**Figure 1 Crossroads Greenhouse is one of several new uses of the SSL site.**

## Executive Summary

It is not often that a landfill previously listed on the U.S. Environmental Protection Agency's (EPA's) National Priorities List (NPL) is included on tour pages as a "hidden treasure" attraction. However, such is the case for South Side Landfill (SSL) in Indianapolis, Indiana. SSL is an example of how innovation and public-private partnerships transitioned a former Superfund Site to its current successful economic reuse. In addition to continuing to operate as a municipal solid waste landfill, reuse at the 324-acre former Superfund Site supports a variety of new land uses, including a methane gas production system that serves multiple local businesses, including Crossroads Greenhouse and the Rolls Royce airplane engine plant, Buffer Park Golf Course and an environmental education center. In 2000, Rolls-Royce and SSL received the Governor's Award for Excellence in Pollution Prevention, as well as recognition from the U.S. Department of Energy, for reducing greenhouse gas emissions with the methane gas collection system. The use of this energy source has reduced nitrogen oxide emissions from the plant by 22 tons per year. Reuse activities at the Site also support over 53 on site local jobs. These jobs contribute an annual average combined income of over $1.4 million to the community.


**Figure 2 Buffer Park Golf Course is another example of several new uses of the SSL site.**

This case study documents SSL's journey from listing on EPA's NPL to its current state of innovative economic development through land reuse and alternative energy use.

**Positive Impacts**

- Southside constructed an award winning methane gas collection system which powers the largest glass greenhouse in North America, provides energy to nearby Rolls Royce's airplane turbine engine plant and helps reduce greenhouse gases.
- Crossroads Green House was built in 1989 and generates more than $530,000 in annual sales, employs eight people and contributes approximately $196,640 in employment income to the community annually.
- Buffer Park Golf Course generates approximately $510,000 annually in revenue, employs 20 people and contributes approximately $366,200 in employment income to the community .
- SSL employs approximately 25 people a year, supplying $862,250 in annual income to the community. The landfill receives 900,000 tons of waste per year.
- The redevelopment of SSL has provided various small independent commercial businesses a place to open their doors. They include Best Way Disposal, United Rentals, and KDC Truck and Trailer Repair.

## Introduction

Superfund site remediation results in restored value to the Site and surrounding community. Making a property ready for reuse revitalizes the local economy with jobs, new businesses, tax revenues, local spending and enhanced recreational and ecological benefits. Additionally, open green spaces, walking paths, parks and playgrounds are often a part of Superfund site reuse.

The goal of this case study is to qualitatively discuss, and where possible, quantify and monetize the impacts that both new development and adaptive reuse of existing buildings on a Superfund site has had on this community and the environment.

SSL occupies 324 acres and is located on the west bank of the White River approximately 4.5 miles southwest of downtown Indianapolis. Approximately 7,000 to 8,000 people live within a 3-mile radius of the Site and many use the ground water as a drinking water supply.

## Site History and Cleanup

SSL is an active sanitary disposal site that began landfill operations in 1971. An estimated four million cubic yards of waste have been disposed at the landfill. Municipal solid waste is considered to be the Site's primary waste. However, over the years, industrial wastes, including coal tar, asbestos, iron oxide, clarifier sludge, and paint waste, and agricultural wastes were also dumped at the Site. In 1984 ground water samples from on-site wells indicated the presence of heavy metals. The Site was proposed to the Superfund Program's NPL in June 1986 and listed in March 1989.[1] The primary contaminants of concern were arsenic, iron, manganese, cadmium, chromium, silver, and nickel.

### Property Cleanup and Transformation

Due to the need to keep operating the landfill, in 1985, SSL operators signed an agreement with the Indiana State Board of Health (ISBH) to correct drainage problems that were identified at the landfill. In 1986, the SSL owners agreed to construct both a hydraulic cut-off barrier (known as a slurry wall) and a leachate collection system to isolate the ground water beneath the landfill from the surrounding ground water.[2] Thus potentially contaminated ground water is prevented from leaving the Site. Additionally, the agreement included a performance monitoring network; cover and grading requirements; operating procedures; closure and post-closure procedures and requirements; and the establishment of both closure and post-closure funds. The established well network monitors ground water levels and quality both inside and outside the slurry wall.

A Remedial Investigation revealed the chemical contamination found in the ground water did not pose an unacceptable risk to human health and the environment. In addition, the existing slurry wall and leachate system were adequately protecting the surrounding ground water from the landfill leachate. The Site was deleted from the NPL on July 3, 1997.

[1] For more information on the site's discovery and listing, please see http://www.epa.gov/superfund/sites/rods/fulltext/r0595293.pdf

[2] EPA Record Of Decision, Southside Sanitary Landfill EPA ID: IND980607360, 1/28/1995 http://www.epa.gov/superfund/sites/rods/fulltext/r0595293.pdf

## Impacts

The remediation at SSL has led not only to a new source of alternative energy, but also to significant economic gains for the community. There are two main new businesses on the Superfund Site, Crossroads Greenhouse and Buffer Park Golf Course. Based on 2011 data, Crossroads Greenhouse generates more than $530,000 in annual sales, employs eight people and contributes approximately $196,640 in annual employment income to the community[3]. Buffer Park Golf Course, which got its name from being the buffer between the landfill and surrounding properties, generates approximately $510,000 annually in revenue, employs 20 people and contributes approximately $366,200 in employment income to the community. In addition to new business development, SSL has continued to function as an active landfill with the added benefit of now collecting the methane gas generated at the landfill. Individually, Southside employs over 25 individuals with a combined annual employment income of $862,250.[4] The landfill receives an annual volume of 900,000 tons of waste per year. There are now over 53 jobs on site with an annual average combined income of over $1.4 million dollars.

**A Reuse Partnership Leads to Local Impacts**

- A successful public-private partnership between SSL, Rolls Royce and Granger Energy LLC, sells recovered methane gas from the landfill to Rolls-Royce Indianapolis. The project has saved Rolls-Royce over $2 million in avoided fuel costs and the reduction in greenhouse gas emissions is estimated to be more than 20 tons per year.
- Crossroads Greenhouse, the country's largest methane-operated greenhouse, produces more than 400,000 poinsettias, bedding plants and hanging baskets. All heating and supplemental energy for Crossroads is produced with the assistance of methane gas collected from the site.

## Innovation

### Landfill Gas Collection as an Alternative Energy Source

As part of its reuse initiative, SSL developed one of the most extensive gas management systems in Indiana, as well as one of the most unique uses of the collected methane gases, Crossroads Greenhouse which is entirely heated by methane gas. Landfill gases are produced when the organic portion of solid waste biodegrades naturally in landfills. This gas consists of approximately 50 percent methane, 45 percent carbon dioxide and small amounts of nitrogen, oxygen, hydrogen, and non-methane organic compounds. Methane is a greenhouse gas which can be harmful to the environment if it is not managed.

Landfill gas (LFG) is utilized in two primary ways. It can be used for electric generation or as a direct-use fuel. As a "direct-use" fuel, methane gas is recovered from a landfill, transported via a network of pipes to an on-site gas production facility and then piped to nearby industrial users. Typically, the gas is used to fuel boilers, furnaces, ovens, or other combustion equipment for large energy users. When used to generate electricity, recovered methane gas fuels engine generator sets that produce electricity. The resulting electricity can then be used directly or sold to a local utility or to other electric customers. SSL's customers use LFG in both ways. The amount of methane released at SSL is significant enough to provide a valuable resource if captured. Using energy from landfill gases avoids the need to use non–renewable resources such as coal, oil or natural gas to produce the same amount of energy. This can

[3] Bureau of Labor Statistics May 2009 State Occupational Employment and Wage Estimates Indiana

[4] Bureau of Labor Statistics May 2009 State Occupational Employment and Wage Estimates Indiana

avoid power plant emissions of $CO_2$ and criteria pollutants such as sulfur dioxide (which is a major contributor to acid rain), particulate matter (a respiratory health concern), nitrogen oxides and trace hazardous air pollutants. Collecting LFG to produce electricity also improves the air quality of the surrounding community by reducing landfill odors and controlling organic pollutants in the LFG. Burning LFG also destroys most of the non-methane organic compounds and odorous compounds that are present at low concentrations in LFG, thereby reducing possible health risks, ozone precursor impacts, and nuisance from these compounds.[5]


**Figure 3 SSL Methane Gas Collection Well**

SSL has more than 15 million tons of waste in place. The landfill gas at SSL is collected through over 300 wells inserted directly into the waste. After the gas is collected and processed, it is then directed to its end use customers, Crossroads Greenhouse, Rolls-Royce and other on-site small businesses.

Rolls-Royce Allison agreed to a 10-year contract to use methane gas from the landfill to help power its 2.73-million-square-foot aircraft turbine engine plant in Indianapolis. Granger Energy LLC partnered with Rolls-Royce to pipe the gas to the plant. SSL has also installed 11,000 feet of pipeline so it can supply gas to produce heat and electricity to some large manufacturing facilities located in Wayne Township.

The energy equivalent for the landfill gas delivered by SSL in 2008 was about 275 railcars of coal or 138,000 barrels of oil.

LFG also represents a cost savings when compared to conventional fuels. As of 2011, SSL currently collects approximately 3,500 cubic feet per minute (cfm) of landfill gas, the majority of which is captured and sold. EPA estimates that gas will continue to be generated for 25 to 30 years after SSL stops receiving waste. The rate of generation would decline over that time period.

## Conclusion

Often, remediating a parcel of contaminated land requires the complete shutdown of operations on the Site. At Southside Sanitary Landfill, however, thanks to cooperation among EPA, state agencies, owners and local developers, the remediation of the Site not only allowed the existing landfill to continue to operate, but also enabled development of an award winning methane gas collection system, the largest glass greenhouse in North America, a community golf course, which is open to local residents and various other businesses, to exist on the property. Today, these commercial and industrial operations on the Site provide the community with jobs and tax revenue. Southside Sanitary Landfill has been so successful in its remediation and reuse efforts that local school children take fieldtrip tours as part of their science or civics curriculum in order to experience and see the three "Rs": Reduce, Reuse and Recycle in action. In addition, SSL has a course designed specifically to instruct teachers on how to incorporate landfill science into their curriculum.

[5] Waste Age, Gas Yields Glory, April 2002, http://wasteage.com/mag/waste_gas_yields_glory/

# Technical Appendix

**Positive Impacts: Employment Information for On-site Jobs**
Each on-site business was researched in the Dun & Bradstreet (D&B), database where number of employees, and sales volume information was gathered. D &B is a company that provides information on businesses and corporations. It maintains a database of over 179 million companies globally and over 53 million professional contact names using a variety of sources including public records, trade references, tele-communication providers, newspapers and publications, and telephone interviews among other various sources www.dnb.com).

The Data Universal Numbering System (DUNS) number, is a unique nine-digit identification number assigned by Dun & Bradstreet to each business and its location within the D&B database for the purpose of identifying each business.

**Southside Sanitary Landfill** –25 employees
DUNS Number: 067130864
Sales Volume (US$): $0

**Crossroads Greenhouse** – 8 employees
DUNS Number: 606452373
Sales Volume (US$): $553,000

**Buffer Park Golf Course** – 20 employees
DUNS Numbers: 031342269
Sales Volume (US$): $510,000

**Positive Impacts: Wage and Income Information for On-site Jobs**
Wage and income information was gathered using the Bureau of Labor Statistics (BLS) data. The BLS is a governmental statistical agency that collects, processes, analyzes, and disseminates essential statistical data to the American public, the U.S. Congress, and other Federal agencies in the broad field of labor economics and statistics. The data provided by the BLS has high standards of accuracy and consistently high statistical quality, and impartiality in both subject matter and presentation.

The types of jobs at each business located on-site of SSL were identified, using standardized occupational codes, then researched in the BLS Indianapolis, Indiana data tables in order to get the average wage for those types of positions. The average wage (mean annual) was then multiplied by the number of employees located at that particular business.

Southside Sanitary Landfill -25 employees X $34,490 =$862,250
Crossroads Greenhouse – 8 employees X $24,580 = $196,640
Buffer Park Golf Course – 20 employees X $18,310 = $366,200

**Table 1: Bureau of Labor Statistics May 2009 State Occupational Employment and Wage Estimates Indiana**
**www.bls.gov/oes/current/oes_in.htm#00-0000**

| Occupation Code | Occupation Title (click on the occupation title to view an occupational profile) | Median Hourly | Mean Hourly | Mean Annual |
|---|---|---|---|---|
| 37-3019 | Maintenance Workers, All Other | $15.01 | $16.58 | $34,490 |
| 39-3091 | Amusement and Recreation Attendants | $8.21 | $8.80 | $18,310 |
| 45-2092 | Farmworkers and Laborers, Crop, Nursery, and Greenhouse | $10.46 | $11.82 | $24,580 |

**Levalized Energy Costs**

When discussing the cost of energy, levalized costs were used, which include production tax credits, investment tax credits, and accelerated asset depreciation as applicable.[1] The investment banking company, Lazard Ltd., which collects information on the true costs of energy production, provides in its June 2008 report, a comparison of traditional and alternative energy and the generation costs of each. Lazard uses levalized costs which is a more accurate depiction of the true costs of energy.[2]

**Conventional Energy:**

| Type | Cost Range (Levalized costs $/MWh)[3] |
|---|---|
| Gas peaking | $221 – 334 |
| Nuclear | $98 – 126 |
| Coal | $74 - 135 |
| Gas combined cycle | $73 – 100 |

**Alternative Energy:**

| Type | Cost Range (Levalized costs $/MWh)[4] |
|---|---|
| Solar PV (Photovoltaics) | $96 – 124 |
| Biomass direct | $50 – 94 |
| Landfill gas | $50 – 81 |
| Wind | $44 – 91 |
| Geothermal | $42 – 69 |

[1] Assumptions include: busbar costs (cost of producing a kilowatt of electricity up to the point of the power plant) in 2008 dollars, 60 percent debt at 7 percent interest rate, 40 percent equity at 12 percent cost, 20-year economic life, 40 percent tax rate, 5-20 year tax life, coal at $2.50 per million Btu, and natural gas at $8.00 per million Btu (British thermal unit).

[2] www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20(2).pdf

[3] Ibid.

[4] Ibid.