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FACT SHEET

# Analysis of Crime Data Near Brownfields Sites

## Introduction

Crime and fear of crime are of great concern to community residents and local officials and can influence public and private investments. To examine crime as an issue for revitalization sites, EPA's Office of Brownfields and Land Revitalization (OBLR) analyzed spatial and temporal data regarding crime associated with brownfield property revitalization projects. This fact sheet outlines EPA's approach for collecting and analyzing crime data near brownfield sites and is intended to serve as a guide for stakeholders who may be interested in conducting similar analyses, or building upon this research and forging partnerships with criminology researchers to examine issues in their community. The objectives of EPA's analysis were to:

- Investigate potential spatial (location-based) and temporal (time-based) connections between brownfield sites and crime rates within a 1-mile radius of brownfield sites, from at least three cities within each EPA region.
- Determine if there are differences in crime rates within a ¼-mile radius and between ¼-mile and 1-mile radius of brownfield properties.
- Evaluate if there are differences in crime rates before and after key brownfield activities (milestones), such as cleanup and redevelopment.

This fact sheet outlines the data used for this analysis and assumptions about that data, the methodology used, limitations and challenges for such analyses, and recommendations and resources for additional analyses.

## Available Data

The two key data streams necessary to conduct an analysis of crime data near brownfield sites are:

- **Crime data represented both temporally and spatially by individual crime occurrences with dates, and point spatial data (latitude and longitude).** EPA researched two sources of crime data for this project:
  - **Census block group crime indices** are available through the ESRI Online platform via Applied Geographic Solutions (AGS) CrimeRisk (AGS 2018). However, since census block groups are much larger than the areas of interest for this analysis (¼-mile and 1-mile radius around sites), this data could not be used to determine the difference in crime rates at brownfield sites. Therefore, census block crime data was not used.
  - **Individual crime location data** is maintained by local law enforcement agencies but the data is not always publicly available. Individual crimes and their discrete locations captured by latitude and longitude are required to create "heat" maps, which illustrate the density of crime occurrences within an area of interest. Local law enforcement data is often stored in databases that include crime activity [including the U.S. Department of Justice (DOJ) Uniform Crime Reporting (UCR) program] and latitude and longitude coordinates. Many cities and agencies make their crime data available for free as a download. EPA used individual crime data because point-specific data can be used to evaluate crime rates spatially and temporally.
- **Brownfield site data, including latitude and longitude, and start and end dates associated with key activities at those sites.** EPA maintains brownfield site data in the Assessment, Cleanup and Redevelopment Exchange System (ACRES) database. ACRES data fields critical to this type of analysis include the unique property identification (ID) code, address, latitude and longitude, and key start and end dates for brownfield site milestones, such as: Phase I and II environmental site assessment, cleanup, and redevelopment.

## Data Selection and Preparation

EPA used a two-step approach to select brownfield sites to analyze, because both crime data and brownfield site data are required. First, EPA determined which cities had available crime data and identified the time period for which the data was available in those cities; EPA then selected brownfield sites in cities where revitalization milestone activities had occurred during the time period with crime data.

### Crime Data

The UCR list of agencies that report crime data varies from year to year depending on several factors. At the time of the analysis, 2016 was the year with the most recent publicly-available data and was used to identify cities for the analysis. Cities were further targeted by selecting only those with available location-specific crime data. No types of crime were excluded.

### Brownfield Site Selection

Using the list of cities with available UCR crime data, the ACRES database was queried to identify associated brownfield sites. In addition to being in a city with UCR data, a brownfields site also needed to:

1. Include an activity end date such as Phase 1 or Phase 2 environmental site assessment, cleanup, or redevelopment within the crime data period,
2. Have a closed grant,
3. Contain latitude and longitude information,
4. Include an activity start and end date after 2005.

Sites with redevelopment end dates were preferentially selected. EPA selected three cities in each of EPA's 10 regions using the method outlined above. For each city, ACRES typically contained a short list of brownfield sites that met the four criteria, and these were selected for analysis.

For each brownfield site, EPA defined a time period for analysis by comparing the brownfield activity end date to the available time period of crime data. An equal number of years was analyzed before and after the brownfield activity end date. For example, if a site had an activity end date in 2014 and the crime data for the associated city was available from 2009 to 2016, two years before and after 2014 (the milestone date) were analyzed (2012-2016).

## Methodology for Analysis

This section outlines EPA's methodology to conduct geographic information system (GIS) and quantitative analysis of the data. The applicability of this methodology to assess additional brownfields sites will vary depending on the type and availability of data for a particular site.

## GIS Analysis

Once a brownfield site was selected and a date range for analysis was identified, GIS was used to establish a 1-mile radius area around each site location (latitude and longitude) and calculate the distance between the brownfield site and each individual crime location. For this study, the data was plotted on two panels for each analysis: (1) before the brownfields site milestone date and (2) after the milestone date to produce the following maps:

### Crime Incident Heat Map

This type of map depicts individual occurrences of crime at a location within a defined time period (ArcGIS 2018). Colors are used to show differences in the frequency of crime over time with green representing a lower crime frequency, red and yellow representing a higher crime frequency, and grey representing areas where no crime events were documented.

### Hot Spot Analysis

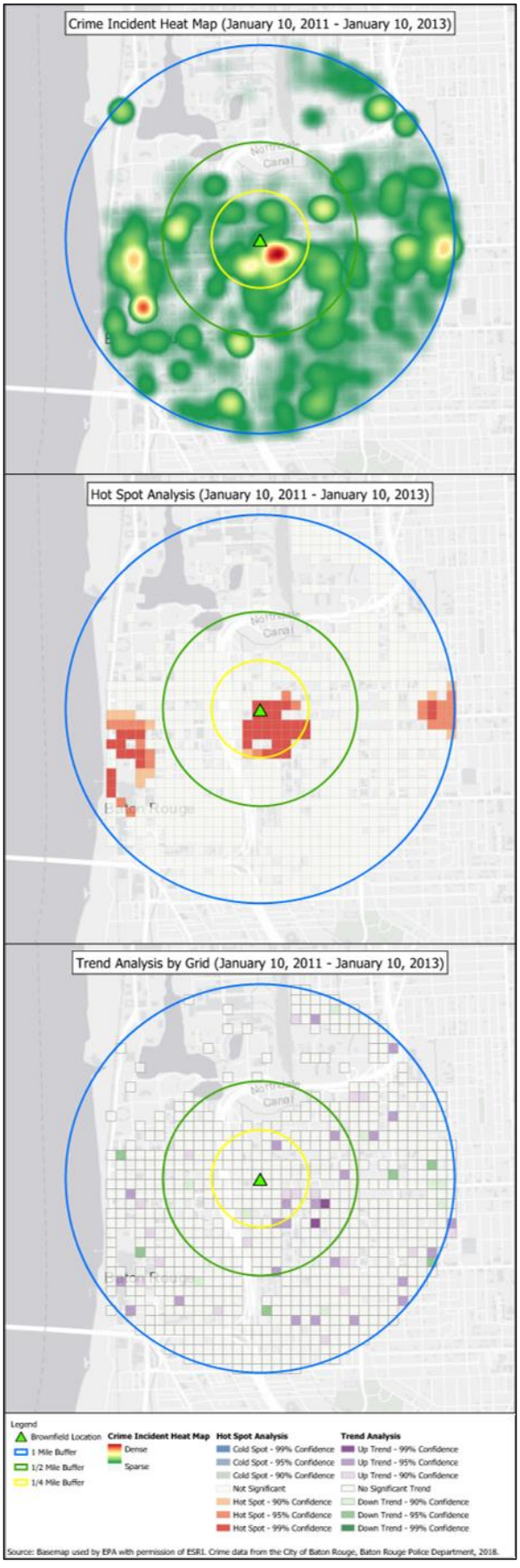
This type of map displays hot spots as orange grid cells where crime density is higher and cold spots as areas of blue grid cells where crime density is lower within a region compared to the whole 1-mile radius, prior to and after the brownfield milestone date. The hot spot analysis divides the 1-mile area around the brownfield site into a spatial grid and then compares crime density in clusters of grid squares to the whole area. If a grid square's crime density is significantly different than the whole area, then it is identified as either a hot (higher incidence of crime) or cold spot (lower incidence of crime). A comparison of the two maps before and after the brownfield milestone activity date identifies the potential migration of crime events away from, or towards, a site.

### Temporal Trend Analysis

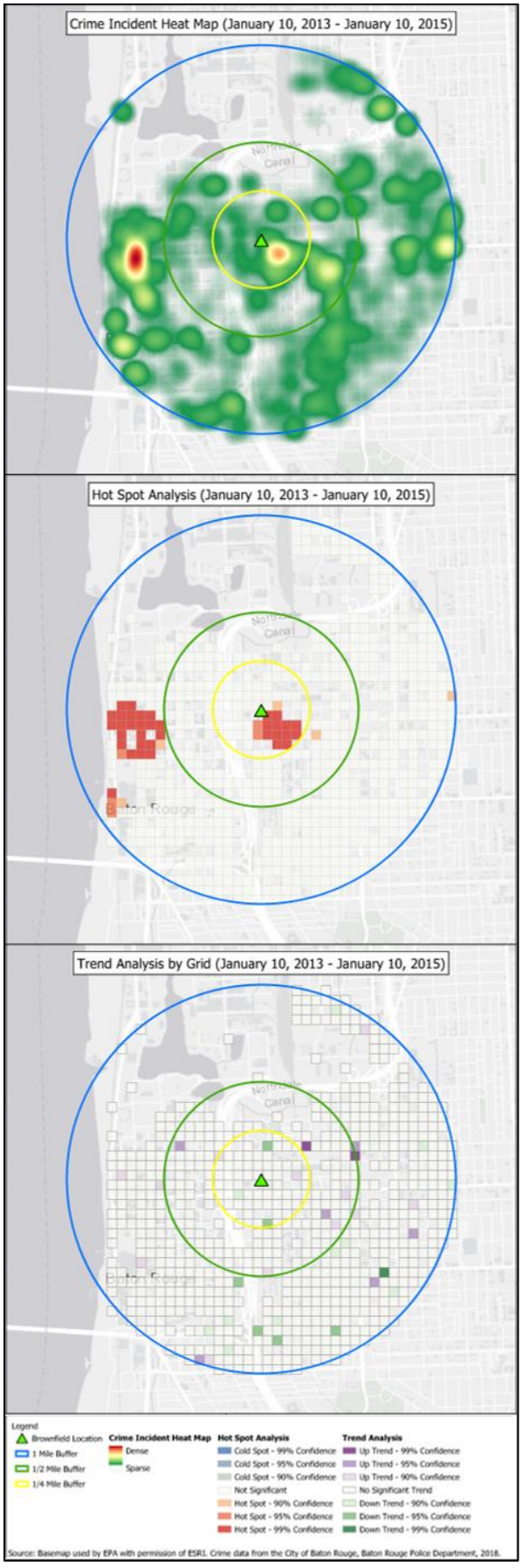
This type of map displays the significance of change in crime within individual grid cells over the time period analyzed, within an individual cell, dark purple depicts an increase in the count of documented crime events over the time period and dark green depicts a decrease in crime events over the time period. If crime is steady before redevelopment and decreases around the brownfield site after redevelopment, then this analysis would not show any change in the before redevelopment panel, but would show a decrease (a color change to blue) in crime after redevelopment close to the site and less of a change farther away from the site.

If all areas under analysis are increasing in crime, a trend would not be identified because there is no statistical significance from one grid cell to another. This analysis provides another way of examining changes in crime over time, rather than identifying location-specific hot spots.

*Analysis of Crime Data Before the Brownfield Milestone Date*



*Analysis of Crime Data After the Brownfield Milestone Date*

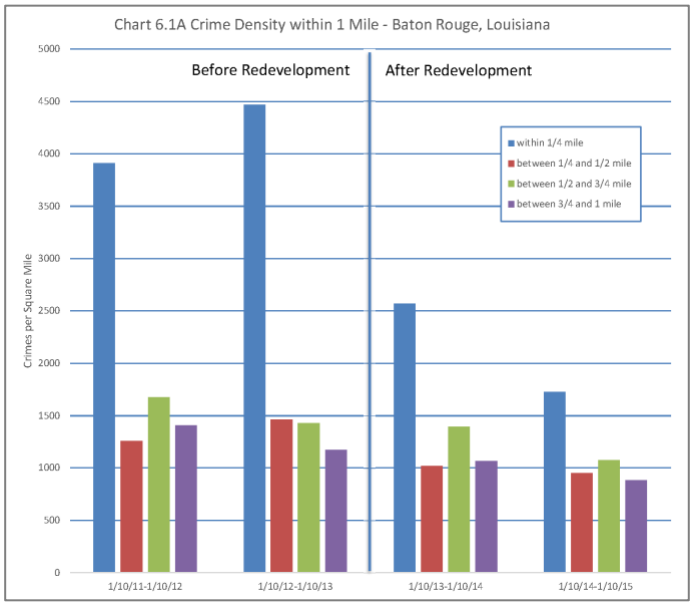



## Quantitative Analysis

EPA also calculated the crime density per year. The crime density per year was calculated for ¼-mile intervals within 1-mile around a site to determine if the crime rate varied with distance from a brownfield site. The following charts are examples of what was prepared for each site to display the crime rates around each brownfield site over time; each chart also shows the data sets before and after redevelopment.

### Chart A

Chart A shows crime density within a 1-mile radius from a brownfield site for all years included in analysis.

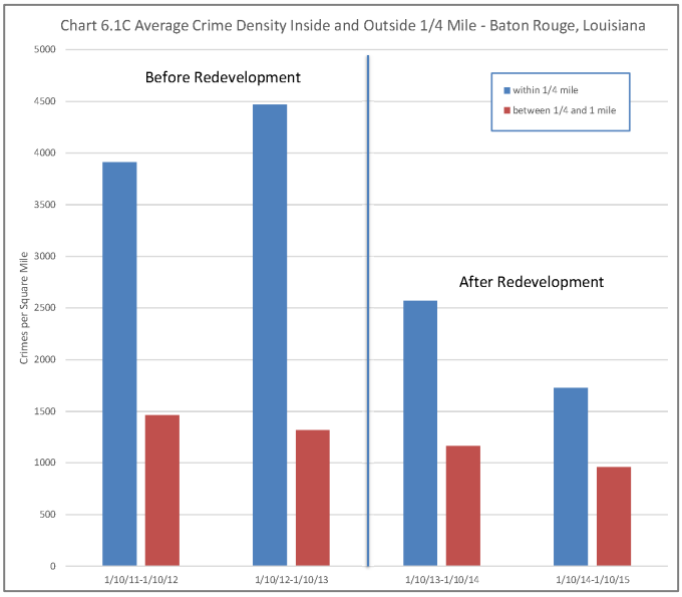



### Chart B

Chart B shows crime density within ¼-mile of a brownfield site for all years included in analysis.

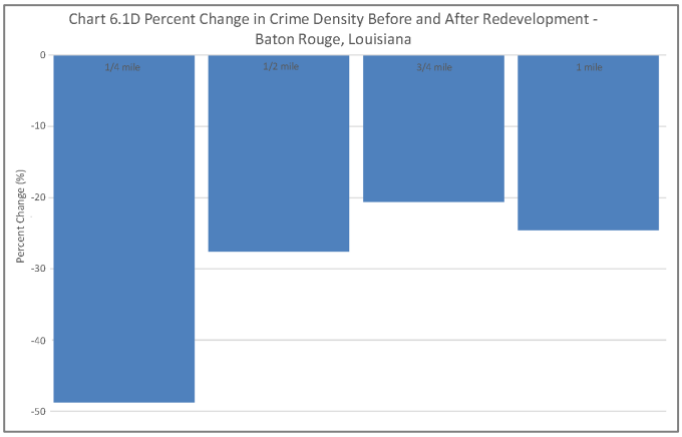
### Chart C

Chart C compares crime density within a ¼-mile radius of a site to crime density within a ¼-mile and 1-mile radius of the site for all years included in the analysis.




### Chart D

Chart D shows the percent change in crime density after the milestone activity end date for a brownfield project site for each ¼-mile interval.




## Limitations/Challenges

Some notable limitations and challenges of this analysis include:

- Brownfield sites in non-city areas were not included; the crime activity in rural areas is typically measured on the census block level and this analysis was restricted to point data analysis.
- Any apparent reductions in crime after brownfield revitalization activities efforts cannot be definitively attributed to the brownfield activity; this analysis does not control for changes in other factors (economic activity, vacancy rates, police presences, demographics) that may influence crime rates.
- The analysis relies on *reported* crime data. Not all crimes are reported and reported crimes may be influenced by the level of policing in an area. Changing patterns of policing can influence the crime rate in an area. For example, if part of the brownfield revitalization effort includes an increased police presence after redevelopment, reported crimes could increase simply because the same criminal activities are being addressed and reported more often.
- The precision of the spatial data related to crime data varies based on each municipality's privacy standard. Some municipalities track crime locations at the exact address, while others use the nearest block.
- Some types of violent crimes are excluded from public datasets to protect the identity of the victims.
- Natural or jurisdictional (city limits) boundaries around or through a brownfield project site may impact the analysis and influence quantitative results. For example, the migration of crime around a natural feature, such as a river, presents a physical barrier, while a city limit may have no impact. However, the extent of crime data available around a brownfield project site may be limited to less than a 1-mile if a city limit is within that distance.

## Recommendations for Further Investigation

- Crime changes per capita could be analyzed instead of crime changes per square mile.
- Population changes could be included in the analysis using census block data.
- A similar analysis of 30 smaller, more rural cities could be conducted if point spatial data becomes available for rural areas in the future.
- Partnerships could be developed with local police departments and a brownfields redevelopment coordinator from each city to evaluate redevelopment goals and best management practices associated with crime mapping to support those efforts.

## References and Resources for Additional Information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