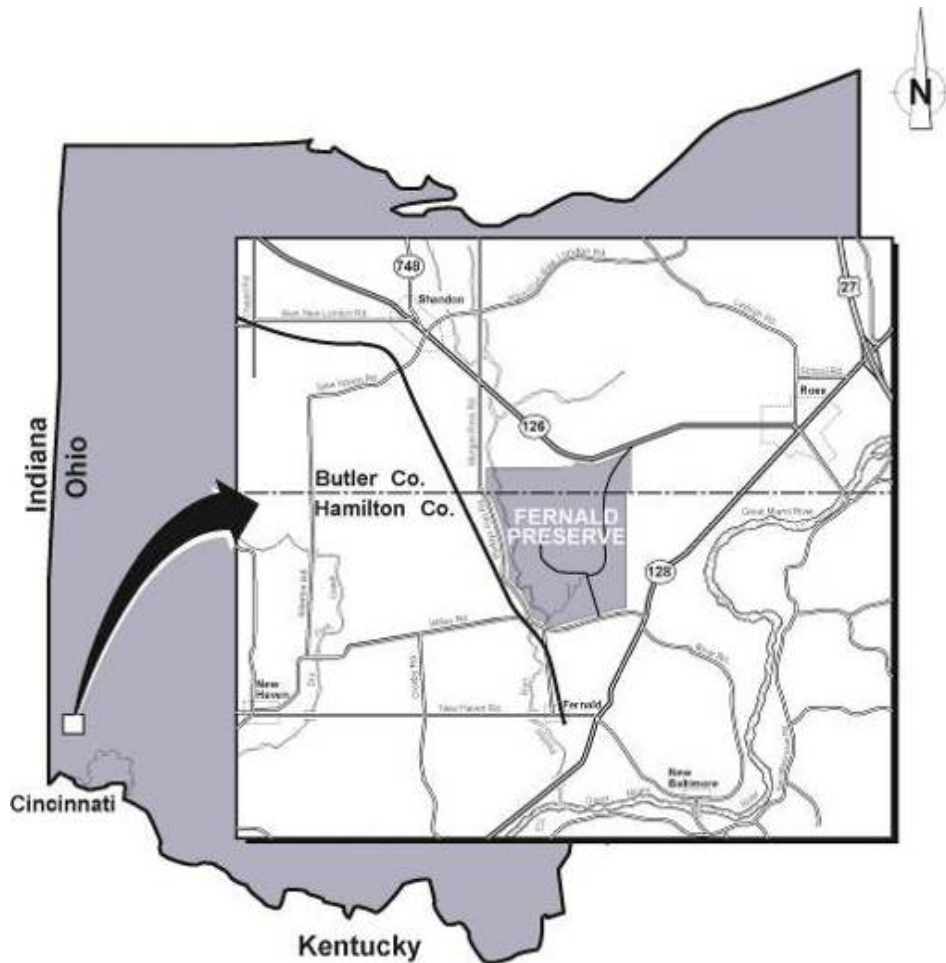
The OSDF is an engineered landfill that was specified as part of the remedial response under CERCLA [1]. It contains approximately 2.3 million cubic meters (m^3) (3 million cubic yards [yd^3]) of low-level radiologically contaminated soil and debris. It is constructed of eight separate cells, each with a separate leachate collection and leak detection system. The design of the OSDF is presented in the *Final Design Criteria Package - On-Site Disposal Facility* [2].

A central component of the OSDF design is the vegetated cap. A mesic prairie mix of grasses and forbs was determined as the optimal approach to meet the following design criteria established by Geosyntec [2]:

- Minimize erosion and offsite sedimentation
- Limit root depth to the vegetated soil layer
- Avoid attraction of wildlife
- Withstand temporary inundation
- Establish vegetation that is low-maintenance, self-sustaining, and drought-resistant, and conforms to the surrounding landscape

Native warm-season grasses and forbs are ideal for low-maintenance establishment of herbaceous cover. They are drought-tolerant, and extensive roots prevent soil erosion. Additionally, native species are perennial and reseed fills in surface areas that become open. The specific seed mix for use on the OSDF is provided in Table 1.

These species are native to southwest Ohio and meet the design criteria listed above. Cell construction took place between 1997 and 2006, so specific seed mixes have varied slightly over the years. The seed mix in Table 1 is the one used most recently on cell 8.



The Fernald Preserve covers about 1,050 acres (425 hectares).

Fig. 1. Fernald Preserve, located in Hamilton and Butler Counties, Ohio

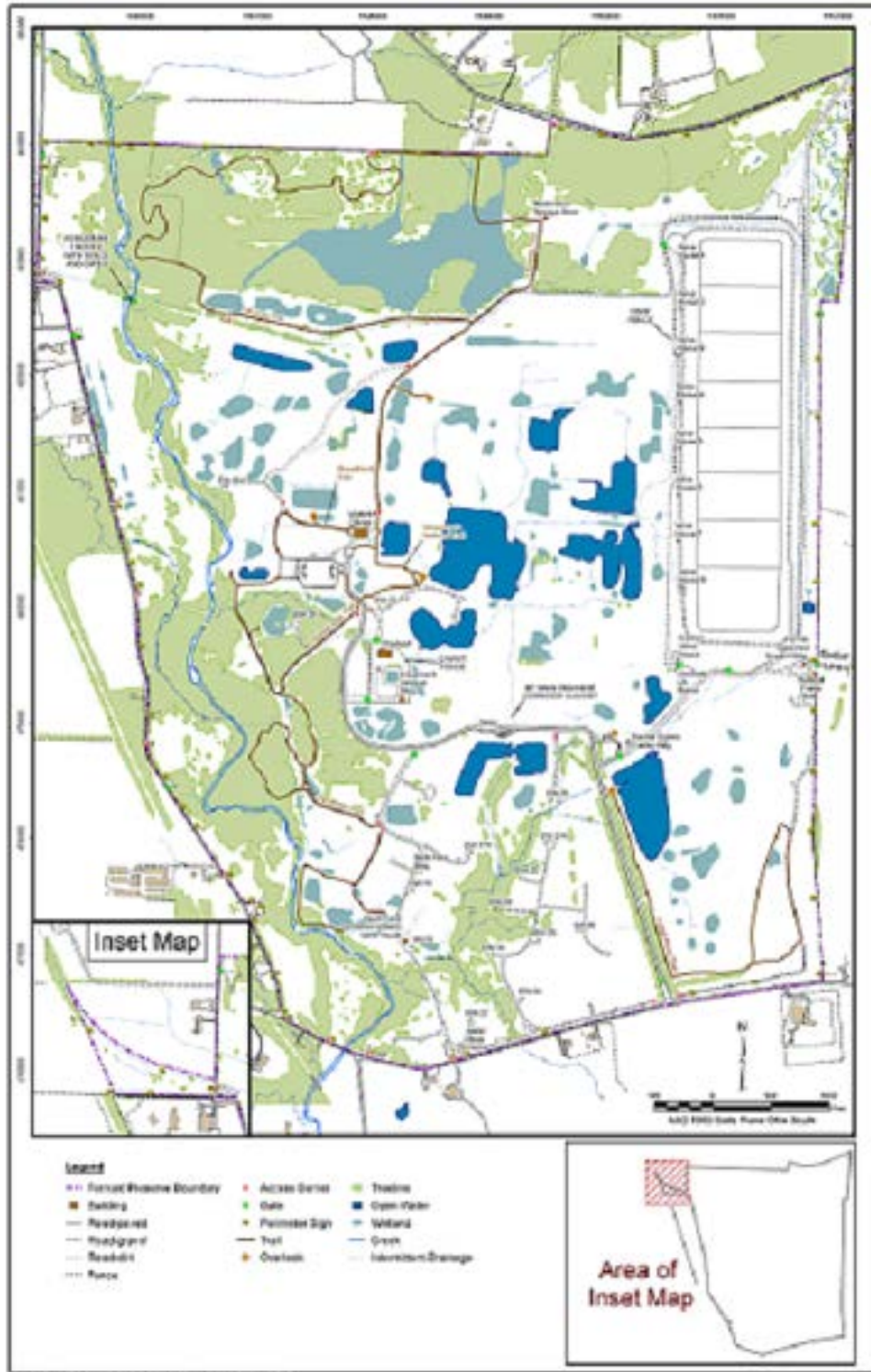


Fig. 2. Fernald Preserve site map

Table 1. OSDF Seed Mix

Scientific Name	Common Name
<i>Andropogon gerardii</i>	big bluestem
<i>Andropogon scoparius</i>	little bluestem
<i>Bouteloua curtipendula</i>	sideoats grama
<i>Panicum virgatum</i>	switchgrass
<i>Sorghastrum nutans</i>	Indian grass
<i>Elymus canadensis</i>	Canada wildrye
<i>Lolium multiflorum</i>	annual ryegrass
<i>Asclepias tuberosa</i>	butterflyweed
<i>Aster laevis</i>	smooth aster
<i>Baptisia australis</i>	blue false indigo
<i>Chamaecrista fasciculata</i>	partridge pea
<i>Echinacea purpurea</i>	purple coneflower
<i>Heliopsis helianthoides</i>	ox eye sunflower
<i>Monarda fistulosa</i>	bergamot
<i>Penstemon grandiflorus</i>	beardtongue
<i>Ratibida pinnata</i>	yellow coneflower
<i>Rudbeckia hirta</i>	black-eyed Susan
<i>Solidago rigida</i>	stiff goldenrod
<i>Tradescantia ohioensis</i>	spiderwort
<i>Verbena stricta</i>	hoary vervain

Prescribed fire has long been identified as the preferred approach in the *Comprehensive Legacy Management and Institutional Controls Plan, Volumes I and II, Fernald Preserve, Fernald, Ohio* [1]. Local stakeholders were approached in 2009 regarding the use of prescribed fire at the Fernald site, including the OSDF. DOE presented the rationale behind the use of fire, and proposed to implement a program for both ecologically restored areas and the OSDF cap. The local community was familiar with the use of prescribed burns at nearby county parks. The consensus opinion at the Fernald site was to allow the use of prescribed fire to manage ecologically restored areas but to prohibit its use on the OSDF. Concerns were related more to the safe execution of a burn rather than the potential for damage to the OSDF cap or release of contamination.

DOE agreed to the approach and, since 2009, approximately 63 hectares (156 acres) have been safely burned at the Fernald site. Site personnel developed an approach for planning and implementing prescribed burns at the site. The process is set forth in the site procedure *Conducting Prescribed Burns at the Fernald Preserve* [3]. A certified prescribed fire manager is responsible for permitting, planning, and providing field oversight for site burns. From 2009 through 2014, prescribed burns were conducted by trained site personnel. Subcontract support was added in 2015 in an effort to increase safe implementation of a 3-year site burn schedule.

For the OSDF, an alternative “mow, rake and bale” approach has been used for grassland management. This process involves a 3-year rotation of mowing and removing thatch in order to mimic conditions following prescribed fire.

PROPOSAL FOR USE OF PRESCRIBED FIRE

An internal white paper was developed in 2015 to identify the benefits of prescribed burns for maintenance of the OSDF. First, prairie grasses and wildflowers are a “fire-based” plant community that require periodic disturbance to thrive. Fire removes thatch buildup and reduces the shade over vegetation, the ash provides extra nutrients for plants, and the blackened earth allows for early spring sprouting of vegetation due to extra warmth absorbed by the soil. Second, burning reduces impacts from vehicles and equipment by reducing the amount of time needed to complete maintenance activities. Finally, burns help control noxious, invasive and undesirable plants on the cap. Many undesirable and invasive plants (woody and herbaceous) are killed in burns. Surviving undesirable and invasive plants are easy to identify in blackened ash as they sprout and are then treated with herbicide via spot application. This precise approach reduces the native plant exposure to herbicide.

In addition to the ecological benefits, there is a practical consideration which is the generation of hay bales. Between 80 and 100 round hay bales are generated annually from the conventional mow, rake, and bale management approach. CERCLA institutional controls prohibit agricultural use of the site. Because of this, the hay bales are required to stay on Fernald property. Field personnel use the hay bales as mulch and soil amendments, but the need for such material is diminishing as site vegetation becomes more established.

In some ways, the design of the OSDF is ideal for conduct of prescribed burns. Perimeter access roads and drainage corridors serve as built-in fire breaks. The 6:1 side slopes are accessible to equipment and personnel. There are no wetlands or infrastructure to work around, and the rectangular shape results in a straightforward burn plan.

For these reasons, DOE decided to revisit the proposal to conduct prescribed burns on the OSDF.

COMMUNITY INVOLVEMENT

DOE has an ongoing relationship with local stakeholders that allows for open communication and discussion of site activities. The Fernald Community Alliance (FCA) is a local stakeholder organization that meets regularly and includes participation by DOE, local residents, current and former regulators, and former employees. A set of talking points that described the proposed approach and the advantages of a prescribed burn on the OSDF was prepared. The talking points described how a burn would be conducted on the OSDF and why a burn wouldn't compromise cap integrity. Burning would be limited to the spring season in order to limit the potential for erosion. Safety concerns were addressed by describing how the

OSDF design is ideally suited for a burn and by referencing the detailed site procedures that are complied with. The addition of experienced subcontractor support was also highlighted. In addition, the talking points provided a summary of a risk evaluation conducted in 2009 that showed no unacceptable risk from smoke or particulates from onsite prescribed burns. Lastly, the talking points summarized the prescribed burn activities in 2015.

The OSDF burn proposal was presented during a November 2015 FCA meeting. Participants were not asked to approve the proposal at that time, but rather to give it consideration for spring 2016. Stakeholders were invited to observe a burn in order to understand the planning and hazard analyses and controls that are put in place to safely execute a burn in the field.

On March 18, 2016, conditions were acceptable to conduct a prescribed burn of a 1.5-hectare (3.7-acre) mesic prairie located south of the Fernald Preserve Visitors Center. Members of the FCA were invited to attend the pre-job briefing and observe the burn from a safe zone located near the Visitors Center. Representatives from DOE and Ohio Environmental Protection Agency (EPA) observed the burn as well and were available to answer questions from stakeholders. The burn was successfully completed without incident. The enhanced access allowed stakeholders to observe the planning involved and implementation of an on-site burn. Key stakeholders discussed the issue immediately following the burn and authorized moving forward on the OSDF when conditions allowed.

RESULTS

Weather conditions were acceptable for an OSDF burn on March 29, 2016. Trained site and subcontract personnel conducted the 10.2-hectare (25.2-acre) burn in 3 phases, burning the top first, then the east side and the west side (Fig. 3). A 30-foot path was mowed across the cap to the north of cell 4 and another to the south of cell 6 on the OSDF to separate the burn area from the rest of the cap. Additionally, a 15-foot path was mowed along the top of the 6:1 slope on the east and west sides of the cap to divide the area into three burn areas and best utilize the topography for a safe burn. The top of the cap has gentle 10:1 and 20:1 slopes and was burned first to provide a large black area to burn up to on the sides (Fig. 4). Once the top was completed, the north and south flanks were ignited down the slope on the east side of the cap, into the wind. Once the toe of the slope was reached, the toe was ignited, burned up the slope to the burnt center area, and then went out. Finally, the same process was used to ignite down the north and south flanks but, in this case, the wind was to the toe. The fire was completed by igniting the top of the 6:1 slope and allowing the fire to burn down the hill, thus completing the burn. Some pocket areas near the top of the burn area remained unburned, but the rest of the area was black, including some invasive woody stems.

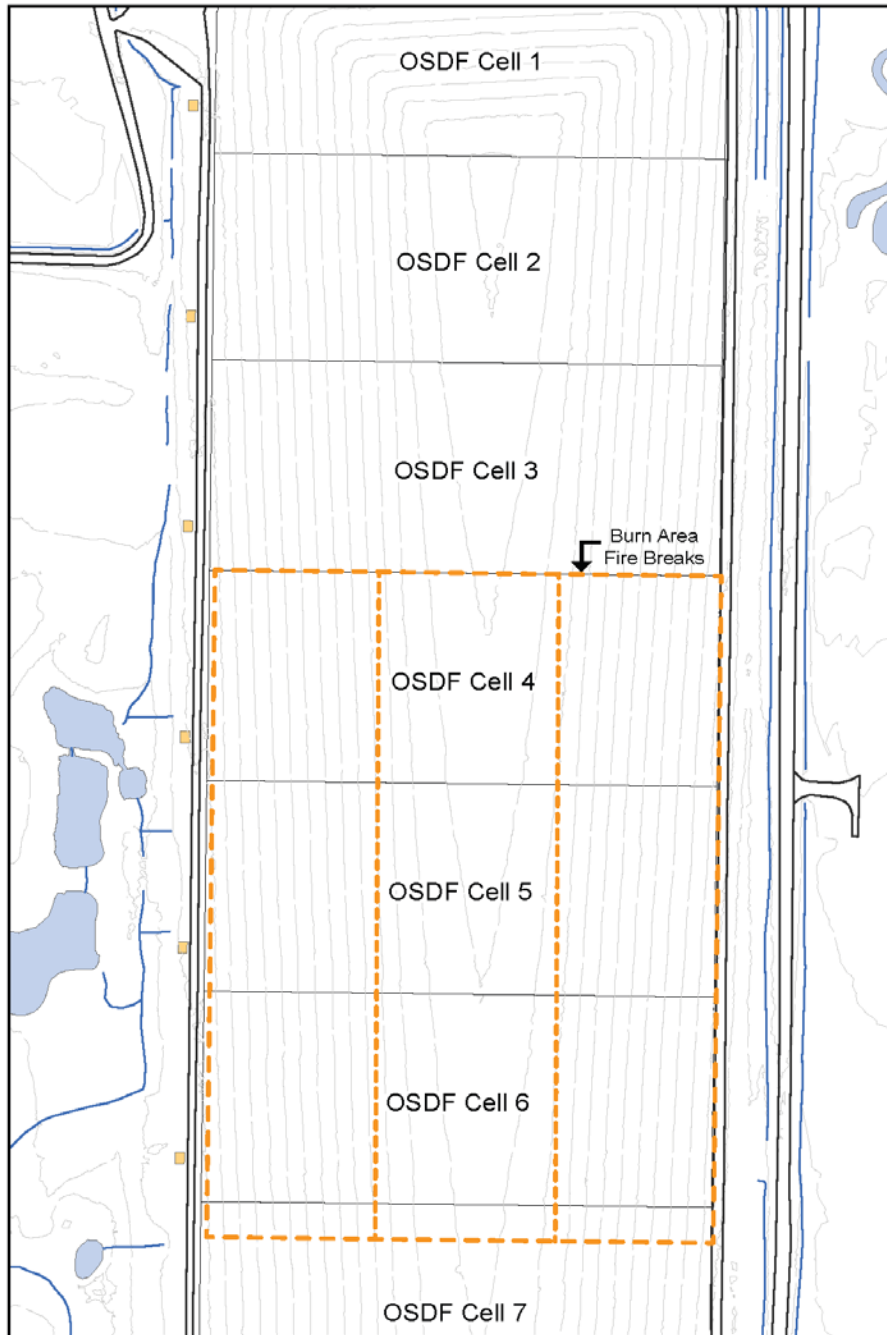


Figure 3. OSDF Burn Area Map



Fig. 4. Field personnel use a drip torch to ignite prairie grasses in the first area on the OSDF cap.

An herbaceous survey of the burn area was conducted in September 2016. A stratified random quadrat approach was used to collect species richness and cover estimates for each OSDF cap, pursuant to the *Fernald Preserve Ecological Monitoring Methods Plan and Procedures* [4]. Results demonstrated that the goals for herbaceous and native cover were met for all three cells that were burned.

The prescribed burn approach yielded a cost savings of approximately \$7,600. The labor and subcontract costs for conducting the prescribed burn are offset by avoiding expenditures for a subcontractor to mow, rake and bale, and the further resources necessary to handle the hay bales generated from the mowing approach.

CONCLUSIONS

The spring 2016 prescribed burn on the Fernald OSDF was successful, from both an ecological and a cost perspective. The benefits of maintaining robust communications with stakeholders were clear, as the burn would not have happened without ongoing discussions with local residents, regulators, and site workers. DOE plans to continue with the 3-year burn rotation on the OSDF, and with regular stakeholder communication regarding site activities.

REFERENCES

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