FIELDS Statistical Evaluation Briefing

South Minneapolis Soil Contamination Site

2 July 2007

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1) Exploring trends in residential arsenic concentrations (all concentrations)
    a. Pre-1963 Construction
    b. Post-1963 Construction
2) Exploring trends in background concentrations w/in residential properties
    a. Pre-1963
    b. Post-1963
3) Exploring trends from extreme SE to NW
    a. Indicative of a new source?

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1) Exploring trends in residential arsenic concentrations.

Scatter-plots show weak directional correlations between arsenic concentrations and distance from the site for Pre-1963 residences (Figures 1-4). For Pre-1963 residences, the strongest correlation occurs in the Northwest quadrant (Figure 2), where the Pearson $r = -0.235$ and the Spearman $r = -0.355$ ($P < 0.001$ in both cases). In the Southeast quadrant, there appears to be a positive concentration-distance correlation, where concentrations *increase* with the increasing distance from the CMC site (Figure 4). Consistent with the findings of CH2M Hill, the scatter-plots presented herein show that a relationship does exist between distance from the CMC site and low/background arsenic concentrations (≤ 20 mg/kg).

For the Post-1963 residences (Figures 5-8), the only observable trend lies in the Northwest quadrant, where arsenic concentrations decrease as distance from the CMC site increases (Figure 6). A marginal positive trend is also observed in the Northeast quadrant (Figure 5).

Overall, the results in the Northwest quadrant *marginally* support the aerial deposition model; the results in the Southeast quadrant contradict the aerial deposition model.

2) Exploring trends in background concentrations (≤ 20 mg/kg) within residential properties.

For Pre-1963 residences (Figures 9-12), a negative trend in concentrations was observed for the Northwest and Southwest quadrants (Figures 10-11). A marginally positive trend was observed in the Southeast quadrant (Figure 12).

For Post-1963 residences (Figures 13-16), the only observable trend lies in the Northwest quadrant, where concentrations decrease with the distance from the CMC site (Figure 14).

Overall (Figures 17-20), the strongest relationship in background concentrations occurred in the Northwest quadrant; only within the Northwest quadrant did a relationship exist over both time periods (Figure 18). Within all other quadrants, the trend was inconsistent over both time periods (e.g., no trend during one time period while a trend was present in the other time period).

3) Exploring trends in residential arsenic concentrations from the Southeast Quadrant to the Northwest Quadrant.

Scatter-plots were created to investigate whether an additional source might be present to the southeast of the site (Figures 21-22). Only data from the SE and NW were included in the scatter-plots. A negative trend would indicate the possible presence of an alternate source to the SE of the site. To observe if any SE-NW trend existed in the data, all SE datasets were converted to negative values (e.g., the SE sample farthest from the CMC site became the lowest value). These scatter-plots do not reveal any observable pattern for the total concentrations or background concentrations in both time periods (no statistical test; Figures 21-22). Furthermore, the lack of sufficient data within 500 m from the site confounds attempts to observe any patterns.

Note: simply assigning negative values to the SE samples is probably not the best way to determine this relationship, but the scatter-plots presented herein would have indicated a general trend if one existed. Although no relationship appears to exist based upon these scatter-plots, other methods may be more useful in identifying a relationship.

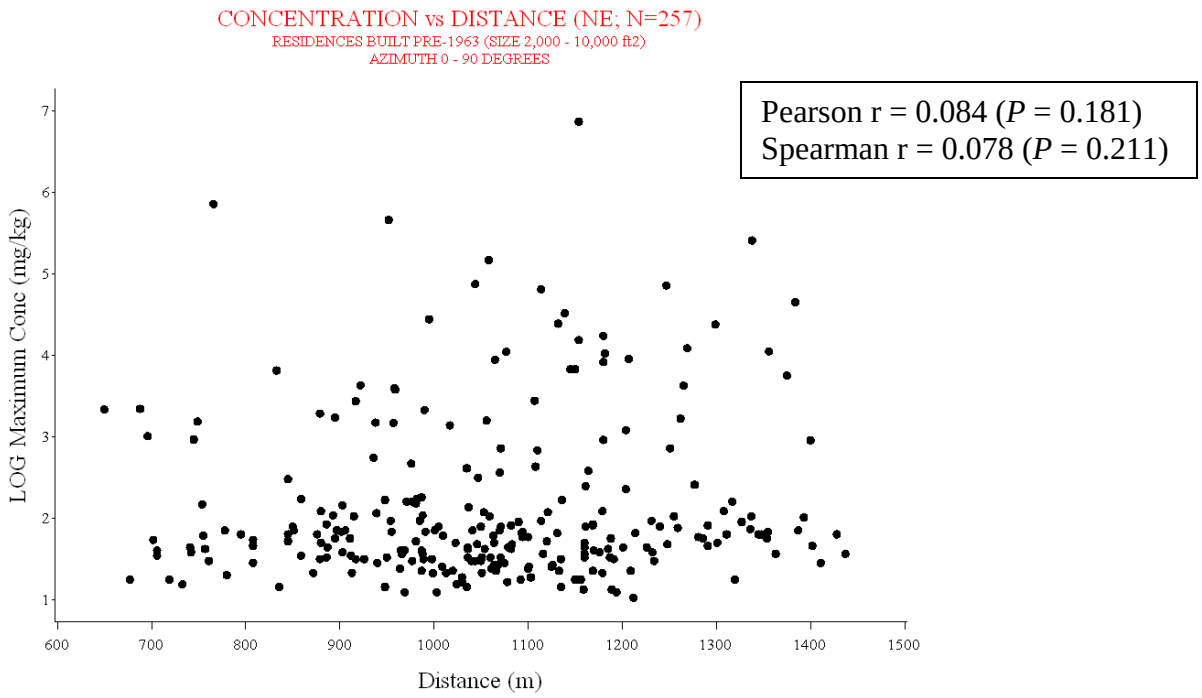

Figure 1. Scatter-plot showing the relationship between maximum arsenic concentration and distance from the CMC facility for Pre-1963 residences, Northeast Quadrant (N = 257).

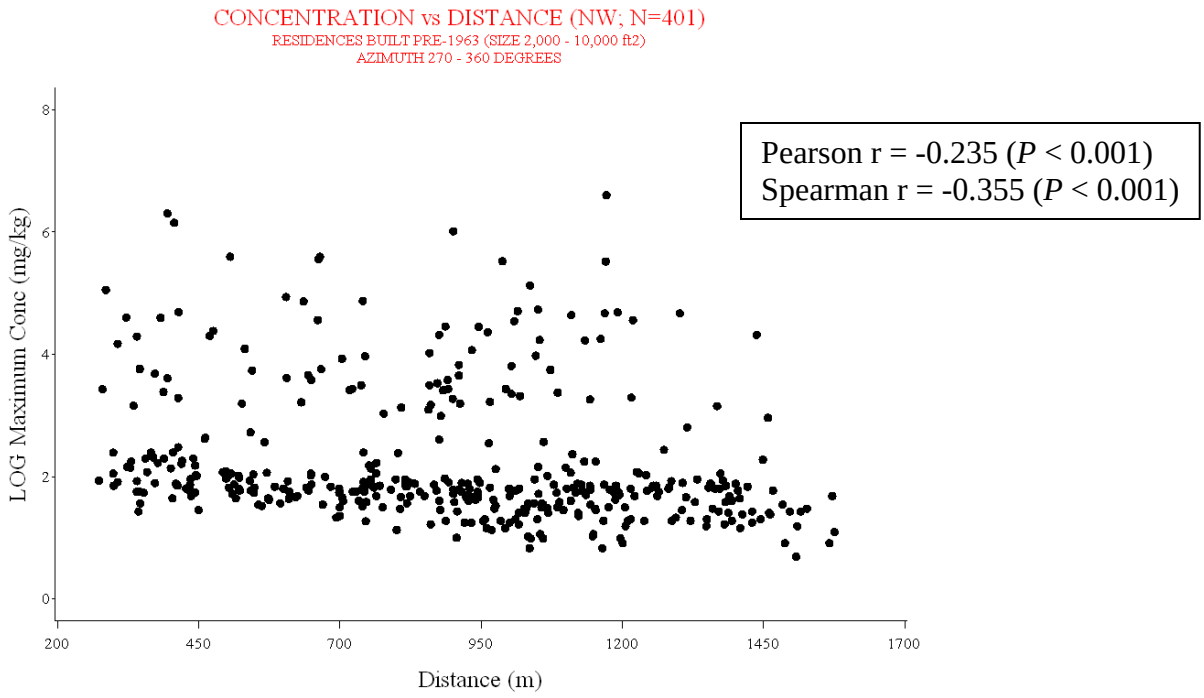

Figure 2. Scatter-plot showing the relationship between maximum arsenic concentration and distance from the CMC facility for Pre-1963 residences, Northwest Quadrant (N = 401).

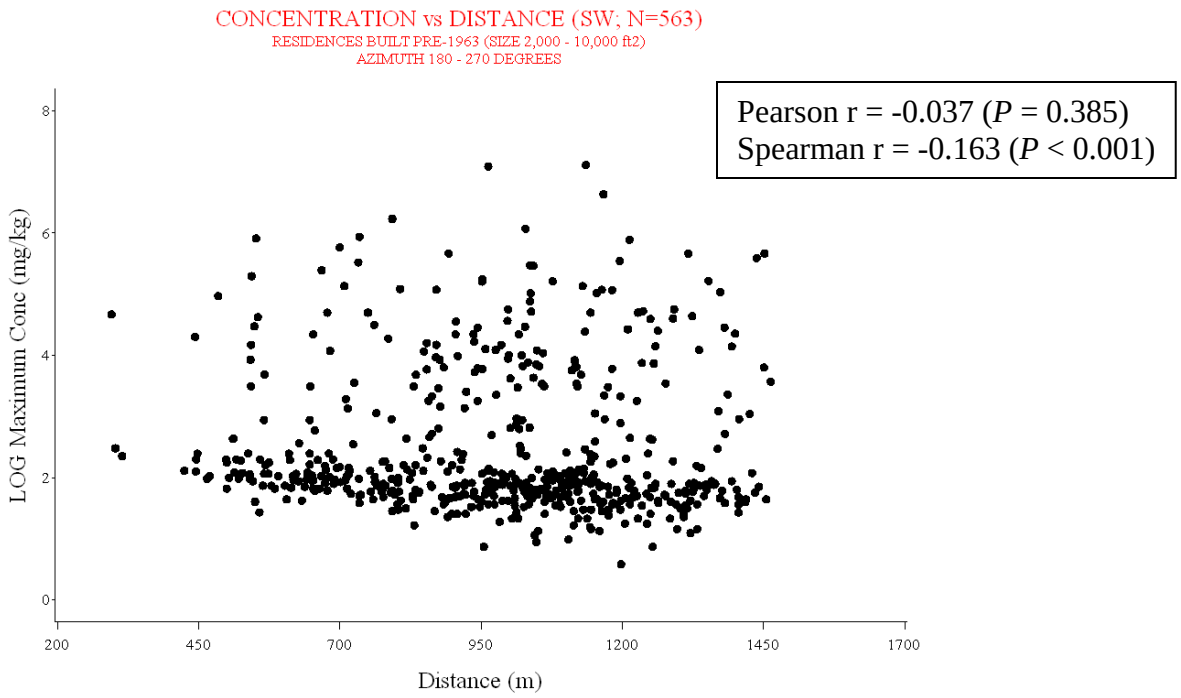

Figure 3. Scatter-plot showing the relationship between maximum arsenic concentration and distance from the CMC facility for Pre-1963 residences, Southwest Quadrant (N = 563).

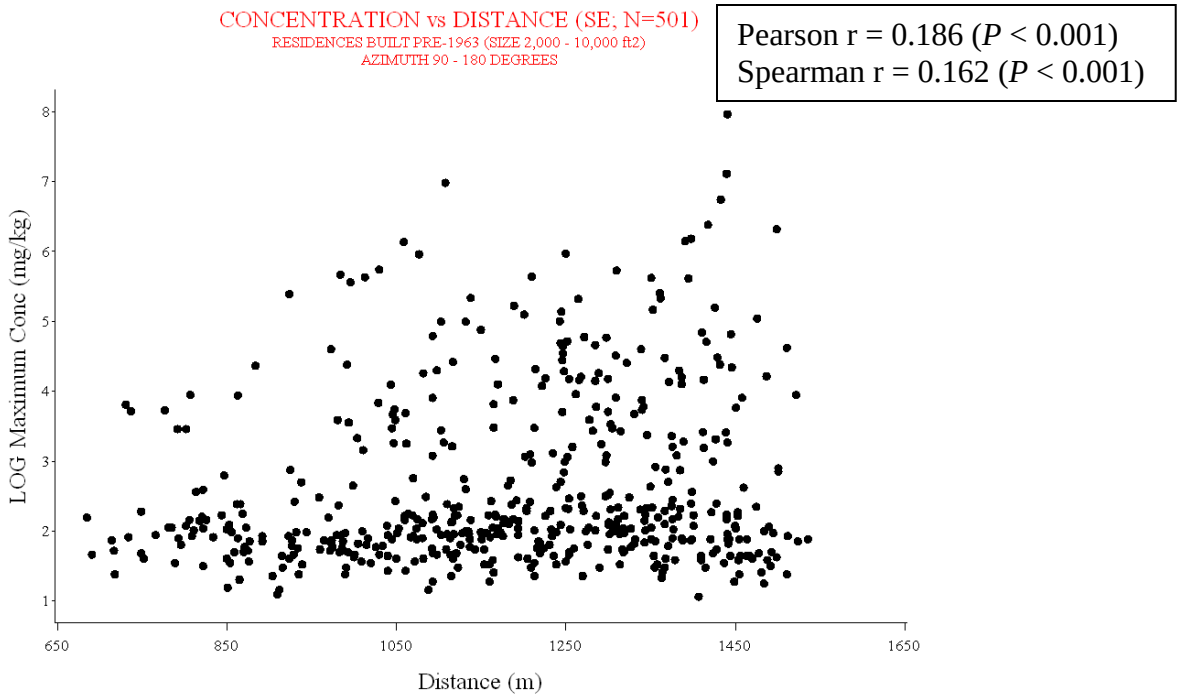

Figure 4. Scatter-plot showing the relationship between maximum arsenic concentration and distance from the CMC facility for Pre-1963 residences, Southeast Quadrant (N = 501).

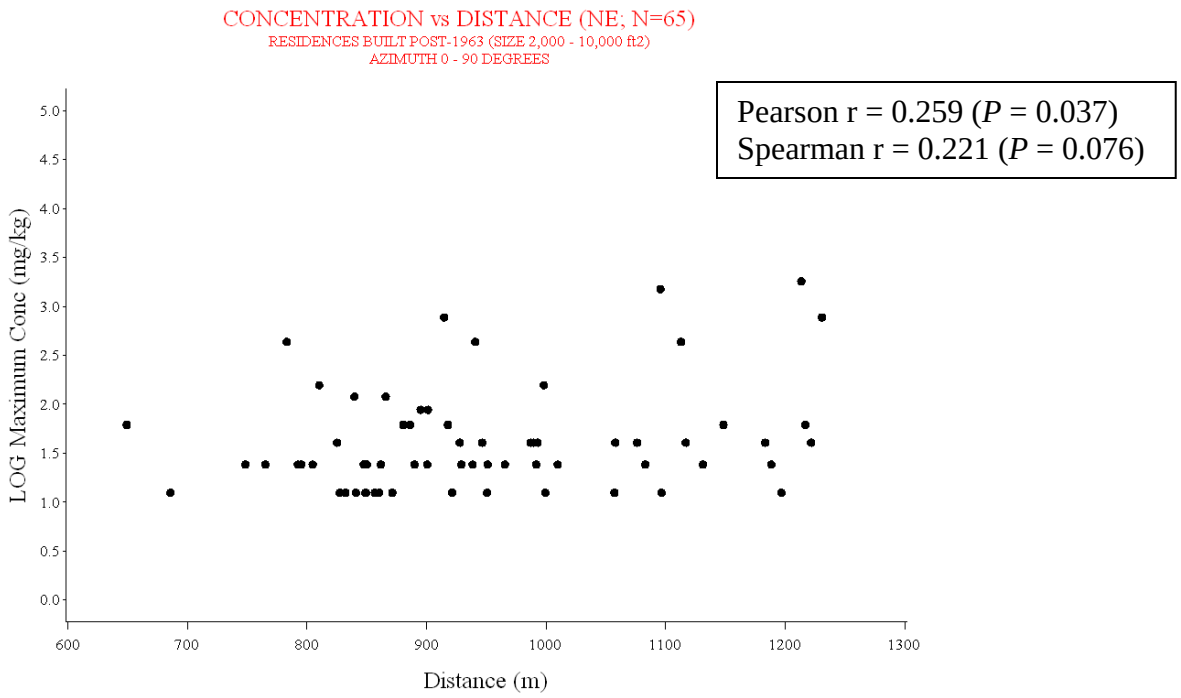

Figure 5. Scatter-plot showing the relationship between maximum arsenic concentration and distance from the CMC facility for Post-1963 residences, Northeast Quadrant (N = 65).

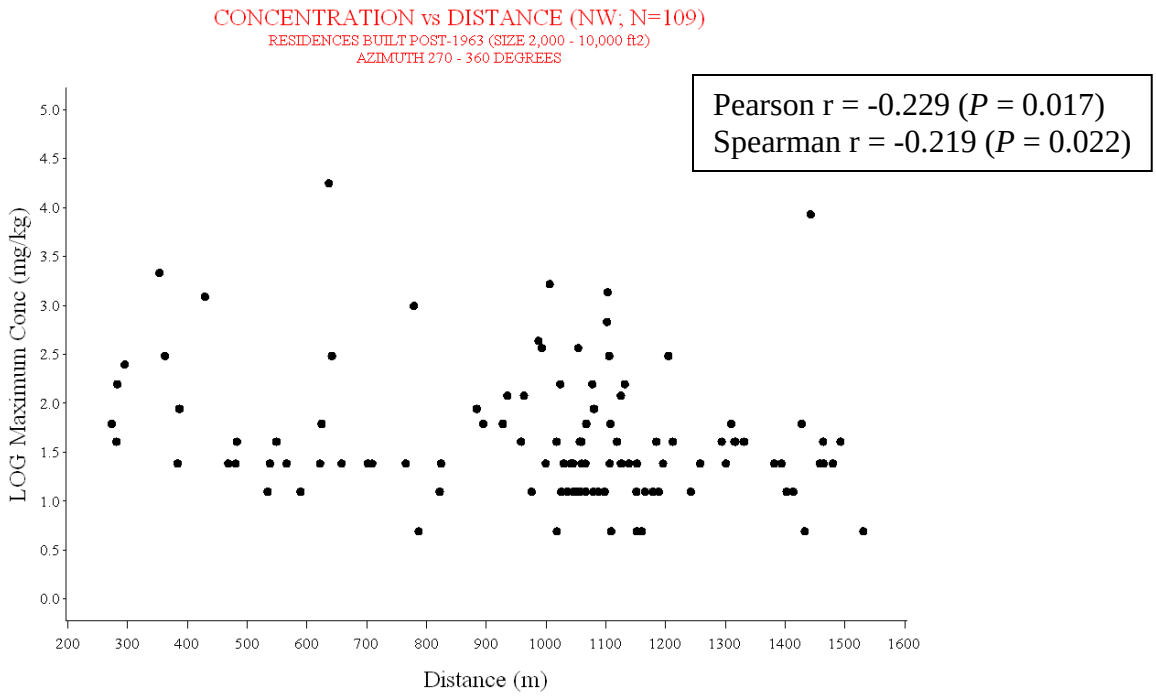

Figure 6. Scatter-plot showing the relationship between maximum arsenic concentration and distance from the CMC facility for Post-1963 residences, Northwest Quadrant (N = 109).

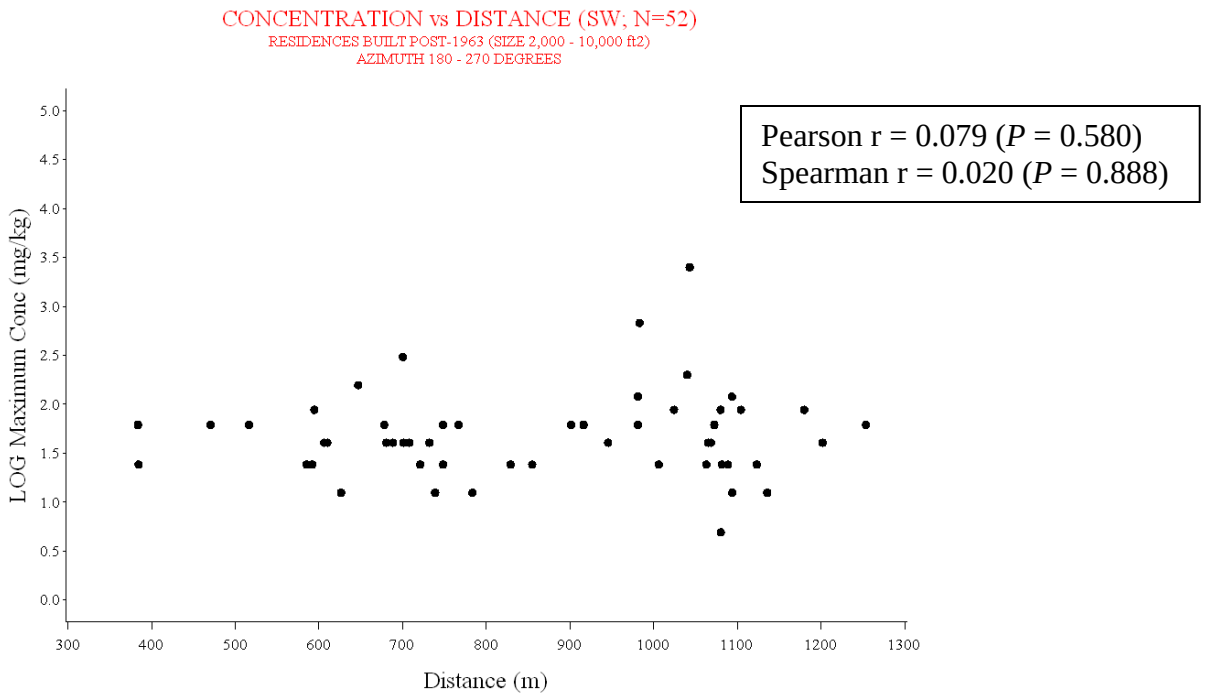

Figure 7. Scatter-plot showing the relationship between maximum arsenic concentration and distance from the CMC facility for Post-1963 residences, Southwest Quadrant (N = 52).

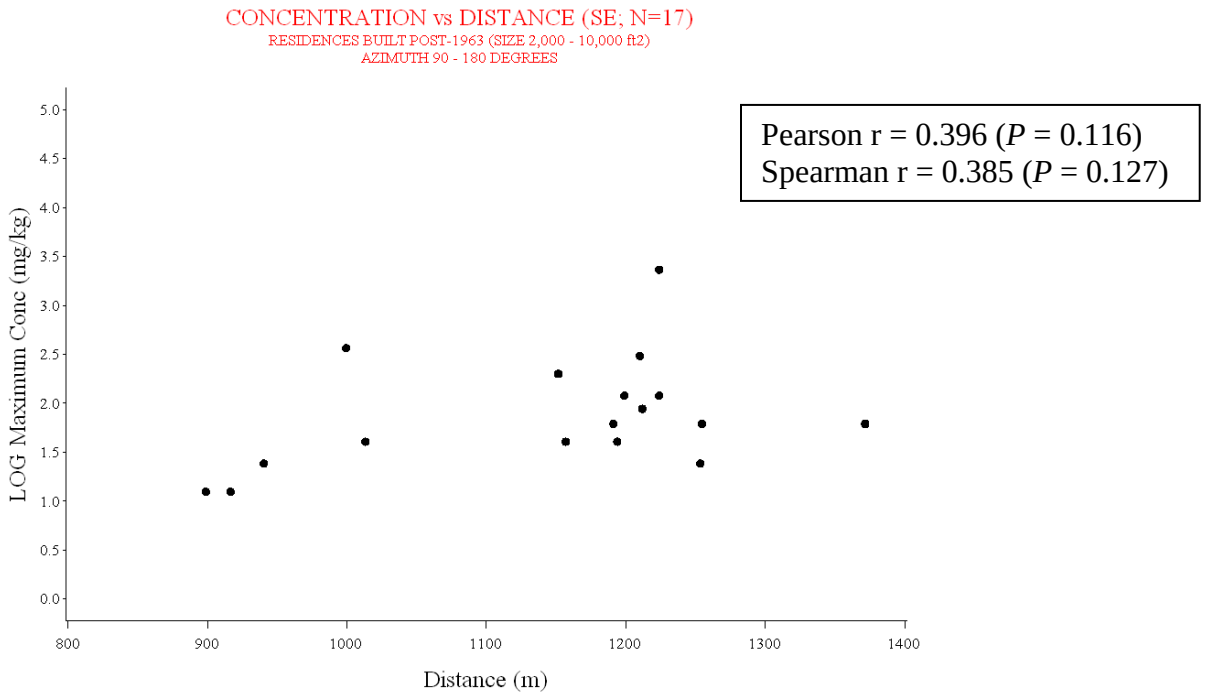

Figure 8. Scatter-plot showing the relationship between maximum arsenic concentration and distance from the CMC facility for Post-1963 residences, Southeast Quadrant (N = 17).

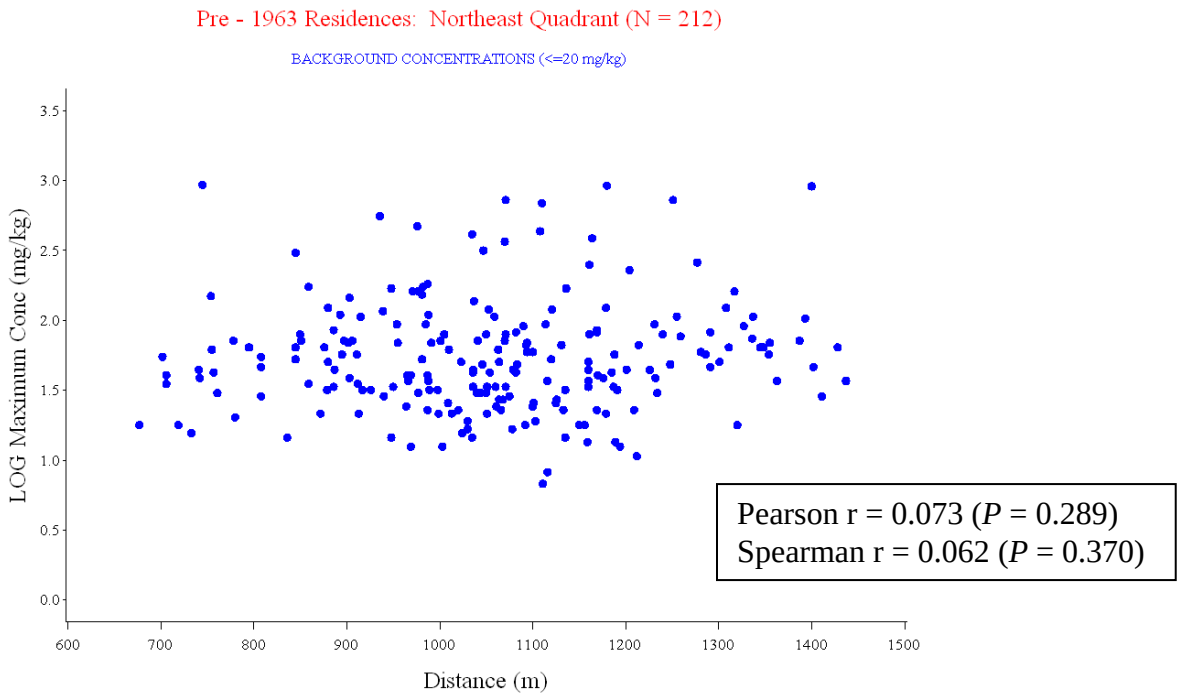

Figure 9. Scatter-plot showing the relationship between background arsenic concentration and distance from the CMC facility for Pre-1963 residences, Northeast Quadrant (N = 212).

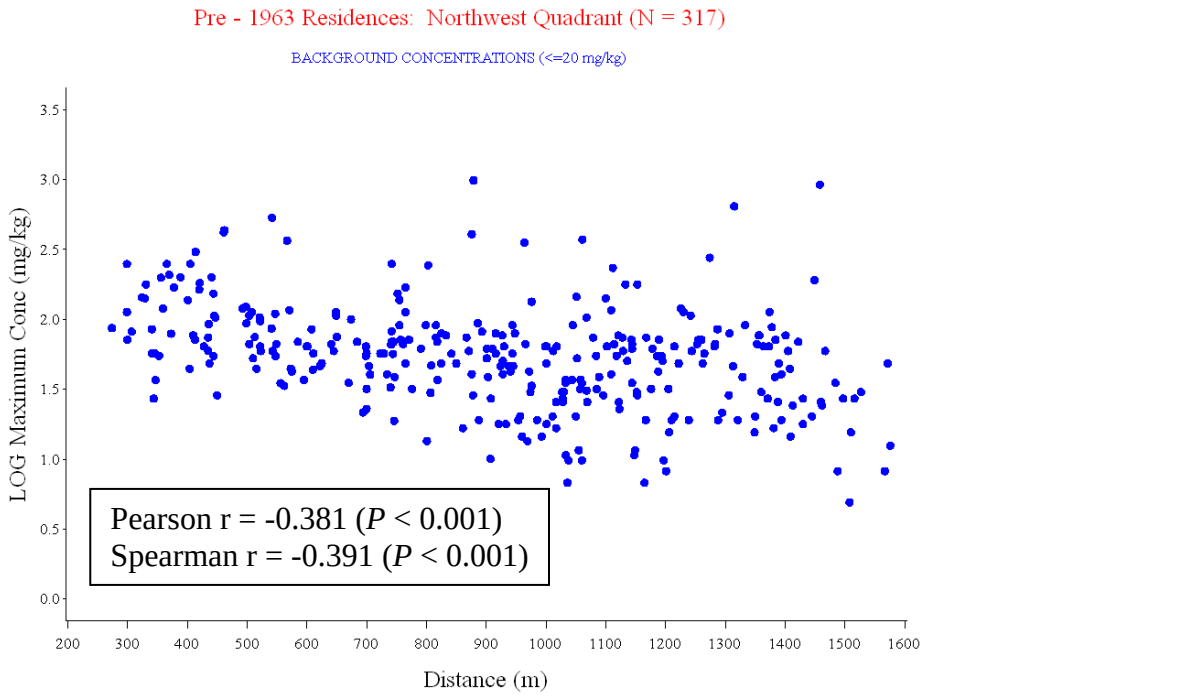

Figure 10. Scatter-plot showing the relationship between background arsenic concentration and distance from the CMC facility for Pre-1963 residences, Northwest Quadrant (N = 317).

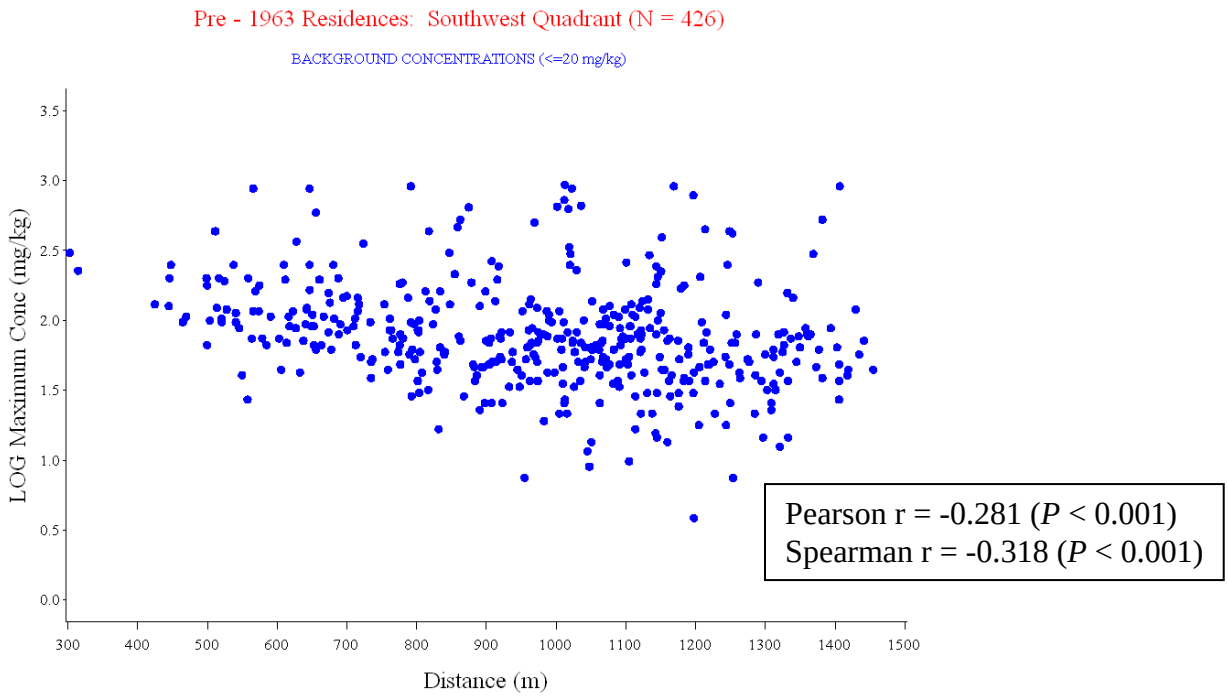

Figure 11. Scatter-plot showing the relationship between background arsenic concentration and distance from the CMC facility for Pre-1963 residences, Southwest Quadrant (N = 426).

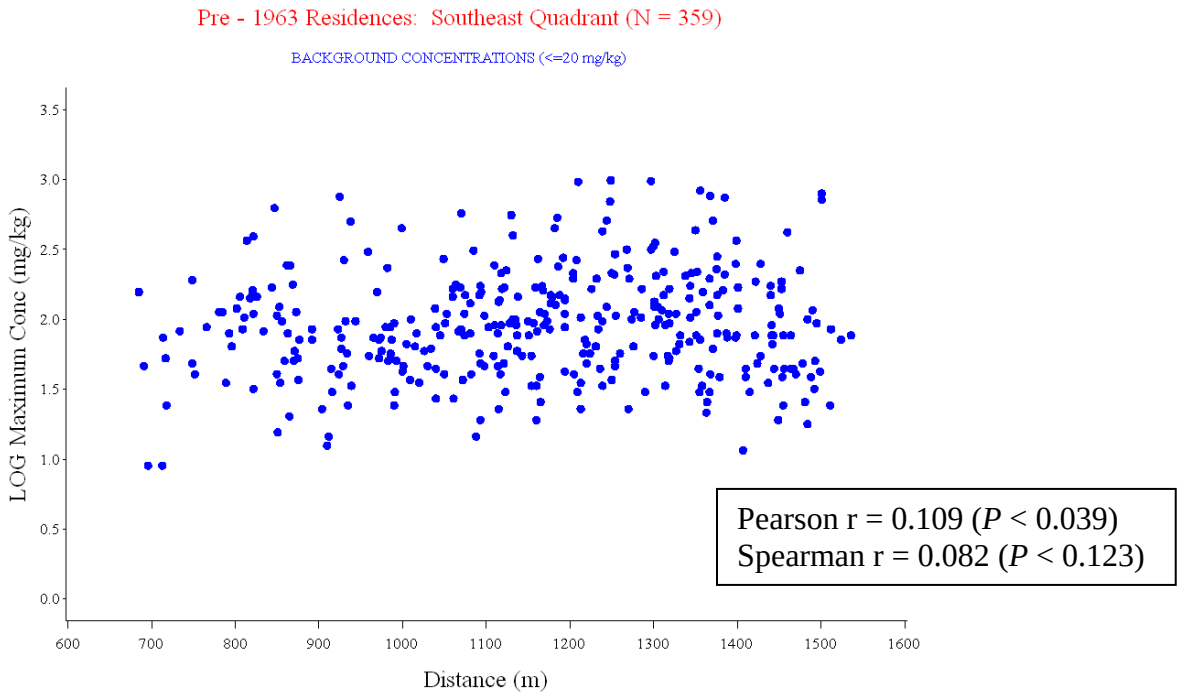

Figure 12. Scatter-plot showing the relationship between background arsenic concentration and distance from the CMC facility for Pre-1963 residences, Southeast Quadrant (N = 359).

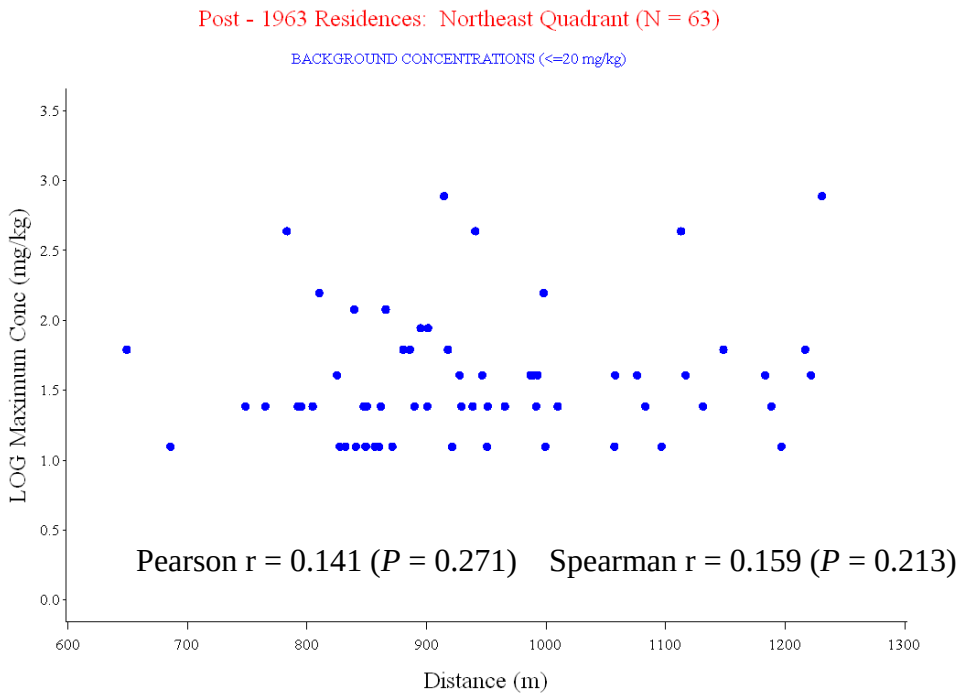

Figure 13. Scatter-plot showing the relationship between background arsenic concentration and distance from the CMC facility for Post-1963 residences, Northeast Quadrant (N = 63).

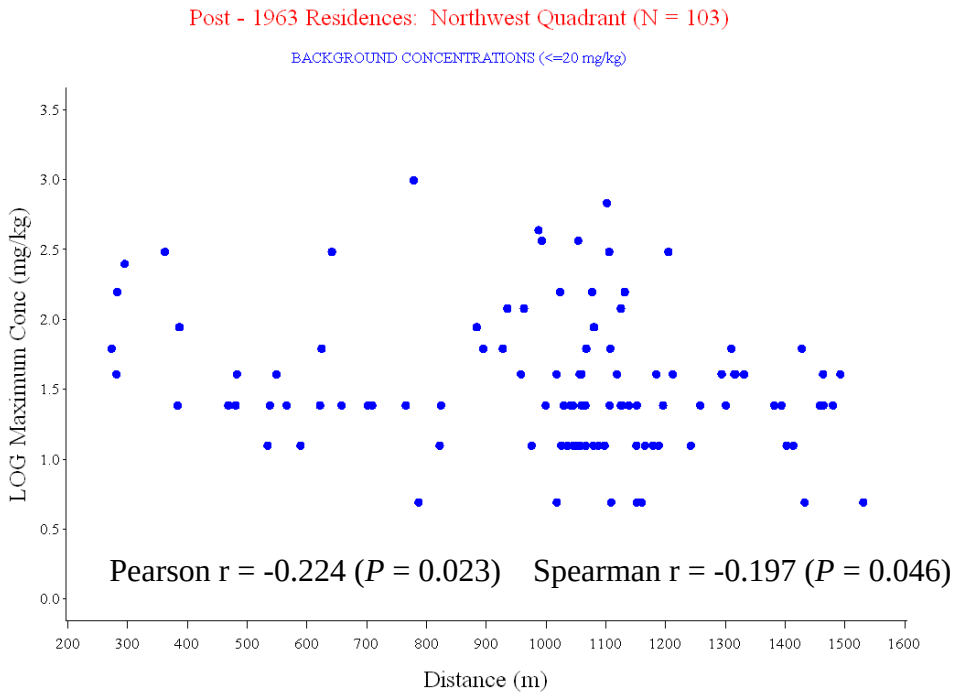

Figure 14. Scatter-plot showing the relationship between background arsenic concentration and distance from the CMC facility for Post-1963 residences, Northwest Quadrant (N = 103).

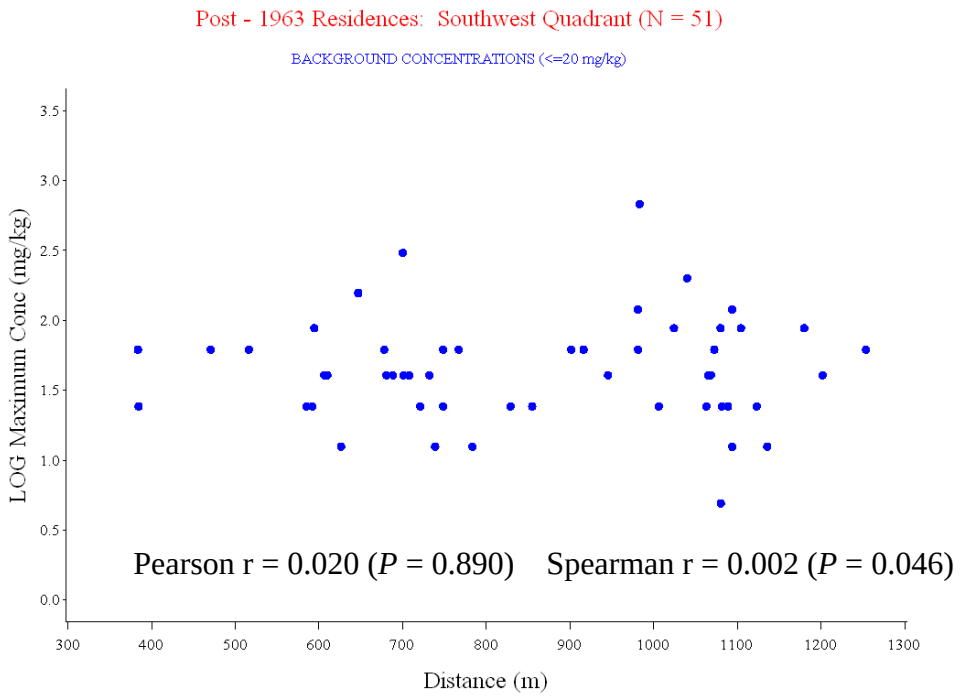

Figure 15. Scatter-plot showing the relationship between background arsenic concentration and distance from the CMC facility for Post-1963 residences, Southwest Quadrant (N = 51).

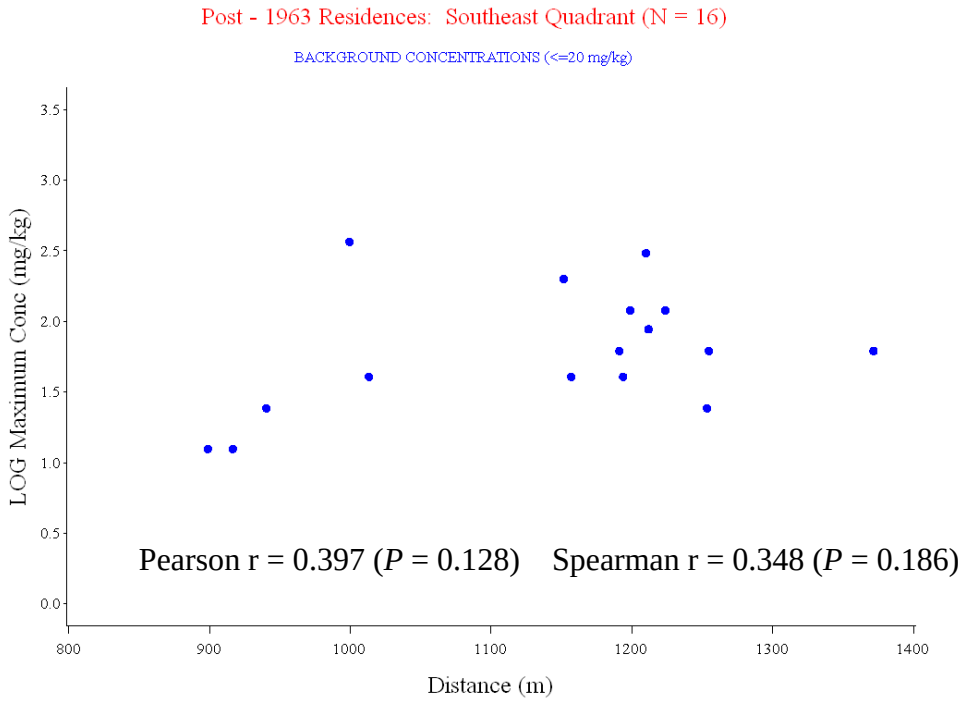

Figure 16. Scatter-plot showing the relationship between background arsenic concentration and distance from the CMC facility for Post-1963 residences, Southeast Quadrant (N = 16).

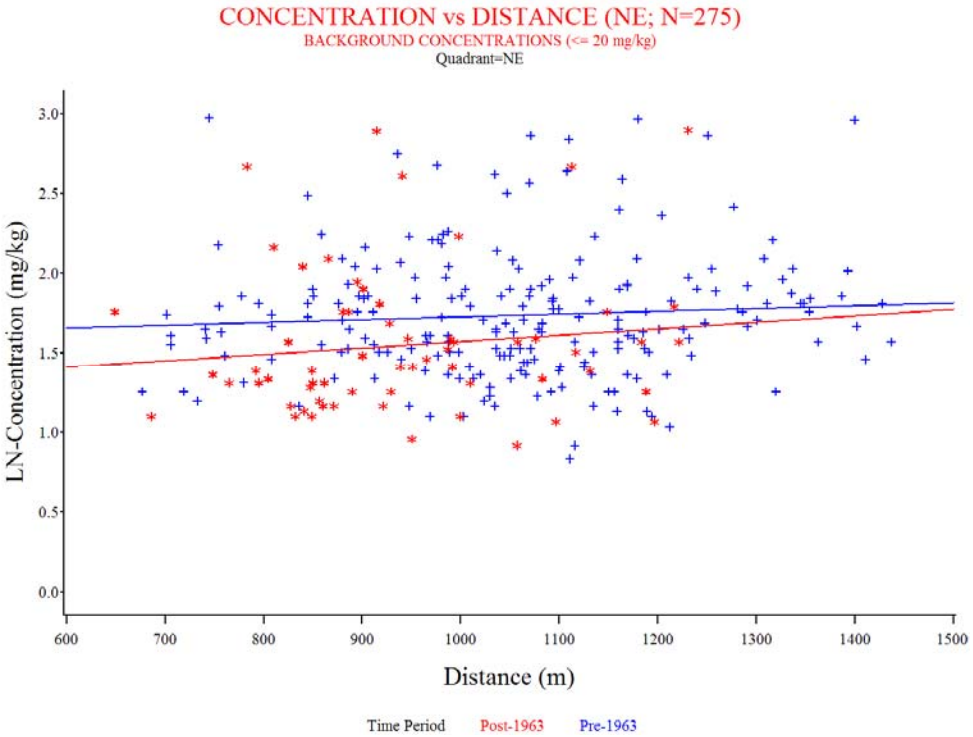

Figure 17. Scatter-plot showing the relationship between background arsenic concentrations and distance from the CMC facility for Pre- and Post-1963 residences, Northeast Quadrant.

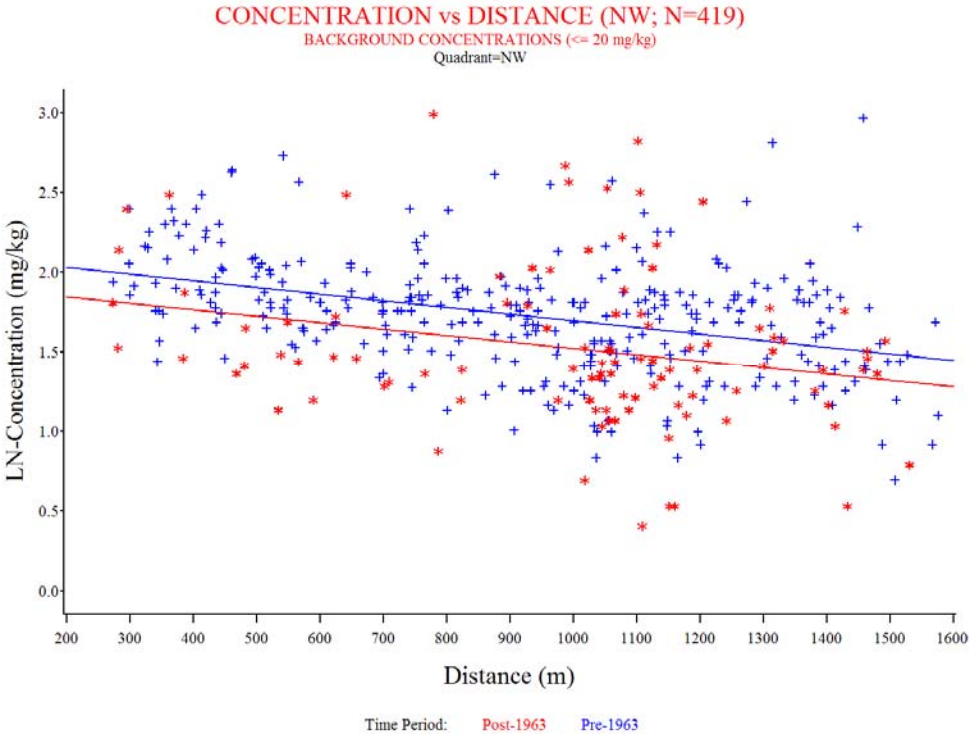

Figure 18. Scatter-plot showing the relationship between background arsenic concentrations and distance from the CMC facility for Pre- and Post-1963 residences, Northwest Quadrant.

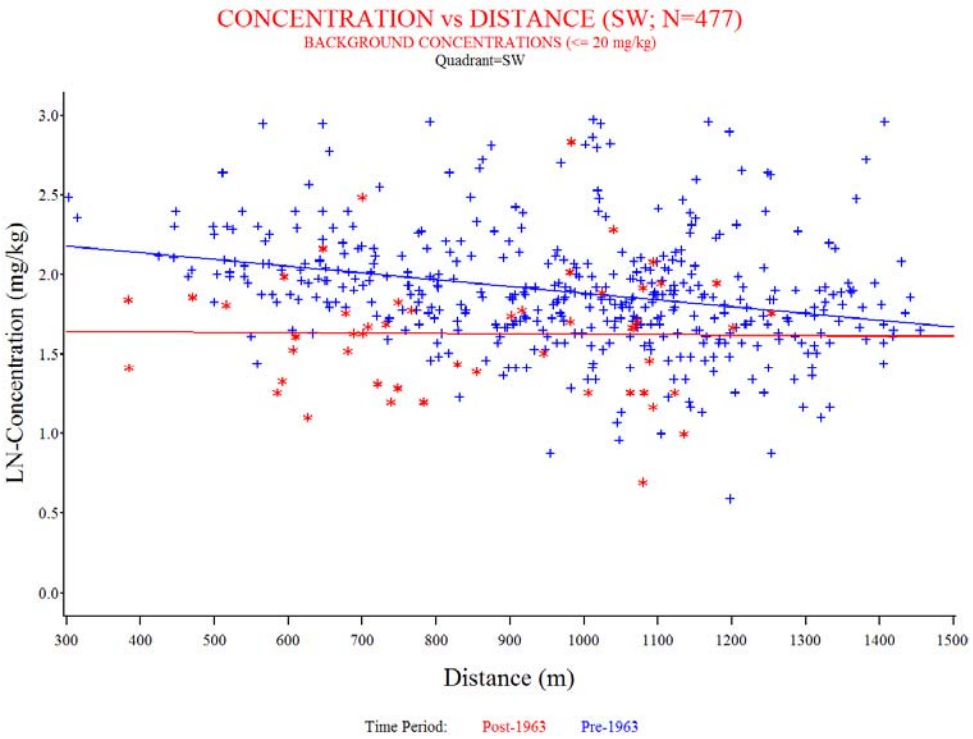

Figure 19. Scatter-plot showing the relationship between background arsenic concentrations and distance from the CMC facility for Pre- and Post-1963 residences, Southwest Quadrant.

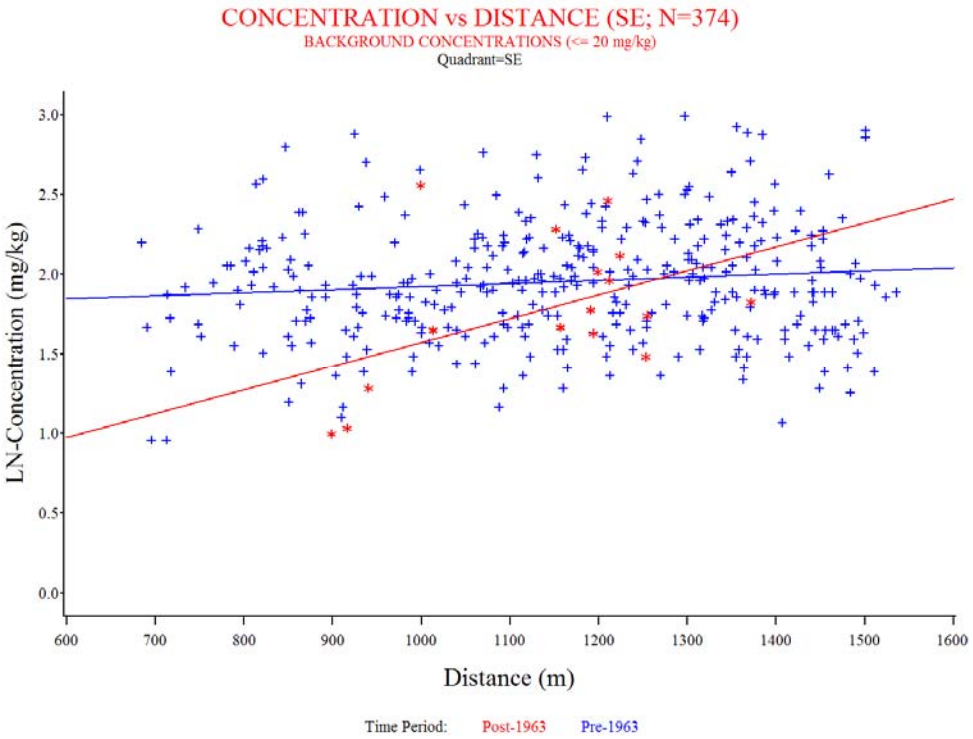

Figure 20. Scatter-plot showing the relationship between background arsenic concentrations and distance from the CMC facility for Pre- and Post-1963 residences, Southeast Quadrant.

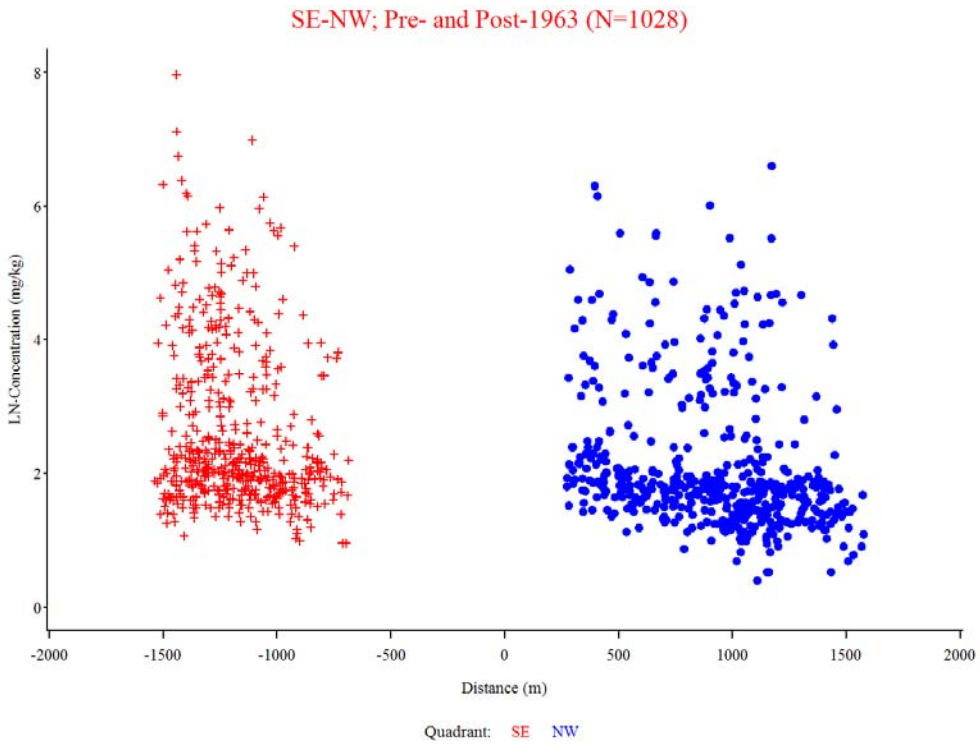

Figure 21. Scatter-plot showing the trend in total arsenic concentrations in residential properties from the Southeast Quadrant to the Northwest Quadrant. Note: very little data exists within 500 m of the site.

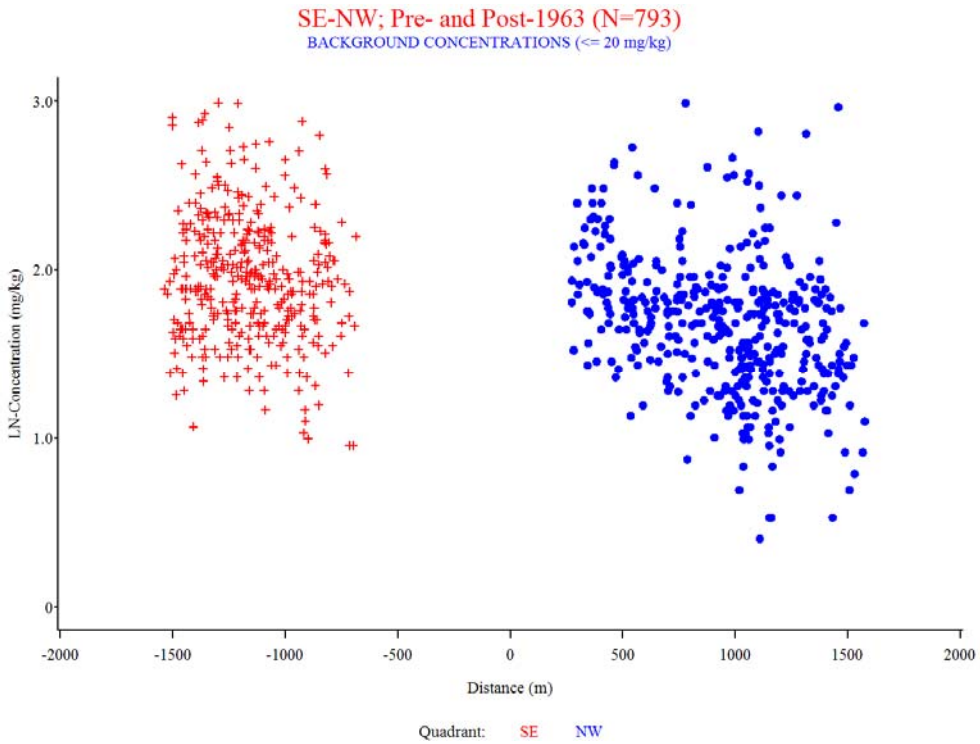

Figure 22. Scatter-plot showing the trend in background arsenic concentrations in residential properties from the Southeast Quadrant to the Northwest Quadrant. Note: very little data exists within 500 m of the site.