New York State Department of Health
Center for Environmental Health

HEALTH CONSULTATION

NYS DOH and ATSDR Response to Comments on:

HEALTH CONSULTATION

Evaluation of Environmental Data Collected in 2000

Abby Street/Hickory Woods Subdivision
City of Buffalo, Erie County, New York
APRIL 30, 2001

April 8, 2004

Prepared under a Cooperative Agreement with
U.S. Department of Health & Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry

In an effort to reduce the costs of printing and postage, please notify us if you wish your name to be deleted from our mailing list or if your address has changed.

New York State Department of Health
Center for Environmental Health
Outreach and Education Unit
Flanigan Square, Room 316
547 River Street
Troy, NY 12180
1-800-458-1158, Ext. 27530
(518) 402-7530

BACKGROUND AND STATEMENT OF ISSUES

This summary was prepared to address comments and questions on the health consultation titled Evaluation of Environmental Data Collected in 2000, Abby Street/Hickory Woods Subdivision, dated April 30, 2001 (ATSDR 2001).

In 2002, the City of Buffalo contracted with a firm to conduct a peer review of the health consultation. The peer review panel consisted of three independent scientists, with expertise in risk assessment, exposure assessment and toxicology. The charge to the peer reviewers was to evaluate whether the approaches used, assumptions made, public health conclusions drawn, and actions recommended are clear, scientifically defensible, and protective of human health. To facilitate that review, the NYS DOH provided the peer reviewers with additional information clarifying exposure assumptions used in the health consultation (see Appendix A). The panel met to discuss the health consultation and the public was invited to attend and provide comments to the panel during the meeting. The peer reviewers responded to or addressed many of the public comments at the peer review public meeting.

The panel's findings were summarized in the "Summary Report of the Meeting to Peer Review the NYS DOH Health Consultation for the Abby Street Residential Neighborhood". The peer review panel concluded that the overall approaches used, assumptions made, conclusions drawn, and public health actions recommended were scientifically sound and appropriately protective given the available data. Many of the peer review comments related to clarity, including process, format, presentation, definition, but did not affect the conclusions of the 2001 Health Consultation.

We also received another set of written comments on the 2001 Health Consultation. They were from faculty at the University of Buffalo's Environment and Society Institute (ESI).

This health consultation is NYS DOH and ATSDR's response to comments on the 2001 Health Consultation. In writing this health consultation, we focused on the major recommendations in the Peer Review Summary Report and the summary of the comments submitted by ESI. However, we also considered the documents in their entirety as well.

DISCUSSION

Summary of Public Health Comments and Responses

Comment 1: Some community health concerns have been addressed, but community members raised additional concerns during the meeting, such as exposures to airborne particulate matter, historical exposures, future exposures associated with remediation and other activities, residents' health status, and subsurface soil exposure. These are valid concerns that should be addressed.

Response 1: As is discussed later in the responses to comments 8, 9, and 10, the soil (and dust) ingestion pathway is the predominant contributor to the contaminant dose when compared to exposures by inhalation of particulate matter. By our estimates (see responses to comments 8, 9, and 10), exposure by the soil ingestion pathway is over several hundred times greater than the inhalation pathway. Thus, the fact that airborne particulates were not directly addressed is unlikely to affect the overall estimate of health risks.

As the peer review panel points out in the Summary Report, interpreting results from sampling of indoor dust, for the purpose of establishing exposures from off-site outdoor sources, is very difficult. In addition to potential outdoor sources of contaminants, there are many indoor sources of contamination (heating sources, smoking, and burning of candles) that make data interpretation difficult.

The air monitoring data for work conducted in the neighborhood or at the adjacent LTV site in the past are too limited to effectively evaluate past exposures. However, deposition of contamination onto soil from previous events would have been detected in the United States Environmental Protection Agency's (EPA) soil sampling and was taken into account by the Health Consultation. All ongoing soil remediation at the adjacent LTV voluntary cleanup site and any future soil remediation within the neighborhood have or will have a community air monitoring requirement to protect residents from exposures to particulate matter (dust), vapors, or odors that may be generated by the work. A community air monitoring plan (CAMP) requires real-time air monitoring for dust and chemical contaminants and recommends common-sense measures (e.g., water misting, smaller work areas, slower truck speeds, temporary work stoppage) to keep airborne releases at a minimum around the work areas. The CAMP also helps confirm that work activities did not spread contamination off-site through the air. Soil cleanups performed under the oversight of the NYS DOH, New York State Department of Environmental Conservation (NYS DEC), and/or the EPA help to ensure that all possible measures are taken to protect nearby residents. The 1999 soil removal from the four residential yards on Abby Street that, according to residents, generated a good deal of dust, and was conducted without state or federal oversight or an approved community air monitoring plan.

The Health Consultation dealt with the subsurface soil contamination based on the potential for exposure. Given the non-volatile nature of the chemicals in the subsurface soil, exposure would come primarily from direct contact. For this exposure to occur, subsurface soil would have to be brought to the surface and be left there. We provided advice for people who wish to limit their exposure to these soils. We could characterize health risks for subsurface soils as if they were at the surface, as requested by the peer review panel, but this characterization will not change the overall public health conclusions. However, such exposures would not normally take place under current conditions unless subsurface soil is brought to the surface.

Comment 2: The goals and limitations of the Health Consultation should be clearly stated, particularly that this is an assessment of environmental data and not a health status assessment.

Response 2: The "Forward" to the Health Consultation (two pages preceding the Table of Contents) discusses the purpose of a Health Consultation. For example, it states that "An ATSDR Health Consultation is not the same thing as a medical exam or a community health study". In future publications, the NYS DOH and ATSDR will include some of this text in the main body of the document to improve communication about the purpose and scope of these documents.

Comment 3: To the extent possible, the environmental sampling and analysis data should be provided in tabular summaries, thus allowing an easier understanding of the scope and distribution of site contaminants. Graphical and other means of presentation might be considered.

Response 3: We agree that tabular summaries and visual displays (e.g., graphs, pie charts, etc.) of the data would help in understanding the document and will try to incorporate these ideas into subsequent documents.

Comment 4: To the extent that natural (e.g., flooding, ponding) or human-derived (e.g., subsurface excavation) processes or activities are believed to increase the potential for human exposure, these exposure scenarios and pathways should be revisited. Additionally, adjacent, off-site (e.g., outside of the Abby Street/Hickory Woods neighborhood proper) migration and transport of contaminants to the neighborhood should be evaluated as to their relevance for increasing human exposure.

Response 4: We considered the potential for occasional exposure to ponding waters resulting from heavy rains or snow melt in the neighborhood. We believe that such occurrences are infrequent and any exposures to these surface waters would be of short duration. See Response 2 for a discussion of the subsurface excavation issue. Additionally, under the NYS DEC's Voluntary Cleanup Program, the environmental consultant for the former owners of the adjacent LTV site developed an Ambient Air Quality Monitoring Program, with input from the NYS DEC and NYS DOH, to determine if the LTV site was releasing contaminants into the air that might blow toward the neighborhood. Air sampling/monitoring was performed over two, five-day periods in July 2000 from five air monitoring stations located along the site perimeter. The locations were chosen based on the anticipated prevailing wind direction (from the southwest) and the location of the residential properties to the east. The results of the air sampling showed that total airborne particulate (dust) concentrations were lower along the eastern (downwind) boundary of the site as compared to the western (upwind) boundary. Railroad activities (vehicles traveling along a railroad access road) along the western boundary appeared to be the cause. The final report, dated September 2000, can be reviewed by contacting the local NYS DEC office at (716) 851-7220.

Comment 5: NYS DOH should provide a discussion of absolute risk (i.e., the risks associated with the levels of contamination measured) versus relative risk (i.e., how the

risks compare to those observed in other locations). This should describe the context under which it is appropriate to compare the risk at a given location to an absolute level of acceptable risk, and the context under which it is appropriate to compare the risk at a location to the background risk or the risk at similar locations.

The basis for relative risk (i.e., how the risks compare to those observed in other locations) comparisons should be transparent. The basis for characterizing risks as "high," "medium," or "low" should be clearly stated.

Response 5: As defined in this comment, absolute risk refers to the numerical estimate of risk for exposure to a specific contaminant measured in an environmental medium (e.g., soil, water, air). Relative risk refers to the comparison of the absolute risk for a specific exposure to that of another exposure. If the environmental medium is soil, for example, we can calculate an estimate of the absolute risk for exposure to levels of arsenic at one location (absolute risk), but we can also compare this to the absolute risk for exposure arsenic in typical soils, which would be an indicator of relative risk.

In the public health consultation, we provided estimates of absolute risk for exposure to contaminants in surface soil whose levels were above typical background levels and/or health-based comparison values. We estimated the absolute risk and provided qualitative descriptors (low, medium or high) to those risks, as described in the appendix of the 2001 Health Consultation (ATSDR, 2001). The estimates of risk include the risks from background exposures (e.g., from levels of the contaminant typically present in soil) in addition to the contamination in excess of background. The commenter appears to be requesting that we make a comparison of the risks we estimated for the contaminant levels found in the Hickory Woods neighborhood to those for background exposures in soil. As this was not provided in the health consultation, the following table shows the estimated cancer risks for typical background levels of four contaminants (aldrin, arsenic, benzo(a)pyrene and dieldrin) found in surface soil in the Hickory Woods neighborhood, assuming the same residential exposure scenario that was used in the document. For comparison, we have also provided the risk estimates for the contaminant levels that were reported in the health consultation. As can be seen in Table 4 of the health consultation, typical background levels in soil are not available for most organic contaminants.

Comparison of Cancer Risks Estimated for Selected Contaminants in Surface Soil at the Hickory Woods Subdivision to the Cancer Risk for their Typical Soil Background Levels

Contaminant	Typical Background Level (mg/kg)*	Cancer Risk	Highest Soil Level Evaluated In Hickory Woods Health Consultation (mg/kg)	Cancer Risk	Average Soil Level Evaluated in Hickory Woods Health Consultation (mg/kg)	Cancer Risk
aldrin	0.001 to 0.05	0.0007 in 100,000 to 0.04 in 100,000	0.36	0.26 in 100,000	0.001	0.0007 in 100,000
arsenic	2 to 20	0.12 in 100,000 to 1.2 in 100,000	41.7	2.5 in 100,000	13	0.79 in 100,000
benzo(a)pyrene	0.1 to 1	0.12 in 100,000 to 1.2 in 100,000	6.2	2.5 in 100,000	1	0.4 in 100,000
dieldrin	0.001 to 0.05	0.0015 in 100,000 to 0.08 in 100,000	9.9	15 in 100,000	0.004	0.006 in 100,000

The basis for characterizing relative risk is discussed in Appendix E of the 2001 Health Consultation. The following is an excerpt from Appendix E.

Increased cancer risks were estimated by using site-specific information on exposure levels for the contaminant of concern and interpreting them using cancer potency estimates derived for that contaminant by the EPA or, in some cases, by the NYS DOH. The following qualitative ranking of cancer estimates, developed by the NYS DOH was then used to rank the risk from very low to very high. For example, if the qualitative descriptor was “low”, then the excess lifetime cancer risk from that exposure is in the range of greater than one per million to less than one per ten thousand. Other qualitative descriptors are listed below:

Excess Lifetime Cancer Risk

Risk Ratio	Qualitative Descriptor
equal to or less than one per million	very low
greater than one per million to less than one per ten thousand	low
one per ten thousand to less than one per thousand	moderate
one per thousand to less than one per ten	high
equal to or greater than one per ten	very high

An estimated increased excess lifetime cancer risk is not a specific estimate of expected cancers. Rather, it is plausible upper bound estimate of the probability that a person may develop cancer sometime in his or her lifetime following exposure to that contaminant.

We will review the text of the appendix for clarity and will include additional information in the body of subsequent documents for increasing readability.

Comment 6: The rationale for the selection of comparison neighborhoods for the assessment of relative risk (i.e., has the risks compare to those observed in other locations) should be clearly presented and justified. This justification should in part be based on comparison of the historical as well as current activities in both neighborhoods to demonstrate that the comparison neighborhood is not itself a contaminated site.

The use of risk comparisons based on background levels of contaminants, or on levels in other neighborhoods, should follow from a clear statement of policy regarding the nature of "acceptable" risk.

Response 6: Chemical levels from other neighborhoods in the area (e.g. Seneca-Babcock, Mineral Springs) were used to help understand local background levels of chemicals. Data on comparable neighborhoods are limited. We used the Seneca-Babcock and Mineral Springs neighborhood data because the data were available and the neighborhoods are nearby. Urban soils are affected by surrounding land use (i.e., industry) and other sources of contamination (i.e., lead-based house paint). In our 1998 report on the two neighborhoods, we indicate that the Seneca-Babcock neighborhood has probably been affected by historic air emissions from automobile exhaust, incinerators,

and burning of fossil fuels to heat homes and run local industries. The Hickory Woods neighborhood likewise has been affected by similar historic airborne emissions as well as using dirty fill.

A discussion of "acceptable risk" is included in Appendix E of the Health Consultation. There is general consensus among the scientific and regulatory communities on what level of estimated excess cancer risk is acceptable. An increased lifetime cancer risk of one in one million or less is generally not considered a significant public health concern. Health comparison values for cancer health effects are set at this level of risk. Cancer risks greater than one per ten thousand usually trigger actions to lower exposures. For noncancer effects, the health comparison value is set at the level of the reference dose, which is an estimate (with uncertainty spanning perhaps an order of magnitude or more) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious noncancer effects during a lifetime. Exposures below the level of the reference dose are generally not considered a significant public health concern.

Comment 7: There should be a further evaluation (e.g., researching values in the U.S. Environmental Protection Agency's [EPA's] Part *503* Technical Support Document) of the crop uptake modeling to determine whether such a pathway is a significant source of risk**.**

Response 7: The NYS DOH's evaluation of vegetable uptake includes the resource identified by the peer review panel. We agree that vegetable ingestion could be a source of additional exposure, and accordingly, we evaluated contaminant levels in known garden areas using the exposure parameters and uptake factors outlined in the Health Consultation. We also provided additional clarification to the peer reviewers in February 2002 (see Appendix A).

Comment 8: There should be an evaluation of the aggregate (sum total) risk at least across pathways within an exposure route, if not across exposure routes. For example, for ingestion, risk should be added for inadvertent ingestion of soil and dust and the intake from garden vegetables.

Response 8: See below.

Comment 9: There should be more attention paid to the inhalation route of exposure, including a quantitative evaluation of the effect of offsite wind-blown dust exposure to total risk and an evaluation of the impact of soil-derived household dust inhalation exposure to total risk.

Response 9: See below.

Comment 10: In the Health Consultation report, exposure to surface soils through ingestion is the only pathway considered in developing health comparison values for contaminants. Dermal contact and inhalation of particulates from surface soils, and all exposure pathways for subsurface soils and vapors were not considered quantitatively in

the Health Consultation. NYS DOH should provide better quantitative justification for why these exposure pathways were neglected and provide evidence that this decision was warranted.

Response to Comments 8, 9, and 10: In the Health Consultation, we focused on the evaluation of the soil ingestion pathway because in our experience, this pathway is the predominant contributor to the contaminant dose when compared to exposures via the inhalation and the dermal routes. In cases where pathways within an exposure route could contribute significantly to the contaminant dose, we did evaluate the aggregate risk. For example, within the oral exposure route, we evaluated the aggregate risk for exposure to contaminants in known garden areas from both soil/dust ingestion and ingestion of homegrown produce.

The NYS DOH's risk assessment of chemicals in neighborhood soil includes an indoor dust component. Although we could provide additional information about possible exposure to neighborhood soil based on inhalation, the incidental ingestion exposure route tends to dominate total exposure. The data on off-site wind-blown dust are inadequate for a quantitative health risk assessment.

In general, soil ingestion will lead to a larger dose than inhalation or dermal exposure. We agree that other exposure routes should also be evaluated if they are likely to contribute significantly to the potential health risks.

There is limited chemical-specific information on the relative contribution of the inhalation of suspended soil particulates to the total contaminant dose from soil. However, the available estimates indicate that the soil ingestion pathway dominates over the pathway for inhalation of particulates. For example, an estimate of the contaminant dose from inhalation of suspended particulates can be made assuming that at a soil contaminant concentration of 1 milligram per kilogram of soil (mg/kg).

•The concentration of particulate matter in air is equal to the current annual PM_{10} standard (50 micrograms per cubic meter (mcg/m^3)) and this concentration is in the breathing zone (the annual average PM_{10} level for the Buffalo area ranged from 19 to 29 mcg/m^3 from 1989 to 1998 (NYS DEC, 2000)).
•A 13.2 kg child (about 29 pounds) inhales 10 cubic meters of air per day.
•One half of the suspended particulate matter is from soil and 75% of this is retained in the lungs (Hawley, 1985).
•The retained fraction is completely absorbed (Hawley, 1985).

The contaminant dose from inhalation of suspended particulates estimated in this manner is about 800 times smaller than the contaminant dose from ingestion at the same soil concentration, assuming a 13.2 kg child ingests 160 mg of soil per day. This soil ingestion rate corresponds to the soil ingestion rate used in health consultation, but with no time-weighting such that an appropriate comparison with the contaminant dose from inhalation of suspended particulates can be made.

A comparison of the relative dermal contribution to the contaminant dose from 1 mg/kg of benzo(a)pyrene (one of the primary contaminants found at Hickory Woods) can also be made using guidance for dermal exposure from the United States Environmental Protection Agency, and assuming that

•A 13.2 kg child is covers his hands and arms in soil while playing.
•The body surface area covered is 1050 cm^2.
•The soil to skin adherence factor is 0.2 mg/cm^2 (US EPA, 2001).
•The dermal absorption factor for benzo(a)pyrene is 0.13 (US EPA, 2001).

The contaminant dose from dermal absorption of benzo(a)pyrene estimated in this way is about six times smaller than the contaminant dose from ingestion at the same soil concentration. Again, the dose from soil ingestion predominates.

Thus, inhaled suspended soil particulates and dermal exposure add a small portion to the total contaminant dose compared to soil ingestion; not including these pathways underestimates exposure and risk to a small amount, but does not change the risk characterization.

References for Response

Hawley, J.K. 1985. Assessment of health risk from exposure to contaminated soil. Risk Analysis 5: 289-301.

NYS DEC. 2000. 2000 Annual New York State Air Quality Report Ambient Air Monitoring System. Division of Air Resources. http://www.dec.state.ny.us/website/dar/reports/00annrpt/00_data.pdf.

US EPA. 2001. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Interim. Office of Emergency and Remedial Response. Washington, DC.

Comment 11: There should be a more transparent presentation of the assumptions in the risk assessment. The clarification document supplied by NYS DOH has helped quite substantially in this area and should be included in future iterations of the Health Consultation.

Response 11: We provided the peer review panel with a written clarification document that can be found in Appendix F of the March 2002 Peer Review Summary Report and is attached as AppendixA. We will work on improving the clarity and transparency of these documents.

Comment 12: An alternative risk strategy to look at identifying highly exposed individuals should be developed. Two methods offered are conducting a sensitivity

analysis using the existing data for the exposure assessment and collecting additional soil samples to delineate the extent of contamination at selected "hot spots."

Response 12: NYS DOH worked with EPA to conduct additional sampling at two of the "hot spots" identified in the Health Consultation in order to delineate the extent of contamination as recommended by this comment. These two "hot spots" (locations of contaminants elevated above typical background concentrations) were eliminated by EPA in 2003 through limited soil excavation, proper off-site disposal, and yard restoration. One additional "hot spot" located 24 to 29 inches beneath the ground surface was not resampled because the homeowner refused access to EPA.

In addition, EPA sampled twenty residential yards adjacent to Boone Park in August 2001 to investigate the potential that arsenic contaminated surface soils found on this City park migrated via surface water runoff, fugitive dust, or human transport onto adjacent properties. The results from 17 yards indicated an average arsenic level consistent with the range of average arsenic levels typically found in New York State soils (2 – 20 milligrams per kilogram). The results from the other three yards were only slightly higher, and we determined that exposure and risk for cancer health effects at the levels found is similar to that of typical soils in New York State. We advised EPA that no further sampling was necessary around the park.

Comment 13: The toxicological mechanisms of action should be discussed. Great detail is not needed, simply a contextual discussion of dose- and route-specific considerations.

Response 13: The Health Consultation was written using methods and practices similar to those used in other health consultations we have prepared under our cooperative agreement with ATSDR. In general, we do not include a discussion of mechanism of action for each contaminant of concern. This would greatly increase the size and technical complexity of the document, and we want to make the document as easy to read as possible. For the chemicals that are evaluated in the Health Consultation, we do use chemical and exposure route-specific dose response and toxicity information to arrive at conclusions concerning the potential health risks posed by contaminants at the site. In the future we will consider including mechanism of action information on a case by case basis as we explore ways to improve the documents.

Comment 14: NYS DOH should discuss the potential for interactions (additivity, synergy, and antagonism) or lack thereof among the contaminants, as appropriate.

Response 14: We agree that a discussion of possible interactions among contaminants would be a useful addition to the Health Consultation. We considered the potential interactions among contaminants that were detected above health comparison values in residential surface soil [e.g., arsenic, cadmium, PAHs (as benzo(a)pyrene equivalents), aldrin and dieldrin]. As with most environmental contaminants, definitive information on their potential additive, synergistic and antagonistic interactions is limited. Based on the available information for these chemicals, we would not expect there to be significant

synergistic interactions because of the differences in mechanisms of action for causing cancer and the lack of commonality in their noncancer toxic endpoints.

Comment 15: There should be limited indoor sampling of dusts to identify the impact of outdoor particulate sources on indoor concentrations. This should be considered in the context of approaches that can distinguish indoor and outdoor sources, possibly through "fingerprinting" concentrations of polycyclic aromatic hydrocarbons (PAHs) (e.g., identifying ratios between various PAHs).

Response 15: Interpreting results from sampling of indoor dust, for the purpose of establishing exposures from historic off-site outdoor sources, is very difficult. In addition to potential outdoor sources of contaminants, there are many indoor sources of contamination (heating sources, smoking, and burning of candles) that make data interpretation difficult. Such sampling is beyond the scope of this Health Consultation. However, routine housekeeping practices generally reduce the amount of dust available for exposure.

Comment 16: The peer reviewers recommended identifying sources of uncertainty, in particular the largest sources and their relative importance to the risk calculations.

Response 16: The sources of uncertainties in the Hickory Woods Health Consultation are the same as those encountered in most evaluations of health risks from exposure to environmental contaminants. Many sources of uncertainty are not site-specific and include:

- The adequacy of the environmental sampling
- The selection of exposure parameters to estimate contaminant doses
- The assumptions involved in deriving the cancer and noncancer toxicity values that were used to develop the quantitative estimates of risk.

Our health consultations typically do not include a quantitative analysis of the relative magnitude of the sources of uncertainties. However, our interpretation of the environmental sampling data and our choice of exposure parameters and toxicity values are reasonably conservative, and therefore we do not expect they will result in an underestimation of the health risks. For example, in several instances, the cancer risk estimates were based on a 95% upper bound on the estimate of carcinogenic potency for the contaminant, as well as the highest detected contaminant level in surface soil, using exposure parameters that would be unlikely to underestimate contaminant intake.

We agree that a general description of the sources of uncertainty should be included in health consultations. We will consider revising the general description of our methods in the Appendix to include such a discussion in future documents.

Comment 17: There should be an interviewer-administered health survey designed to minimize subjectivity and identify physician-diagnosed conditions, with particular emphasis on thyroid problems.

Response 17: The exposure survey that the NYS DOH conducted (the Exposure Survey) was provided to residents by mail, and telephone interviews were conducted with households that did not return completed surveys by mail. In response to the apparently elevated number of thyroid conditions that were reported by residents of Hickory Woods in the Exposure Survey, the NYS DOH conducted a follow-up health survey. The purpose of the follow-up was to gather additional information from the ten individuals who reported thyroid conditions to evaluate possible explanations for the thyroid problems such as predisposing conditions or family history. By learning more about the specific diagnoses, factors in common among the group might suggest whether there was a need for further study.

After a review of possible risk factors for thyroid conditions, a questionnaire was developed. The households with individuals reporting thyroid problems were contacted by telephone and asked to complete the questionnaire over the telephone. The interviewer asked about their thyroid condition, medical history, family medical history, residential history, and general health. Medical records were also requested from the individual's physician, with the individual's consent. Information from individuals who chose to participate and from the medical records received has been evaluated and a draft summary of the findings for the group as a whole is currently being drafted. To protect the identities and privacy of health information for participants in the follow-up, no individual-level information will be provided. When the summary of findings is completed, a public comment draft of the summary of the findings will be provided first to the participants, and then to the community and other stakeholders. We expect the draft of the summary to be available for public comment in early 2004.

Comment 18: There should be an evaluation of all available blood lead data for the neighborhood residents.

Response 18: The Health Consultation reviewed children's blood lead data (for children less than six years old) that were reported to the NYS DOH during the time period January 1, 1994 to December 16, 2000. Although not reported in the Health Consultation, the NYS DOH also reviewed the data for people ages 6-18 years. Of the 12 people ages 6-18 years screened in the Hickory Woods neighborhood, none had elevated (greater than or equal to 10 micrograms per deciliter) blood lead levels.

Comment 19: The Environment and Society Institute (ESI) commends the NYS DOH and EPA for collecting a significant amount of spatial data from the Hickory Woods neighborhood. ESI understands that this is a challenging and costly effort. To obtain the maximum benefit from this extensive data collection effort, NYS DOH, or some other agency as directed by NYS DOH, should perform and publish a more formal analysis of these data and other data collected earlier, with a focus on statistical and geographical trends.

Response 19: On March 21, 2003, Dr. Joseph Gardella of the University of Buffalo's Environment and Society Institute presented his Hickory Woods Geographic Information

Systems Project: "Analysis of Chemical Data in Hickory Woods and Surrounding Environs" to NYS DOH staff. A significant portion of Dr. Gardella's analysis (dated February 4, 2002) appears in the March 2002 Peer Review Summary Report. The updated version (dated March 21, 2003) includes additional spatial analyses using EPA soil sampling data and data from samples collected by University of Buffalo students participating in Dr. Gardella's project. We reviewed Dr. Gardella's analysis and did not identify any other actions that need to be taken other than those already completed by the EPA or recommended for some vacant lots and for Boone Park. In addition, in preparing the April 2001 Health Consultation, NYS DOH staff looked for geographical trends in the data from soil samples taken across the neighborhood and performed a statistical evaluation of the data for patterns in the distribution of lead and benzo(a)pyrene in soils. Not all of the analyses were included in the Health Consultation because we found no particular trends.

Comment 20: For the exposure scenario evaluated in the Health Consultation (ingestion of surface soils), NYS DOH used a number of assumptions to develop the health comparison values. NYS DOH should provide explicit justification for these assumptions and report how they compare to default values published by EPA for analysis of residential exposure.

Response 20: See combined Response 8, 9, and 10, especially the enclosed written clarification document we prepared for the peer review panel, at their request, that also appears in the March 2002 Peer Review Summary Report.

Comment 21: The findings of the exposure survey suggest that a significant portion of residents engage in gardening and/or other activities that might involve exposure to subsurface soils or higher than average exposure to surface contamination. These non-typical scenarios should be explicitly analyzed.

Response 21: See Response 1. In the Health Consultation, we sampled all of the known garden areas that were identified by citizens and evaluated the risks for exposure to the contaminants by soil ingestion and ingestion of homegrown produce.

Comment 22: The surface soil contamination levels in Hickory Woods were compared to residential areas including the Seneca-Babcock neighborhood where NYS DOH health advisories have been issued. The use of heavily industrially polluted Seneca-Babcock neighborhood as a standard or even typical urban neighborhood is an extremely inappropriate choice for comparisons with levels of contaminants in Hickory Woods samples.

Response 22: We agree with ESI that the choosing and use of comparison neighborhoods must be done carefully and differences between neighborhoods acknowledged. We discuss this further under Response 7.

Comment 23: Throughout the Health Consultation, the term "average" is frequently used to refer to soil concentrations and exposure to contaminants. Relevant aspects of the

report should be reworked to clarify the meaning of this term in a particular context, and discuss the magnitude and significance of any difference between "average" and "maximum" exposure scenarios. Effort should be directed toward assessing the geographic distribution of both contaminant concentrations and calculated health risk.

Response 23: Soil data are averaged to evaluate long-term (chronic) exposure to chemicals in the surface soil because over a long time period people could be exposed to chemicals throughout their yard or neighborhood, not from just one location. However, the Health Consultation also reported what the estimated health risks would be if the highest contaminant levels were considered representative of exposure. We also looked at the data from surface soil samples to determine whether the levels of chemicals were a concern for short-term (acute) health effects and the evaluation of potential acute health effects were considered in the conclusions and recommendations presented in the Health Consultation.

Comment 24: The health outcome data were limited to lead screening available for children only under six years of age. Children over age six years have much higher exposure potential to outdoor soils contaminated with lead on their own residential properties, in play areas and in the Boone Park Playground. In addition, the health outcome data obtained in the exposure survey was based on an open-ended question about health concerns which was not designed or intended to be used for health-outcome assessment. Therefore, any comparisons to national or normative data are inappropriate.

Response 24: See Response 18 for the results of our review of blood lead data for children 6 years old and older. In regard to health concerns reported in the Exposure Survey, the cover letter provided to residents with the Exposure Survey stated that the exposure survey would help in planning an appropriate health study, if the sampling results indicated the need for a health study. While the sampling results did not indicate the need for a follow-up environmental health study, the survey responses were evaluated in order to see if there was a clearly unusual pattern of reported health problems that warranted additional follow-up. A rank-order listing of health conditions reported by Hickory Woods residents was compared with a similar ranking of health conditions from a national sample. The results of the Exposure Survey suggest that there may be more thyroid conditions, described as hypothyroidism or underactive thyroid, among Hickory Woods residents participating in the survey than among the general population. The limitations of this comparison were described in the Summary of Exposure Survey Responses, Appendix C of the Health Consultation. This rank ordering was used as a screening tool to identify any obviously unusual pattern needing additional follow-up, not as an analysis showing definitive comparative findings. As stated in the Summary, these results cannot show conclusively whether or not particular health problems are known to be elevated in the Hickory Woods community.

Comment 25: The NYS DOH should reconsider their process of public input and public comment in the construction of this Health Consultation. No dedicated public meetings were held before it was issued, it was not issued in Draft, no opportunity for organized and reasoned response was apparent, despite other Health Consultations where such

process was respected. In this particular case, with an organized and dedicated homeowners group, interested participants from across the city, the DEC, EPA, Buffalo Urban Renewal Authority and the City of Buffalo all involved and interested players, it would be beneficial to all stakeholders to have an open and engaged process.

Response 25: The NYS DOH worked with the Coalition of Impacted Neighborhoods (COIN) of Western New York to address concerns expressed by residents and environmental groups about the Department's outreach process as it relates to environmental health issues. COIN includes representatives of the Hickory Woods Homeowners' Association and the University of Buffalo's Environment and Society Institute. In response to these concerns, the NYS DOH Center for Environmental Health (CEH) and the NYS DOH Cancer Surveillance Program (CSP) developed a document that describes our approach to outreach on environmental health issues. This document outlines specific recommendations that address many of the concerns brought to our attention. These recommendations are being implemented statewide. The document is available on the Department's website and will be available at future public meetings and availability sessions in which CEH and CSP participate. The document is considered a "living" document that may be revised over time to reflect comments received from the public and NYS DOH staff involved in outreach.

Comment 26: The overall approaches used, assumptions made, conclusions drawn, and public health actions recommended are scientifically sound and appropriately protective given the available data. However, it is unclear whether additional actions may be necessary for the protection of public health after NYS DOH addresses the reviewers' other recommendations.

Response 26: We believe there is no need for additional actions other than those already recommended in the Health Consultation.

CONCLUSIONS AND RECOMMENDATIONS

The NYS DOH and ATSDR concluded that the actions recommended in the 2001 Health Consultation, including those already taken and those planned for Boone Park, were appropriate.

The NYS DOH and ATSDR evaluated the general format of health consultations and public health assessments that we write and agreed with many of the comments about format and clarity. We have been working to improve the format and data presentations to make them more readable and informative to the public.

REFERENCE

Agency for Toxic Substances and Disease Registry (ATSDR). 2001. Health Consultation Evaluation of Environmental Data Collected in 2000. Abby Street/Hickory Woods Subdivision, City of Buffalo, Erie County, New York. U.S. Department of Health and Human Services, Public Health Service. Atlanta, Georgia

FOR MORE INFORMATION

Staff have spoken with many residents of Hickory Woods over the last two years, by telephone and in person. NYS DOH staff with expertise in environmental exposures, toxicology, and epidemiology, as well as nurses and our environmental health physician have been, and continue to be, available to answer community questions about their health in person, via E-mail (cehedu@health.state.ny.us), or by telephone. If you have questions about this Response to Comments or other public health-related matters relating to Hickory Woods, you may contact NYS DOH staff Mark VanValkenburg toll-free at 1-800-458-1158, extension 27860 or Cameron O'Connor of the NYS DOH Western Regional Office at 716-847-4385.

PREPARERS OF
RESPONSE TO COMMENTS

Mark E. VanValkenburg
Public Health Specialist
Bureau of Environmental Exposure Investigation
New York State Department of Health

Thomas B. Johnson
Research Scientist
Bureau of Toxic Substance Assessment
New York State Department of Health

Elizabeth Lewis-Michl
Research Scientist
Bureau of Environmental and Occupational Epidemiology
New York State Department of Health

Donald W.R. Miles
ATSDR Grant Coordinator
Bureau of Environmental Exposure Investigation
New York State Department of Health

Nancy K. Kim
Director, Division of Environmental Health Assessment
New York State Department of Health

Agency for Toxic Substances and Disease Registry

ATSDR Regional Representative
Arthur Block
Senior Regional Representative
Region 2
Office of Regional Operations

ATSDR Technical Project Officer
Greg Ulirsch
Environmental Health Engineer
Superfund Site Assessment Branch
Division of Health Assessment and Consultation

CERTIFICATION

The Response to Comments on the 2001 Health Consultation for the Abby Street/Hickory Woods Subdivision site was prepared by the New York State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time.

_____

Technical Project Officer, SPS, SSAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this Response to Comments and concurs with its findings.

_____

Acting Chief, SSAB, DHAC, ATSDR

APPENDIX A

Responses to Questions of Clarification on the
Public Health Consultation for the
Abby Street/Hickory Woods Subdivision

Center for Environmental Health
Bureau of Toxic Substance Assessment
New York State Department of Health

1. Soil Ingestion Rate, Frequency and Duration of Exposure

The exposure assumptions for the comparison values and estimates of risk are found in the definitions of Table 4 in the health consultation document. They are provided here with some additional detail.

To evaluate noncancer effects, we assumed a 13.2 kg child ingests 80 milligrams of soil per day, 5 days per week, 6 months per year and 40 milligrams of indoor dust with an outdoor soil source per day, 7 days per week, 12 months per year. The body weight is taken from the US EPA Exposure Factors Handbook (US EPA, 1999). The exposure duration and frequency are selected to reflect a reasonably conservative yet typical estimate of these parameters for children at a residential property in New York State. The soil ingestion rates for children are based on studies by Calabrese et al. (1989) and Davis et al. (1990).

The cancer comparison values assume a time-weighted average body weight of 47.7 kg and a time-weighted average soil ingestion rate of 19.3 milligrams per day for nine different age classes up to age 30. The body weights for each age class were taken from the US EPA Exposure Factors Handbook (US EPA, 1999). Children through age five are assumed to have the same soil ingestion rate as described for the noncancer scenario. For ages six through age 30, the soil ingestion rate is 82 mg/day (based on Hawley (1985) and Calabrese et al. (1990)) for two days per week, for five months per year.

2. Duration of Exposure at the Site

In estimating the cancer risk, we assumed an exposure duration of 30 years (US EPA, 1999). Noncancer risks, which generally are not averaged over a lifetime (i.e., the averaging time equals the exposure duration), were evaluated for a 13.2 kg child exposed as described in Item 1(above).

3. Sources of Cancer Potency Factors

Cancer potency factors for the following contaminants were obtained from the US EPA's Integrated Risk Information System (US EPA, 2001a):

arsenic
aldrin
alpha-BHC
beta-BHC
bis(2-ethylhexyl)phthalate
alpha-chlordane
gamma-chlordane
2,4-dinitrotoluene
2,6-dinitrotoluene
heptachlor
heptachlor epoxide
hexachlorobenzene
N-nitrosodiphenylamine

The cancer potency factors for gamma-BHC and carbazole were obtained from the US EPA's Health Effects Assessment Summary Tables (US EPA, 1997).

Cancer potencies for Aroclor 1254and Aroclor 1260 were derived by the National Center for Environmental Assessment (US EPA, 1996).

The New York State Department of Health developed the cancer potency factors for benzo(a)pyrene (10 $(mg/kg/day)^{-1}$), 4,4'-DDD (0.33 $mg/kg/day)^{-1}$), 4,4'-DDE (3.3 $mg/kg/day)^{-1}$), 4,4'-DDT (3.5 $mg/kg/day)^{-1}$) and dieldrin (38 $mg/kg/day)^{-1}$).

4. Sources of Reference Doses

Reference doses for the following contaminants were obtained from the US EPA's Integrated Risk Information System (US EPA, 2001a):

aluminum
antimony
arsenic
barium
beryllium
chromium
cyanide
manganese
mercury
nickel
selenium
silver
zinc

acenaphthene
anthracene
Aroclor 1254
fluoranthene
fluorene
naphthalene
pyrene
acetophenone
aldrin
benzaldehyde
gamma-BHC
1,1'-biphenyl
bis(2-ethylhexyl)phthalate
butylbenzylphthalate
caprolactam
alpha-chlordane
gamma-chlordane
4,4'-DDT
di-n-butylphthalate
2,4-dichlorophenol
dieldrin
diethylphthalate
2,4-dimethylphenol
2,4-dinitrophenol
2,4-dinitrotoluene
endosulfan I
endosulfan II
endrin
heptachlor
heptachlor epoxide
hexachlorobenzene
methoxychlor
nitrobenzene
phenol

The reference doses for copper, vanadium, 2,6-dinitrotoluene, di-*n*-octylphthalate, 4-methylphenol and 2-nitroaniline were obtained from the US EPA's Health Effects Assessment Summary Tables (US EPA, 1997).

Reference doses for cobalt, iron, thallium and dibenzofuran were derived by the US EPA's National Center for Environmental Assessment (US EPA, 2001b).

The New York State Department of Health developed the reference dose for cadmium (7E-4 mg/kg/day).

Surrogates were used for 21 chemicals lacking a specific reference dose, as indicated in the footnotes in Table 4 of the health consultation document.

5. Benzo(a)pyrene Relative Potency Factors

Relative potency factors for the seven carcinogenic polycyclic aromatic hydrocarbons (PAHs) were the same as those derived by the US EPA in their provisional guidance document (US EPA, 1993), with the exception of chrysene, for which we used a relative potency factor of 0.01 instead of 0.001.

6. Calculated Risk Values

The following table shows the toxicity values used for the primary contaminants evaluated in the health consultation. This is followed by sample calculations of comparison values and estimates of risk.

Toxicity Values for the Selected Chemicals Evaluated in the Abby Street/Hickory Woods Subdivision Public Health Consultation

Chemical	Reference Dose (mg/kg/day)	Reference	Cancer Potency Factor $(mg/kg/day)^{-1}$	Reference
arsenic	3E-4	IRIS	1.5E+0	IRIS
cadmium	7E-4	NYS DOH [1]		
aldrin	3E-5	IRIS	1.7E+1	IRIS
bis(2-ethylhexyl)phthalate	2E-2	IRIS	1.4E-2	IRIS
dieldrin	5E-5	IRIS	3.8E+1	NYS DOH [2]
hexachlorobenzene	8E-4	IRIS	1.6E+0	IRIS
acenaphthene	6E-2	IRIS		
acenaphthylene	6E-2	---[a]		
anthracene	3E-1	IRIS		
benz(a)anthracene	3E-2	---[b]	1.0E+0	---[c]
benzo(a)pyrene	3E-2	---[b]	1.0E+1	NYS DOH [3]
benzo(b)fluoranthene	3E-2	---[b]	1.0E+0	---[c]
Benzo(g,h,i)perylene	3E-2	---[b]		
benzo(k)fluoranthene	3E-2	---[b]	1.0E-1	---[c]
chrysene	3E-2	---[b]	1.0E-1	---[c]
dibenz(a,h)anthracene	3E-2	---[b]	1.0E+1	---[c]
fluoranthene	4E-2	IRIS		
fluorene	4E-2	IRIS		
indeno(1,2,3-cd)pyrene	3E-2	---[b]	1.0E+0	---[c]
naphthalene	2E-2	IRIS		
phenanthrene	3E-2	---[b]		
pyrene	3E-2	IRIS		

Footnotes

[a] Based on acenaphthene.

[b] The oral reference dose for pyrene may be used as a surrogate for polycyclic aromatic hydrocarbons (PAHs) that do not have a chemical specific reference dose.

[c] The relative potency factors applied to carcinogenic PAHs other than benzo(a)pyrene are: 0.1 for benz(a)anthracene, 0.1 for benzo(b)fluoranthene, 0.01 for benzo(k)fluoranthene and chrysene, 1.0 for dibenz(a,h)anthracene and 0.1 for indeno(1,2,3-cd)pyrene.

References

IRIS: On-line Integrated Risk Information System Database (http://www.epa.gov/iris/).

NYS DOH [1]: New York State Department of Health. 1988. Risk Reference Dose Documentation: Cadmium. Albany, NY: Bureau of Toxic Substance Assessment.

NYS DOH [2]: New York State Department of Health. 1984. Recommended Surface Ambient Water Quality Criteria Fact Sheets. Albany, New York: Bureau of Toxic Substance Assessment.

NYS DOH [3]: New York State Department of Health. 1999. Technical Support Document. Proposed Oral Cancer Potency Factor for Benzo(a)pyrene. Relative potency factors are applied to carcinogenic PAHs other than benzo(a)pyrene.

The noncancer soil comparison values are calculated from reference doses using the specific exposure assumptions summarized in Item 1 (above). The time-weighted soil/dust ingestion rate is calculated as follows:

$$80\ \frac{mg}{day} \times \frac{5\ days}{7\ days} \times \frac{180\ days}{365\ days} + 40\ \frac{mg}{day} \times \frac{7\ days}{7\ days} \times \frac{365\ days}{365\ days} = 68.2\ \frac{mg}{day}$$

The comparison value for arsenic, for example, which has a reference dose of 0.0003 mg/kg/day, is calculated as follows:

$$0.0003\ mg/kg/day \times 13.2\ kg \times \frac{day}{68.2\ mg_{soil}} \times 10^6\ \frac{mg_{soil}}{kg_{soil}} = 58\ \frac{mg}{kg_{soil}}$$

To evaluate the noncancer risks, a ratio of the soil sampling result to the comparison value is calculated for each chemical. This process is equivalent to calculating a hazard index, or the ratio of the estimated contaminant intake to the reference dose. The value of the hazard index is then given a qualitative descriptor for noncancer risk, as described in Appendix E of the health consultation. In the health consultation, the average arsenic level detected in residential surface soil was 13 mg/kg. The hazard index is calculated as follows:

$$\text{hazard index} = \frac{\text{soil concentration}}{\text{comparison value}} = \frac{13\ mg/kg}{58\ mg/kg} = 0.22$$

Based on the categories in Appendix E of the health consultation, the qualitative descriptor for noncancer risk would be minimal.

The calculation of cancer comparison values is similar to that of noncancer comparison values, except that the one-in-one-million risk dose is used instead of the reference dose, and the exposure parameters are adjusted to reflect exposure over the first 30 years of a person's life as described in Item 1 (above). The cancer comparison value for benzo(a)pyrene, for example, is calculated from its one-in-one-million risk dose (1E-7 mg/kg/day) as follows:

$$1E\text{-}7\ mg/kg/day \times 47.7\ kg \times \frac{day}{19.3\ mg_{soil}} \times 10^6\ \frac{mg_{soil}}{kg_{soil}} = 0.25\ \frac{mg}{kg_{soil}}$$

The estimated increase in cancer risk is then calculated and given a qualitative descriptor as described in Appendix E of the health consultation. In the health consultation, the average level of benzo(a)pyrene equivalents detected in residential surface soil was 1.0 mg/kg. The estimated increased lifetime cancer risk is calculated as follows:

$$\text{estimated cancer risk} = \frac{\text{soil concentration}}{\text{comparison value}} \times 10^{-6} = \frac{1\ mg/kg}{0.25\ mg/kg} \times 10^{-6} = 4E\text{-}6$$

Based on the categories in Appendix E of the health consultation, the qualitative descriptor for the cancer risk would be low.

7. Vegetable Uptake Factors

The vegetable uptake factors for PAHs (which represent the ratio of the dry-weight concentration of contaminant in the vegetables compared to that in the soil) used in the health consultation are as follows:

Contaminant	Vegetable Uptake Factor
acenapthene	1.94E-1
anthracene	1.04E-1
benz(a)anthracene	4.02E-2
benzo(a)pyrene (empirical)	5.60E-2
benzo(b)fluoranthene	1.25E-2
benzo(k)fluoranthene	1.22E-2
benzo(g,h,i)perylene	6.68E-3
chrysene	4.02E-2
dibenz(a,h)anthracene	4.31E-3
fluoranthene	5.70E-2
fluorene	1.49E-1
indeno(1,2,3-cd)pyrene	6.09E-3
napthalene	4.37E-1
phenanthrene	1.04E-1
pyrene	5.85E-2

The vegetable uptake factor for benzo(a)pyrene was reported in the scientific literature as average of empirical values (Edwards, 1983 as cited in Travis and Arms, 1988). The vegetable uptake factors for the remaining PAHs were calculated from the relationship between octanol-water partitioning coefficients and vegetable uptake factors as reported in Travis and Arms (1988).

The health consultation did not evaluate uptake of lead into garden crops, but compared the lead levels in surface soil to the US EPA lead hazard standards (US EPA, 2001c).

8. Vegetable Ingestion Rates

To evaluate noncancer risks for garden areas, we assumed the same exposure scenario as described in Item 1 (above) for soil, and also that a child consumes 21 grams of homegrown produce (wet weight) per day.

To evaluate the cancer risks for garden areas we assumed the same scenario described for soil in Item 1 (above), and that the average consumption rate for

homegrown produce (wet weight) for the first 30 years of a 70 year lifetime is 76 grams per day.

References

Calabrese, E.J., R. Barnes, E.J. Stanek III, H. Pastides, C.E. Gilbert, P. Veneman, X. Wang, A. Lasztity and P.T. Kostecki. 1989. How much soil do young children ingest: An epidemiologic study. Reg. Tox. Pharm. 10: 123-137.

Calabrese, E.J., E.J. Stanek, C.E. Gilbert, R.M. Barnes. 1990. Reg. Tox. Pharm. 12: 88.

Davis, S., P. Waller, R. Buschbom, J. Ballou and P. White. 1990. Quantitative estimates of soil ingestion in normal children between the ages of 2 and 7 years: Population-based estimates using aluminum, silicon, and titanium as soil tracer elements. Arch. Env. Health 45: 112-122.

Edwards, N.T. 1983. Polycyclic aromatic hydrocarbons (PAHs) in the terrestrial environment—A review. J. Environ. Qual. 12: 427-441.

Hawley, J.K. 1985. Assessment of health risk from exposure to contaminated soil. Risk Analysis 5: 289-302.

Travis, C.C. and A.D. Arms. 1988. Bioconcentration of organics in beef, milk and vegetation. Environ. Sci. Technol. 22: 271-274

US EPA (United States Environmental Protection Agency). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Washington, DC: Office of Research and Development. EPA/600/R-93/089.

US EPA (United States Environmental Protection Agency). 1996. PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures. National Center for Environmental Assessment. Office of Research and Development. Washington, DC.

US EPA (United States Environmental Protection Agency). 1997. Health Effects Assessment Summary Tables. FY-1997 Update. Washington DC: Office of Research and Development, Office of Emergency and Remedial Response. EPA 540-R-97-036. PB97-921199.

US EPA (United States Environmental Protection Agency). 1999. Exposure Factors Handbook. Office of Research and Development. Washington DC. EPA/600/C-99/001.

US EPA (United States Environmental Protection Agency). 2001a. Integrated Risk Information System. Office of Research and Development. http://www.epa.gov/ngispgm3/iris/subst-fl.htm.

US EPA (United States Environmental Protection Agency). 2001b. Risk - based Concentration Table. Region III. Superfund Technical Support Section (http://www.epa.gov/reg3hwmd/risk/riskmenu.htm).

US EPA (United States Environmental Protection Agency). 2001c. Lead: Identification of Dangerous Levels of Lead. Final Rule. Federal Register 66: 1206-1240.