

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION
National Center for Environmental Health/
Agency for Toxic Substances and Disease Registry**



**Board of Scientific Counselors Meeting
June 28-29, 2016
Atlanta, Georgia**

Record of the Proceedings

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Executive Summary

The U.S. Department of Health and Human Services and the Centers for Disease Control and Prevention (CDC) National Center for Environmental Health/Agency for Toxic Substances and Disease Registry (NCEH/ATSDR) convened a meeting of the Board of Scientific Counselors (BSC) on June 28-29, 2016 at the CDC Chamblee Campus in Atlanta, Georgia.

MEETING OVERVIEW

The Designated Federal Official (DFO) conducted the meeting in accordance with all rules and regulations of the Federal Advisory Committee Act. The DFO verified that the voting members and *ex-officio* members constituted a quorum for the BSC to conduct its business on both days of the meeting. The DFO announced that BSC meetings are open to the public and all comments made during the proceedings are a matter of public record.

The DFO reminded the BSC voting members of their individual responsibility to identify potential conflicts of interest with any of the published agenda items and recuse themselves from participating in or voting on these matters. None of the BSC voting members publicly disclosed any conflicts of interest for the record. The DFO called for public comment at all times noted on the published agenda for the June 28-29, 2016 BSC meeting.

Certificates of appreciation were presented to four members whose terms have expired. The outgoing members were applauded for their outstanding service during their tenures on the BSC. The members of the Lead Poisoning Prevention Subcommittee (LPPS) who were in attendance were welcomed and encouraged to provide input over the course of the meeting.

NCEH/ATSDR OFFICE OF THE DIRECTOR (OD) UPDATES

The NCEH/ATSDR Director covered the following topics in the OD report to the BSC.

- There was general support by the Board with the NCEH reorganization plan to consolidate EEHS and EHHE
- Level funding proposed for NCEH/ATSDR in the FY2017 budget and NCEH/ATSDR's two key priorities of lead and water
- LPPS's advisory role
- The upcoming reorganization of NCEH, particularly the program consolidation of the Division of Emergency and Environmental Health Services (EEHS) and Division of Environmental Hazards and Health Effects (EHHE)
- The CDC transition booklet to brief the new Administration on its role, function and activities
- "Hot" EPH topics: community exposures to perfluorinated compounds, the Zika outbreak response, lead-contaminated water in Flint, Michigan, and contaminated drinking water at Camp Lejeune

CLIMATE CHANGE AND HEALTH

The CDC Climate and Health Program is housed in NCEH/ATSDR and represents the only federal investment in climate change preparedness in the public health sector. The CDC Climate-Ready States and Cities Initiative funds 18 state and local health departments to use the “Building Resilience Against Climate Effects” framework and tools for planning, implementing and evaluating climate adaptation strategies. CDC will expand funding later in 2016 to support new climate and health adaptation activities conducted by three tribal and two territorial health departments.

PREVIOUS BSC GUIDANCE

NCEH/ATSDR OD and program staff presented an extensive set of responses to the BSC’s guidance, action items and input on key presentations during the December 2015 meeting: “The Role of Environmental Health Services in Legionnaires’ Disease” and “Ecological Analysis of U.S. Cities: Parking Prices and Active Commuting.” NCEH was unable to take action on two of the BSC’s suggestions because the line-item for the Healthy Community Design Initiative was closed out in December 2015.

FLINT RESPONSE

Federal assistance provided by the Unified Coordinated Group (UCG) in response to lead-contaminated water in Flint has covered multiple activities. Guidance was provided to the community on blood lead level (BLL) monitoring. Residents were linked to case management. Health messaging was coordinated and harmonized among the UCG partners. An Assessment of Chemical Exposure investigation was conducted with three major components: a questionnaire, clinical referral and water sampling.

A Community Assessment for Public Health Emergency Response was conducted with a total of 345 households. CDC published an article in the *Morbidity and Mortality Weekly Report (MMWR)* on June 24, 2016 regarding the distribution of BLLs ≥ 5 $\mu\text{g}/\text{dL}$ in children < 6 years of age in Flint. Water filter and rash studies were conducted. Long-term services in Flint will include expanded Medicaid services to children up to 21 years of age, lead abatement in homes and other educational opportunities.

LEAD SURVEILLANCE

NCEH is considering several issues to modify or improve the existing strategy for the Lead Surveillance Program. An automated syndromic surveillance system with an electronic alert will allow NCEH to review blood lead test data in real time before an incident occurs in communities. Enhanced lead surveillance will increase screening rates of high-risk children and allow states and localities to eliminate lead sources prior to exposure. Cross-sector collaborations will be continued with federal, state and local partners. Improvements will be made in several areas to enhance data reporting. Secondary and tertiary prevention will help to identify and implement policies, systems and environmental changes to minimize lasting effects of lead exposure in children through case management, social services and educational interventions.

ZIKA OUTBREAK RESPONSE

CDC deployed 1,265 staff to respond to the emergence of Zika virus in the United States. CDC staff has been providing scientific, technical and programmatic leadership and support, operations, logistics and a presence in the field. CDC published an *MMWR* article in June 2016 with recommendations on screening the blood supply in Puerto Rico. CDC posted maps on the

CDC.gov website with its best estimates of the potential range of the two types of mosquitoes that carry the Zika virus in the United States.

CDC is conducting body fluid studies in Puerto Rico and Colombia to better understand the transmission of the Zika virus and the length of its survival in urine and semen. CDC published a special report in *The New England Journal of Medicine* on April 13, 2016, "Zika Virus and Birth Defects: Reviewing the Evidence for Causality."

CDC has been providing technical assistance and expertise to the Puerto Rico Department of Health in the areas of vector control, personal protection for pregnant women and women of childbearing age, access to effective contraception, risk communication and community engagement. CDC launched Zika pregnancy registries and enhanced surveillance in the United States, Puerto Rico and Colombia. CDC issued recommendations and messaging on the Zika virus to the public.

BLOOD LEAD REFERENCE VALUE (BLRV)

NCEH's current review of the BLRV includes <1,900 blood lead test results for children 1-5 years of age from the two most recent National Health and Nutrition Examination Survey (NHANES) cycles conducted in 2011-2012 and 2013-2014. Based on the upper limit of the BLRV in the 2011-2014 NHANES cycles, 2.5% of children in the United States had BLLs ≥ 3.5 $\mu\text{g}/\text{dL}$. Disparities in the 2011-2014 NHANES cycles were similar to those in previous cycles (e.g., a larger prevalence of BLLs ≥ 5 $\mu\text{g}/\text{dL}$ in non-Hispanic black children and an association between higher BLLs and poverty-to-income ratio). The extremely small number of children with BLLs ≥ 3.5 $\mu\text{g}/\text{dL}$ is a remarkable public health success and demonstrates the effectiveness of previous interventions in protecting children.

PER-/POLYFLUOROALKYL SUBSTANCES (PFAS)

ATSDR's strategy to address PFAS in the environment includes three components: (1) ATSDR's technical assistance and support to states and other partners; (2) internal NCEH/ATSDR coordination and external coordination with partners on various PFAS-related issues; and (3) ATSDR's ongoing research to identify and fill key data gaps in PFAS to address community concerns. These studies are focusing on maternal PFAS and breastfeeding to determine the half-life of this chemical in mothers and nursing infants; the half-life of PFAS in children; pharmacokinetic modeling of PFAS; and a feasibility assessment of PFAS health studies.

ATSDR conducted a feasibility assessment of a children's health study. The study will be designed with a sample size of 350 children from daycare centers at the Pease Tradeport, New Hampshire site and 175 unexposed children from other daycare centers as the control group. The health endpoints will include lipids, thyroid function, uric acid, sex hormones (e.g., testosterone and estradiol), puberty/delays in puberty, immune outcomes, and IQ and other neurobehavioral parameters.

INTEGRATED SAFE WATER PROGRAM

NCEH will develop an integrated safe water program due to the proposed reorganization of NCEH that calls for the merger of EEHS and EHHE. The two NCEH programs will need to consolidate their individual water-related services, science and priorities to strategically develop and grow an integrated safe water program over time. EEHS and EHHE described their individual missions, ongoing water activities and key areas of focus. However, the integrated water program will be based on the mission, goal and objectives of the 2015-2020 NCEH/ ATSDR Safe Water Strategic Plan.

BSC FORMAL RECOMMENDATION

The BSC Chair proposed a formal recommendation regarding NCEH/ATSDR's role in CDC's response to the Zika outbreak. The draft recommendation advised NCEH/ATSDR to take a more active role in evaluating the health effects of pesticides recommended by CDC for pregnant women to use against Zika and identify current data gaps in the use of these chemicals.

GENERAL CONSENSUS: The NCEH/ATSDR Director confirmed that NCEH/ATSDR would take action on the BSC's formal recommendation.

***EX-OFFICIO* UPDATES**

- The National Institute for Occupational Safety and Health described its ongoing occupational activities that are complementary to those conducted by NCEH/ATSDR: occupational blood lead surveillance, hazards to hydraulic fracturing workers, and interventions to protect workers from climate change/heat exposures and the Zika virus.

- The National Institute of Environmental Health Sciences, National Toxicology Program described its ongoing studies, research and systematic reviews:
 - Potential health hazards from cell phone radiofrequency radiation
 - Exposure scenarios and health effects related to shift work at night, artificial light at night, and circadian disruption
 - Botanical dietary supplements safety
 - Immunotoxicity associated with perfluorooctane sulfonate and perfluorooctanoic acid
 - Synthetic turf/recycled tire crumb rubber
 - Cancer and non-cancer outcomes and characteristics of carcinogens related to glyphosate
 - Neurological outcomes from fluoride focusing on learning and memory

- The U.S. Environmental Protection Agency (EPA) described the stronger focus on public health in its research agenda and products, including the Environmental Quality Index and the Community-Focused Exposure and Risk Screening Tool. EPA conducted testing to determine the performance of two commercially available water filters in removing lead from the Flint water supply. EPA provided support for the toxicology assessment of recycled tire crumb rubber. EPA is preparing and planning for upcoming changes to address its mandate in the 2016 TSCA amendments: release new risk-based safety standards, evaluate chemicals with a clear and forceful deadline, and allocate funding to support these activities.

CURRENT BSC GUIDANCE

The BSC reviewed action items, proposed new agenda items, and suggested changes to improve the structure and format of BSC meetings. The BSC provided extensive input over the course of the meeting in response to presentations by the NCEH/ATSDR programs.

- Messages to convey to the new Administration on the NCEH/ATSDR EPH portfolio
- Feedback to improve CDC's climate and health activities
- Public health messaging and communications to the Flint community on BLLs in children
- The public health and laboratory implications of lowering the BLRV from ≥ 5 $\mu\text{g}/\text{dL}$
- Additional or new issues, messaging and studies to consider in modifying, improving or refining the following areas:

- The current strategy for the CDC Lead Surveillance Program
- CDC's response to the Zika outbreak
- ATSDR's current strategy to address PFAS in the environment
- Integration of the EEHS/EHHE water activities in the upcoming NCEH reorganization



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**BOARD OF SCIENTIFIC COUNSELORS MEETING
June 28-29, 2016
Atlanta, Georgia**

Minutes of the Meeting

The U.S. Department of Health and Human Services (HHS) and the Centers for Disease Control and Prevention (CDC) National Center for Environmental Health/Agency for Toxic Substances and Disease Registry (NCEH/ATSDR) convened a meeting of the Board of Scientific Counselors (BSC). The proceedings were held on June 28-29, 2016 in Building 106 of the CDC Chamblee Campus in Atlanta, Georgia.

The BSC is a Federal Advisory Committee that is chartered to provide advice and guidance to the Secretary of HHS, Director of CDC, and Director of NCEH/ATSDR regarding program goals, objectives, strategies and priorities in fulfillment of the agencies' mission to protect and promote persons' health. The BSC provides advice and guidance to assist NCEH/ATSDR in ensuring the scientific quality, timeliness, utility and dissemination of results. The BSC also provides guidance to help NCEH/ATSDR work more efficiently and effectively with its various constituents to fulfill its mission to protect America's health.

Information for the public to attend the BSC meeting in person or participate remotely via teleconference was published in the *Federal Register* in accordance with Federal Advisory Committee Act (FACA) regulations. All sessions of the meeting were open to the public (*Attachment 1: Participants' Directory*).

**June 28, 2016 Opening Session: Welcome, Introductions,
Awarding of Certificates, and Agenda Review for Conflict-of-Interest Topics**

William Cibulas, Jr., PhD, MS
Deputy Associate Director for Science, NCEH/ATSDR
BSC Designated Federal Official (DFO)

Dr. Cibulas opened the floor for introductions and confirmed that the 13 voting members and *ex-officio* members in attendance constituted a quorum for the BSC to conduct its business on June 28, 2016. He called the proceedings to order at 8:37 a.m. and welcomed the participants to day 1 of the BSC meeting.

Dr. Cibulas announced that BSC meetings are open to the public and all comments made during the proceedings are a matter of public record. He reminded the voting members of their responsibility to disclose any potential individual and/or institutional conflicts of interest for the public record and recuse themselves from voting or participating in these matters. None of the BSC voting members publicly disclosed conflicts of interest for any of the items on the June 28, 2016 published agenda.

Dr. Cibulas welcomed five members of the Lead Poisoning Prevention Subcommittee (LPPS) who were attending the BSC meeting. He explained that the LPPS members would have an opportunity to provide feedback over the course of the meeting after NCEH/ATSDR obtained guidance and input from the BSC members. He announced that a separate LPPS meeting would be held on the following day from 8:30-11:00 a.m.

Dr. Cibulas announced that the terms have expired for four BSC members: Drs. Lisa Alvarez-Cohen, Hilary Carpenter, Robert Wright, and Mr. Sanjay Ranchod. The four outgoing members were presented with certificates of appreciation and applauded for their outstanding service during their tenures on the BSC. The outgoing members also were commended for their commitment, dedication and efforts to improving environmental health (EH) in the field.

Dr. Cibulas announced that nine new members are expected to be appointed by the next BSC meeting. HHS has formally approved five of the new members at this time.

Melissa Perry, ScD, MHS, BSC Chair

Chair, Department of Environmental and Occupational Health
George Washington University School of Public Health and Health Services

Dr. Perry also welcomed the participants to the BSC meeting and thanked the four outgoing members for their excellent service. She asked the participants to join her in welcoming Dr. Douglas Trout, the new *ex-officio* member for the National Institute for Occupational Safety and Health (NIOSH).

Dr. Perry reiterated the importance of the BSC's guidance and input to NCEH/ATSDR. Most notably, the BSC's advice is well reflected in NCEH/ATSDR's new initiatives and modifications to its existing environmental public health (EPH) programs.

NCEH/ATSDR Office of the Director Updates

Patrick Breyse, PhD, CIH

Director, NCEH/ATSDR
Centers for Disease Control and Prevention

Dr. Breyse covered the following topics in his NCEH/ATSDR Office of the Director's (OD) report to the BSC.

NCEH/ATSDR BUDGET AND PRIORITIES

NCEH/ATSDR has faced tremendous challenges over the past year due to drastic cuts in the FY2016 budget. NCEH/ATSDR has been soliciting extensive input from the BSC and other partners on strategies to better communicate the impact of its EPH activities to Congressional staff and other stakeholders.

Dr. Breyse's recent discussions with Congressional staff primarily have focused on NCEH/ATSDR's two key priorities of lead and water. His opinion was that these discussions generated a groundswell of support for increasing resources to more broadly focus on lead and water issues. Legislative markups for the FY2017 budget to date have proposed level funding rather than cuts.

In terms of the lead priority, the establishment of a new blood lead reference value (BLRV) will be one of NCEH/ATSDR's most significant accomplishments in 2017. Decision-making on whether to lower the current BLRV of 5 µg/dL will have important implications and impact in the field. Presentations would be made over the course of the meeting for NCEH/ATSDR to obtain additional guidance from the BSC on increasing the impact of its lead and water activities.

ADVISORY ROLE OF LPPS

CDC did not renew the charter of its Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP) that expired on October 31, 2013. To supplant ACCLPP's role as an external advisory body, NCEH/ATSDR formed the LPPS that is charged with providing expertise and guidance to the BSC on lead-specific issues.

LPPS is a FACA-chartered subcommittee under the BSC at this time, but the current Senate markup for the FY2017 budget proposes the following language: "CDC is encouraged to reestablish the National Advisory Committee on Childhood Lead Poisoning Prevention that was disbanded in 2013." Based on the language in the final legislative markup, NCEH/ATSDR will either retain LPPS as a BSC subcommittee or reestablish ACCLPP as a separate advisory body to the HHS Secretary and CDC Director. NCEH/ATSDR is committed to obtaining ongoing formal advice on lead-specific issues from external experts in the field.

NCEH/ATSDR REORGANIZATION

OD recently initiated strategic planning efforts on the existing NCEH/ATSDR organizational structure to strengthen programs, consolidate activities, and respond to the FY2016 budget cuts in the most efficient and effective manner. NCEH's three major divisions are the Division of Emergency and Environmental Health Services (EEHS), Division of Environmental Hazards and Health Effects (EHHE), and Division of Laboratory Sciences.

OD solicited extensive input from NCEH/ATSDR senior leadership on the value of consolidating EEHS and EHHE. The consensus was that the two divisions should have been merged quite some time ago. Most notably, an independent consultant recommended the same program consolidation in 2012 during a review of NCEH/ATSDR's organizational structure at that time. To obtain broader guidance, OD formed a subcommittee with diverse representation by CDC staff from both inside and outside of NCEH/ATSDR, Dr. Perry as the BSC Chair, and external stakeholders. After the subcommittee proposed various models of program consolidation, OD convened a senior committee to review the strengths and weaknesses of each proposed model.

The proposed EEHS/EHHE merger will provide opportunities for synergies and enhanced impact between the two programs. The program consolidation also will facilitate growth of the National EPH Tracking Network, National Asthma Control Program, and Clean Water for Health Program. The lead-contaminated water crisis in Flint, Michigan required NCEH to prioritize and reconsider the current strategy for its Lead Surveillance Program as well.

Other changes that are being considered as part of the reorganization include efforts to improve interaction and synergies between the NCEH/ATSDR Communications and Policy Offices. Closer coordination between the two offices will provide a more formal mechanism for NCEH/ATSDR to better communicate the strengths of its EPH programs and describe its budgetary challenges. EH emergency operations conducted by each NCEH/ATSDR division will be better coordinated and integrated as well. Dr. Breyse introduced and asked the participants to join him in welcoming Dr. Pamela Protzel Berman in her new position as the NCEH/ATSDR Policy Director.

ATSDR's current organizational structure will be maintained, but a new senior leadership position will be created and housed in OD to provide ongoing guidance directly to the NCEH/ATSDR Director on strengthening and growing ATSDR. The new position is a critical need. Despite the increasing demand for ATSDR's site-specific activities and other services each year (e.g., community exposures to perfluorinated compounds (PFCs) and soil vapor intrusion (SVI) as a major pathway of exposure to solvents), the ATSDR budget has remained flat for the past 20 years. ATSDR is an extremely valuable agency with a broad and powerful mandate that is crucial to the American public.

Overall, the reorganization is not intended to reduce the NCEH/ATSDR workforce, save costs or diminish programmatic strengths. Instead, the overarching purpose of the reorganization is to achieve efficiencies by consolidating programs that conduct similar activities and require similar expertise. OD's next steps will be to submit the reorganization package, announce NCEH/ATSDR's final reorganization within the next two weeks, and formally launch the new organizational structure by September 30, 2016. An update on the NCEH/ATSDR will be presented to the BSC during the next meeting.

NCEH/ATSDR OPPORTUNITIES WITH THE NEW ADMINISTRATION

Federal agencies create and submit transition booklets to brief the new Administration on their roles, functions and activities. In addition to providing a transition booklet, NCEH/ATSDR also is interested in obtaining input from the BSC on messaging that should be conveyed in the event the new Administration is energized about improving and increasing the federal EPH portfolio.

NCEH/ATSDR recognizes that nearly 45 years have passed since significant advancements were made or considerable attention was given to EH issues at the federal level, such as enactment of the 1972 Clean Water Act and 1973 Clean Air Act. However, NCEH/ATSDR also is aware of recent developments that indicate a renewed interest in EH issues at the federal level. For example, President Obama signed the "Frank R. Lautenberg Chemical Safety for the 21st Century Act" into law on June 22, 2016 to update the 1976 Toxic Substances Control Act (TSCA). Language in the amended TSCA calls for NCEH/ATSDR to strengthen its ability to conduct cancer cluster investigations and improve capacity to address community concerns on this topic.

“HOT TOPICS”

The current BSC agenda includes presentations and updates on several “hot topics” that are requiring substantial attention from NCEH/ATSDR at this time:

- ATSDR’s activities to address community exposures to PFCs
- CDC’s response to water contamination in Flint and other lead-related issues
- CDC’s response to the Zika outbreak

Dr. Thomas Frieden, Director of CDC, announced that the complexity of the Zika outbreak response is unprecedented due to the involvement of multiple CDC centers, the need for a broad range of expertise, and an enormous amount of unknown scientific and public health questions. NCEH/ATSDR is playing a key role in the Zika outbreak response by providing expertise on the appropriate use of pesticides for mosquito vector control in communities.

ATSDR is continuing its collaborative efforts with the U.S. Department of Veterans Affairs (VA) to assess the strength of the evidence and clearly define the relationship between health impacts and exposure to contaminated drinking water at Camp Lejeune. The VA currently is providing health care to affected individuals at the site and will use findings from ATSDR’s public health assessment as the basis for its medical compensation program.

BSC DISCUSSION: NCEH/ATSDR OD UPDATES

Dr. Breyse provided additional details on NCEH/ATSDR’s current activities in response to specific questions posed by the BSC members.

- The impact of lead issues in Flint on the FY2017 NCEH/ATSDR “flat” budget (e.g., increased funding for lead versus actual decreased or level funding for asthma, tracking or other EPH issues).
- An updated NCEH/ATSDR Strategic Plan for the upcoming reorganization versus the development of new, separate strategic plans due to differences in the NCEH and ATSDR EPH missions, Congressional appropriations and activities.
- Potential opportunities in the proposed reorganization to improve synergies, EH capacity and the overall working relationship between NCEH and ATSDR.
- Activities that will be discontinued or excluded from the NCEH reorganization, such as the recent termination of funding for the Healthy Community Design Initiative (HCDI).
- ATSDR’s establishment of Community Assistance Panels and other mechanisms to extensively engage communities in site-specific research and other activities.
- NCEH/ATSDR’s joint projects, regular teleconferences and other ongoing efforts, to strengthen its existing partnerships with the U.S. Environmental Protection Agency (EPA) and National Institute of Environmental Health Sciences (NIEHS).
- Opportunities for NCEH/ATSDR to enhance collaborations with EPA, NIEHS, NIOSH, the U.S. Geological Survey (USGS) and other federal partners on key EPH issues: the 2016 TSCA amendments; community protection from exposure to wildfire smoke; and new EPA tools to improve the capacity of the EPH Tracking Network to address exposures, environmental justice (EJ) and other EH issues in communities.
- NCEH/ATSDR’s plans to enhance partnerships with state and local health departments and strengthen relationships with regional EPA administrators to ensure science is accurately translated from the federal to community level through risk assessment, risk communication and risk management in the field.

- The inability of Congressional staff to clearly distinguish between NCEH/ATSDR's advisory role and EPA's regulatory role during the Flint response due to inaccurate perceptions and other complexities.

BSC GUIDANCE

- NCEH/ATSDR should ensure that broad, visionary and powerful messages in two key areas are included in CDC's transition booklet to brief the new Administration on the EPH portfolio. First, NCEH/ATSDR's role in cancer cluster investigations in the 2016 TSCA amendments should be highlighted. Second, NCEH/ATSDR's role as the steward of CDC's entire continuum of expertise, from mitigation to adaptation, to respond to climate change threats should be emphasized. CDC is the only HHS agency that formally names "climate" in one of its programs. Funding of the CDC Climate and Health Program continues to be in jeopardy and uncertain, but NCEH/ATSDR is uniquely positioned at this time to describe its leadership role in implementing a robust and aggressive response to climate change threats and public health protection.
- NCEH/ATSDR should design the Strategic Plan as a living document that is revisited and updated on a regular basis to maintain pace with the proposed reorganization or other changes in the future.
- NCEH/ATSDR should utilize the BSC in an expanded role in its preparations to leverage opportunities during the transition to the new Administration.
 - Solicit broader input from networks, stakeholders and other organizations in the field
 - Conduct outreach to the media to increase public attention and knowledge of NCEH/ATSDR's activities
 - Engage and collaborate with other coalitions that also are making efforts to advance public health
 - Educate Congressional staff and other relevant policymakers on NCEH/ATSDR's critical EPH activities to make a strong case on the need to increase the current budget
- NCEH/ATSDR has a long history of addressing important evidence-based issues from EH, toxicologic and public health perspectives, such as lead, trichloroethylene and fluoride. However, efforts are not being made to retrospectively apply non-scientific experiences and lessons learned to current community concerns, such as lead-contaminated water in Flint. To improve EPH responses to "Flint-like" crises in the future, NCEH/ATSDR should give stronger weight and attention to community concerns at the outset that are not based on scientific or epidemiologic evidence.

LPPS GUIDANCE

- ATSDR's unique and important EPH role should be highlighted in CDC's transition booklet to the new Administration.
 - The ATSDR petition process is the only mechanism in the U.S. government that allows private citizens to submit a request to a federal agency to conduct a public health consultation for a National Priorities List site.
 - ATSDR's solid and longstanding partners (e.g., American College of Medical Toxicology and American Academy of Pediatrics) likely would be willing to describe their cooperative agreement (CoAg) experiences with ATSDR. Members of these organizations should be contacted to provide feedback on the tremendous value of ATSDR's site-specific activities.

Dr. Perry reminded the BSC that during the December 2015 meeting, she emphasized the importance of individual members communicating with their Congressional representatives as

private citizens regarding the severe cuts to the FY2016 NCEH/ATSDR budget. She hoped the efforts of individual BSC members had an impact on the proposed FY2017 budget that calls for flat rather than decreased funding. She encouraged the outgoing BSC members to continue communicating with their Congressional representatives regarding the urgent and essential need for ongoing or increased federal funding of EPH issues.

Dr. Perry asked Dr. Protzel Berman to provide individual BSC members with up-to-date information on NCEH/ATSDR's current and proposed budgets. This information would allow the members to submit letters to continue to outreach to and communicate with the current Administration.

CDC's Public Health Role in Climate Change

George Lubber, PhD

Chief, NCEH Climate and Health Program
Centers for Disease Control and Prevention

Dr. Lubber presented an update on CDC's public health role in climate change. Climate change is the altering average (mean) global temperature and global frequency of extremely hot temperatures (variance). The impacts of climate change significantly vary by region. Certain locations are warming more rapidly than others.

Dr. Lubber presented graphs to illustrate the increase in global average temperatures from 1850-2016. As of March 2016, global warming has been unprecedented. Warmer than average days have occurred more frequently based on summer temperatures recorded from 1951-1980. Extremely hot days have occurred more frequently based on summer temperatures recorded from 1981-1991. These data demonstrate the principal challenge of climate change. "Normal" weather is occurring less frequently, while "abnormal" weather is becoming more normal.

Based on Tracking data, the number of extreme heat days (or those >100°F) in the United States has dramatically increased from 1979-2012. Climate change is associated with three key health threats. Threat 1 is a "disaster within a disaster." The 2014 Lubber, *et al.* study reported that the magnitude and frequency of extreme events, such as heat waves, tropical storms and heavy rainfall, increase the probability of complex emergencies in which multiple system failures occur (e.g., electrical, transportation and communication systems) and response capacity is exceeded.

Heat waves also impact human health. The 2004 Vandentorren, *et al.* study reported that public health was not protected during the European heat wave in August 2003. At that time, eight countries confirmed and reported >30,000 heat-related deaths. However, subsequent analyses on excess mortality found that the 2003 European heat wave actually was responsible for ~70,000 deaths.

Threat 2 is "morbidity and mortality by a thousand cuts." Based on the 2014 Lubber, *et al.* study, impacts add to cumulative stresses currently faced by populations and in locations that are most vulnerable to extreme events and ongoing, persistent climate-related threats: degraded air and water quality, wildfires, and increased ozone and aeroallergens. The 2011 Sheffield, *et al.* study projected an increase of up to 10.2% in pediatric emergency department (ED) visits for asthma in 2020 due to the impact of increased ozone and climate change on worse asthma outcomes.

Threat 3 is the “emergence of novel threats.” The 2014 Luber, *et al.* study reported that large-scale ecological perturbations will facilitate the emergence and redistribution of disease. The 2003 Brownstein, *et al.* study included a climate-based model that predicted the impact of precipitation, humidity and temperature changes on Lyme disease. The model showed that climate, ecological and social factors influence the spread of Lyme disease.

Climate change is broad in scope and includes multiple components, such as carbon dioxide (CO₂) levels, temperature and increased severe weather. Sea levels affect a vast array of distributions and direct effects of extreme weather, such as temperature, air quality and ecological changes. Several system effects from climate change have an impact on human health, including the water and food supply, destabilization of economies and countries, and forced migration.

The NCEH Climate and Health Program is not designed to address each individual human health effect from climate change. However, CDC provides funding and technical guidance to assist state and local health departments in identifying and better understanding determinants of health threats and effectively protecting the public’s health. To help states and cities prepare for health challenges related to climate change, CDC provides scientific guidance on identifying climate trends; develops and disseminates decision support tools; promotes the inclusion of a public health framework in climate change adaptation and mitigation strategies; and creates partnerships between public health and other sectors.

The NCEH Climate and Health Program represents the only federal investment in climate change preparedness in the public health sector. The Climate-Ready States and Cities Initiative reflects CDC’s efforts to enhance the capacity of state and local health departments to identify, address and respond to health challenges associated with climate change. Under this initiative, CDC funds 18 state and local health departments to use the “Building Resilience Against Climate Effects” (BRACE) framework and tools for planning, implementing and evaluating climate adaptation strategies.

The BRACE framework is an empirical, evidence-based process that grantees use to develop climate and health adaptation plans based on experiences in their individual jurisdictions. The five steps involved in the BRACE framework are highlighted below.

- Forecast climate impacts and assess vulnerabilities
- Project the burden of disease
- Assess public health interventions
- Develop and implement a climate and health adaptation plan
- Evaluate the impact and improve the quality of activities

BRACE tools and materials (e.g., the extreme heat toolkit) are designed to identify populations and locations that are vulnerable to climate impacts and communicate climate and health issues to public health partners. The 18 grantees are being funded for an additional five-year cycle to shift from conducting assessment activities to implementing and monitoring interventions.

The grantees are using their funds to focus on several climate-sensitive exposures of concern, including the ozone/particulate matter, pollen, extreme temperatures, rise in sea levels, flooding, drought and storms. Health impacts from climate-sensitive exposures that the grantees are

addressing include heat-related illness; cardiovascular, respiratory and mental health outcomes; vector-borne, water-borne and foodborne diseases; and injuries.

CDC develops and disseminates technical guidance documents to grantees for each of the five BRACE steps. The three guidance documents CDC has produced to date include *Climate Models and the Use of Climate Projections*; *Assessing Health Vulnerability to Climate Change*; and *Projecting Climate-Related Disease Burden*. CDC also partnered with the American Public Health Association (APHA) to produce *Adaptation in Action: Grantee Success Stories from CDC's Climate and Health Program, March 2015*. Several grantees are featured in the report: New York City's (NYC) success story of creating resilient communities; Arizona's success story of readying for extreme events; and Michigan's success story of responding to local needs.

CDC will award new funding to the 18 grantees later in 2016, but the CoAg will be expanded to support new climate and health adaptation activities conducted by three tribal and two territorial health departments. CDC also will collaborate with partners to identify vulnerable areas and populations.

BSC DISCUSSION: CLIMATE CHANGE AND PUBLIC HEALTH

Dr. Luber provided additional details on CDC's public health role in climate change in response to specific questions posed by the BSC members.

- The rationale for excluding the Zika virus from infectious diseases listed under "changes in vector ecology."
- The status of CDC's current data systems for climate change (e.g., integration with other CDC and non-CDC databases, existing gaps and areas of improvement).
- Wildfire-specific activities that are being conducted by CDC, its partners and any of the 18 climate-ready grantees (e.g., California and Oregon).
- Limited correlation between jurisdictions with the highest numbers of extreme heat days and the locations of the 18 grantees.
- Potential reasons for variations across the 18 grantees in addressing health impacts from climate-sensitive exposures.
- The possibility of CDC expanding its climate change activities to include the private sector, such as large healthcare organizations that are becoming more involved in the health of their communities in the context of preparedness and planning.
- NCEH's collaborations with other CDC National Centers, EPA and external partners on climate change.
- Ongoing efforts to review remote sensor data to develop ultraviolet metrics.

BSC GUIDANCE

- CDC's climate change activities should have a much stronger focus on social impacts. Populations that are most socially or economically disadvantaged are more significantly affected by climate change than other groups.
- CDC should make efforts to integrate its public health surveillance data systems with databases that are not currently available to better address unknowns related to climate change.
- CDC's funding of a total of 23 climate-ready grantees later in 2016 (e.g., 16 states, 2 large cities, and 5 new tribal/territorial health departments) excludes the majority of the country that also could benefit from the development and implementation of climate and health

adaptation strategies. CDC should broadly disseminate the BRACE technical guidance documents to non-funded state and local health departments.

- CDC’s competitive funding process is designed to award the highest-scoring applicants, but these states typically have the strongest capacity. CDC should ensure that quantitative impact and outcome data from activities and evaluation projects conducted by grantees are collected and shared with non-funded, lower-capacity states with similar morbidity and mortality rates related to climate change.

Dr. Breyse made two remarks in follow-up to the BSC’s discussion. First, NCEH will continue to emphasize “adaptation strategies” rather than “climate change” to ensure the Climate and Health Program is maintained and protected regardless of the new Administration’s position on this issue. Second, the Climate and Health Program and other EPH initiatives are not national in scope and actually reflect funding to a few states and large cities. NCEH/ATSDR is well positioned to leverage every possible opportunity with the new Administration to scale up all of its EPH programs to have a broader, more significant impact at the national level.

Dr. Luber agreed with Dr. Breyse’s comments regarding the need to continue to emphasize adaptation strategies rather than climate change. He noted that this approach likely has protected the Climate and Health Program over time. Appropriations have incrementally increased from the first budget of \$7 million in 2009 to \$10 million in 2016.

NCEH/ATSDR Program Responses to BSC Guidance and Action Items

William Cibulas, Jr., PhD, MS

Deputy Associate Director for Science, NCEH/ATSDR
BSC Designated Federal Official (DFO)

Dr. Cibulas presented NCEH/ATSDR OD’s responses to action items and guidance the BSC proposed during the December 2015 meeting.

BSC ACTION ITEMS AND GUIDANCE	
BSC Request	NCEH/ATSDR OD Response
1. Invite Dr. Frieden to a BSC meeting to provide his perspectives on alignment between CDC-wide and NCEH/ATSDR EPH priorities.	Dr. Frieden was confirmed to attend the current meeting, but a recent change in his schedule required him to cancel. Dr. Anne Schuchat, Principal Deputy Director of CDC, also was unable to attend the current meeting.
2. Present the following updates: (1) CDC’s response to the Zika outbreak; (2) NCEH Climate and Health Program; (3) ATSDR’s assessment of per-/polyfluoroalkyl substances (PFAS); and (4) ATSDR SVI assessment at Camp Lejeune.	Updates on topics 1-3 are included in the current agenda. The update on topic 4 will be placed on a future agenda.

BSC ACTION ITEMS AND GUIDANCE

BSC Request	NCEH/ATSDR OD Response
3. Present a status report on the formation of the new BSC Fracking Workgroup.	The new workgroup will be established with an overarching charge of providing guidance on hydraulic fracturing issues that should be specifically addressed by NCEH/ATSDR. The current charge for the workgroup was drafted prior to Dr. Breysse's appointment as the NCEH/ATSDR Director. Dr. Breysse and other OD leadership will review the current draft charge, make any necessary revisions, and solicit input from the BSC on potential candidates to serve on the workgroup.
4. Present regular updates on NCEH/ATSDR's top three priorities: asthma, safe water and the ATSDR infrastructure.	These updates will be periodically placed on agendas. An update on the Safe Water Program will be presented on the following day.
5. Provide the BSC with program impact statements that were distributed to APHA.	The Policy Office shared information on NCEH/ ATSDR programs that were in jeopardy of severe cuts to their budgets in FY2016.
6. Allow for more involvement and input from the BSC in developing meeting agendas.	Draft agendas will continue to be distributed to the BSC members for review and comment as early as possible.
7. Solicit advice from the BSC on changes to improve the format and organizational structure of meetings.	Efforts are ongoing to continue to make improvements in this area, such as distributing meeting materials to the BSC members well in advance of meetings and shortening presentations to allow for longer BSC discussions.

Dr. Cibulas explained that during an update on the following day, ATSDR would respond to the BSC's guidance on its activities to address community exposures to PFCs. He opened the floor for CDR Jasen Kunz and Dr. Tegan Boehmer to present responses to the BSC's guidance on two key presentations NCEH/EEHS made during the December 2015 meeting.

BSC GUIDANCE ON KEY PRESENTATIONS

BSC SUGGESTION	NCEH/ATSDR PROGRAM RESPONSE
<i>The Role of Environmental Health Services in Legionnaires' Disease</i>	
1. Apply lessons learned, experiences and successful models in providing EH training	NCEH will allocate funding to develop a comprehensive, online Legionnaires' disease prevention and response training program for

BSC GUIDANCE ON KEY PRESENTATIONS

BSC SUGGESTION	NCEH/ATSDR PROGRAM RESPONSE
and guidance to state/local health departments.	state/local EH and public health officials. NCEH will undertake this effort in collaboration with the National Center for Immunization and Respiratory Diseases (NCIRD).
2. Collaborate with ASHRAE to increase outreach and raise awareness of <i>Legionella</i> .	CDC participated in the 10-year effort to develop ASHRAE 188 that was published in December 2015. ASHRAE 188 is the first national standard that addresses the prevention of Legionellosis in building water systems. The standard will allow CDC to implement a primary prevention strategy for Legionnaires' disease. NCEH and NCIRD collaborated in the creation of a toolkit to translate the ASHRAE 188 standard for building owners and managers to develop and implement water management programs that will reduce the growth and spread of <i>Legionella</i> in their buildings. CDC piloted the toolkit during the response to Legionnaires' disease in Flint and also described the toolkit in the June 2016 <i>VitalSigns</i> TM report on Legionnaires' disease prevention. An article also was recently published in the <i>Morbidity and Mortality Weekly Report (MMWR)</i> , "Deficiencies in Environmental Control Identified in Outbreaks of Legionnaires' Disease-North America, 2000-2014." CDC's review of its investigations of Legionnaires' disease over the past 15 years found that the implementation of water management plans could have been prevented 9 out of 10 outbreaks and significantly decreased cases of sporadic disease. The <i>VitalSigns</i> TM fact sheet was distributed to the BSC members.
3. Adapt London's water cooling tower regulations to building codes in the South Bronx hotel that was the source of the large <i>Legionella</i> outbreak in NYC in 2015.	Cooling tower regulations have now been implemented for both NYC and New York State. This effort reflects a turning point in Legionnaires' disease prevention and response in the United States. NCEH and NCIRD will jointly allocate funding in 2016 to evaluate the impact of New York's regulations on reducing the burden of Legionnaires' disease in NYC and decreasing the burden of <i>Legionella</i> in water cooling towers.

BSC GUIDANCE ON KEY PRESENTATIONS

BSC SUGGESTION	NCEH/ATSDR PROGRAM RESPONSE
4. Use existing data on susceptible populations to shift from an outbreak response to prevention of sporadic cases.	Efforts are underway to more aggressively target <i>Legionella</i> prevention to healthcare facilities and other high-risk settings, such as buildings with ≥ 10 stories that have complex water systems. Moreover, the ASHRAE toolkit includes an annex that specifically focuses on healthcare facilities.
5. Improve the collection of EH data to drive <i>Legionella</i> prevention efforts.	This task will be difficult to accomplish because Legionnaires' disease data are collected and reported by multiple CDC National Centers. However, NCEH is collaborating with its internal CDC partners to streamline the collection and reporting of Legionnaires' disease data.
6. Additional response: Epidemiologic Laboratory Capacity (ELC) CoAg.	NCEH and NCIRD were given ~\$2.8 million to award ELC CoAgs to build capacity for EH and public health to respond to and prevent Legionnaires' disease at state and local levels. The applications are currently being reviewed and the awards will be announced in August 2016.
<i>Ecological Analysis of U.S. Cities: Parking Prices and Active Commuting</i>	
7. Adjust models with a stronger focus on median age. Collect data on commuting methods other than walking or bicycling alone that also benefit health and the environment.	NCEH is unable to take action on these two suggestions at this time. The HCDCI line-item in the NCEH budget was closed out in December 2015, but the BSC's guidance potentially could be revisited if funding is restored in the future. HCDCI's only support at this time is basic funding from NCEH to retain two staff. The other four team members, including Dr. Geoffrey Whitfield (former lead of HCDCI), have accepted positions in other parts of CDC. NCEH is no longer conducting HCDCI extramural activities because no FY2016 funds are available to allocate to external partners. The closeout of HCDCI extramural activities includes CoAgs with six health impact assessment (HIA) grantees; an initiative with the American Planning Association; and other HIA activities through an umbrella CoAg with APHA, the Association of State and Territorial Health Officials (ASTHO), and the National Association of County and City Health Officials. NCEH also discontinued its

BSC GUIDANCE ON KEY PRESENTATIONS

BSC SUGGESTION	NCEH/ATSDR PROGRAM RESPONSE
	interagency HCDCI activities with federal partners, such as the transportation and health tool with the U.S. Department of Transportation (DOT) and parks and trails initiatives with the National Park Service.
8. Determine whether the availability of more walking and bicycling paths in the built environment would increase active commuting to work.	This important research question warrants the collection of additional longitudinal data. However, assessments of built environment interventions are challenging due to the extensive time required to change policy, leverage funding, make physical changes to the environment, and observe behavioral and health outcome changes.
9. Collect additional data to fill gaps in the existing large, more affluent convenience sample.	NCEH's collaboration with DOT resulted in a better assessment of walking and bicycling behaviors that was included in the National Household Travel Survey. The survey data are expected to be released in 2018 and likely will provide a more comprehensive, in-depth picture of travel patterns among individuals.
10. Partner with the Climate and Health Program to recommend effective policies on reducing greenhouse gas emissions and issuing carbon credits.	NCEH agrees with the BSC's guidance on synergies between HCDCI and the Climate and Health Program, particularly in the context of interventions to reduce greenhouse gas emission by decreasing the number of vehicle miles traveled. NCEH is collaborating with the Nashville Metropolitan Planning Organization to calibrate the "Integrated Transport and Health Impact" model. The model allows users to input scenarios in which the normal mode of travel is adjusted to increase walking/bicycling each week and decrease the number of vehicle miles traveled. Based on the inputs, the model will generate outputs: physical activity benefits, changes in injury rates, and changes in air pollution exposures. Efforts are underway for HCDCI and the Climate and Health Program to collaborate in calibrating the model on a national scale, including the CO ₂ emission module. Moreover, the proposed NCEH/ATSDR reorganization likely will provide additional collaborative opportunities between HCDCI and the Climate and Health Program.

BSC DISCUSSION: NCEH/ATSDR RESPONSES TO BSC GUIDANCE

CDR Kunz provided additional details on CDC's Legionnaires' disease prevention activities in response to specific questions posed by the BSC members.

- The role of population density as a risk factor in predicting Legionnaires' disease outbreaks in cooling towers.
- CDC's ongoing efforts to improve *Legionella* prevention in hospitals, long-term care facilities and nursing homes.

Dr. Breyse announced that Legionnaires' disease and *Legionella* bacteria continue to be significant issues and ongoing concerns in Flint due to the increased number of cases. NCEH recently presented data on the use of water filters to remove lead, but the mayor of Flint was much more interested in interventions to eliminate *Legionella* from the water supply. NCEH's groundbreaking and critical advancements in Legionnaires' disease serve as a model of its unique leadership role and expertise in a particular EPH issue. He commended CDR Kunz and his colleagues in NCEH and NCIRD for their outstanding efforts in this regard.

BSC GUIDANCE

- If the HCDI line-item is restored in the future, NCEH should collect data from its Integrated Transport and Health Impact model to analyze transportation-related issues, such as CO₂ levels and injuries.

CDC's Response to Water Contamination in Flint, Michigan

Donna Knutson, PhD

Acting Deputy Director, NCEH/ATSDR
Centers for Disease Control and Prevention

Dr. Knutson presented an update on CDC's response to water contamination in Flint. She informed the BSC that the child featured on her first slide is "Little Miss Flint." The child wrote a letter to President Obama with a request for him to visit Flint and discuss the "dirty" water in her community. The child and CDC staff were able to meet President Obama during his recent visit to Flint.

Dr. Knutson described the timeline of the lead-contaminated water problem in Flint.

- August 2014: The decision to switch the water source to the Flint River that served as the source of contamination.
- August 2015: Publication of a study by a local pediatrician of higher blood lead levels (BLLs) in pediatric patients in Flint.
- October 2015: Declaration of a public health emergency (PHE) by the Genesee County Health Department.
- December 2015: Declaration of a state of emergency by the Flint mayor.
- January-February 2016: Formation of the Unified Coordinated Group (UCG) to provide federal assistance to Flint and activation of the CDC Emergency Operations Center (EOC) under the UCG.

- March 2016: Deactivation of the CDC EOC, but ongoing provision of assistance to Flint.

HHS is the lead agency under the UCG and has responsibility for addressing immediate health-related needs in the community and facilitating community resilience. Roles and responsibilities of other UCG partners include ensuring the long-term safety of the water supply (EPA) and providing immediate access to safe water (Federal Emergency Management Agency). The other UCG partners include the U.S. Department of Agriculture (USDA), U.S. Department of Housing and Urban Development (HUD), and state and county health departments in Michigan.

NCEH/ATSDR provided leadership for CDC's role on the UCG. NCEH/ATSDR deployed the first team to Flint in January 2016 to meet with state/local public health and EH staff and discuss their technical assistance needs. Expertise was leveraged from the CDC Childhood Lead Poisoning Prevention Program (CLPPP), BSC and LPPS on lead surveillance and interventions. NCEH/ATSDR's other contributions to the Flint response are highlighted below.

Guidance was provided to the community on BLL monitoring and residents were linked to case management. NCEH/ATSDR released CDC's official guidance on enhancing blood lead surveillance in Flint in February 2016. Immediate testing of BLLs was recommended for all children who were ≤ 6 years of age from October 1, 2015-April 1, 2016 and resided in homes, attended school/childcare centers, or spent time in the homes of caregivers that used the Flint water supply. Case management was recommended for all children with BLLs ≥ 5 $\mu\text{g}/\text{dL}$. April 1, 2016 was recommended as the date to complete screening.

Front-line public health nurses in the field described the difficulties in complying with the CDC guidance due to challenges in reaching Flint residents, forming relationships, and establishing trust to provide honest responses to questions and explore solutions. The public health nurses overcame these barriers with telephone calls, home visits and text messaging to Flint residents.

Health messaging was coordinated and harmonized among the UCG partners (e.g., CDC, EPA, HUD and USDA) to ensure consistency before distribution to the public. NCEH/ATSDR contributed to 107 UCG communication materials in various formats for diverse public audiences, including coloring books, handouts, talking and interview points, flyers, and professional education materials for the medical community.

An Assessment of Chemical Exposure (ACE) investigation was conducted with three components. For the questionnaire component, 406 Flint residents met the case definition. To date, 376 interviews have been conducted. For the clinical referral component, 122 Flint residents were examined by a dermatologist due to complaints of rashes and hair loss. For the water sampling component, 87 samples have been collected to date from the homes of Flint residents who complained of rashes.

The preliminary ACE results indicate that 64% of Flint residents who were examined had conditions "possibly" related to water exposure. However, no causality or statistical association was found between nickel exposure in water and rashes. The water quality and level of contaminants in the water supply in 2015 were different than when samples were collected in 2016. NCEH/ATSDR will extensively involve risk communicators because the findings of the rash study likely will not be accepted by the Flint community. Residents are continuing to complain of rashes and avoid using the water supply by bathing with bottled water or other sources outside of the Flint water system.

A Community Assessment for Public Health Emergency Response (CASPER) was conducted with a total of 345 households. Of these households, 242 expressed an interest in speaking with NCEH/ATSDR and 210 completed surveys. The key demographics of the respondents included 49 years of age on average; majority of females; 80% with residence in Flint >12 years; and 55% African Americans and 40% whites. The CASPER survey responses are summarized below.

- 51% of households: The physical health of at least one member has worsened due to the Flint water crisis.
- 43% of households: Perceived need for behavioral health services for a household member <21 years of age.
- 41% of households: Fear of using filtered tap water for drinking and cooking.
- >30 of surveyed individuals: Symptoms of anxiety.
- ~20% of surveyed individuals: Regular worries about money for rent and food.
- Greatest household needs: money, safe water and plumbing.

CDC published an *MMWR* article on June 24, 2016. CDC's analysis showed that BLLs ≥ 5 $\mu\text{g}/\text{dL}$ were significantly higher in the proportion of children <6 years of age who were switched to the Flint water system. Based on the implications for public health practice, CDC encouraged the use of NSF-certified water filters to remove lead as well as the use of filtered or bottled water for drinking, cooking and brushing teeth.

NCEH/ATSDR and EPA are collaborating to determine whether drinking filtered tap water would be safe for children and pregnant women. The city of Flint and other local/state health officials expressed an interest in releasing guidance to advise these populations that bottled water for consumption would no longer be necessary. Based on a review of nearly 300 water samples, including samples from households with young children, pregnant women and lead service lines, NSF-certified filters were found to be highly protective in terms of removing most of the lead from water. The remaining lead levels in water were well below the EPA standard of 15 ppb. NCEH/ATSDR and EPA also collaborated to coordinate logistics for implementation of a protocol to test additional filters in homes.

The long-term services in Flint will include expanded Medicaid services until age 21 to all persons <21 years of age who resided in Flint during the October 1, 2015-April 1, 2016 period of exposure; lead abatement in homes; and additional educational opportunities. The U.S. Department of Labor awarded a \$15 million grant to the city of Flint to train community members to install NSF-certified water filters and replace cartridges in households. The HHS Region V Director is deployed to Flint four days per week to ensure community members are aware of and enroll in available health services. An EPA outreach coordinator also maintains a regular presence in Flint to link community members to environmental services.

NCEH/ATSDR's next steps will be to release the rash study as a UCG activity; complete and submit the CASPER study to the state of Michigan; provide ongoing education and advocacy for lead and safe water issues in impacted communities in addition to Flint; and continue to offer technical assistance to the CDC CLPPP and EPA.

Overall, the Flint water crisis serves as an example of Dr. Breyse's comments regarding the need for NCEH/ATSDR to scale up and sustain strong, robust EPH programs at the national level to ensure sufficient capacity is available to mount an effective response to PHEs. The Flint water

crisis also initiated discussions at the federal level on the possibility of enacting new legislation to increase appropriations for the CDC CLPPP in particular and safe water programs in general.

BSC DISCUSSION: FEDERAL RESPONSE TO THE FLINT WATER CRISIS

Drs. Knutson and Breyse provided additional details on NCEH/ATSDR's role in the federal response to the Flint water crisis in response to specific questions posed by the BSC members.

- The rationale for not finding a causal relationship between nickel exposure in water and rashes, particularly since the association between nickel exposure and atopic dermatitis is well documented in the literature.
- Elevated levels of chloromethane detected in the initial Flint water quality assessments.
- Potential reasons for lower BLLs after switching back from the Flint to the Detroit water supply (e.g., consumption of filtered or bottled water only).
- Data collection and lead interventions specifically targeted to pregnant women and nursing mothers who used the Flint water supply during the period of exposure.
- Early educational interventions that will be provided to lead-exposed children in Flint, such as increased opportunities to enroll children in Head Start Programs and broader availability of behavioral health programs.

BSC GUIDANCE

- NCEH/ATSDR should carefully consider its BLL recommendations and messaging to the Flint community. A BLL is an integrated index of exposure that involves multiple lead sources other than water, such as lead-based paint in the older housing stock in Flint with an average age of >50 years. The ability to achieve analytical precision to measure low blood lead concentrations in the field with a Lead Care II or III instrument will be virtually impossible. Due to weak analytical proficiency in the field, caution should be taken in making statistical comparisons based on the short period of exposure from October 1, 2015-April 1, 2016.
- NCEH/ATSDR and its partners should use UCG as an opportunity to identify successes and areas of improvement in federal coordination efforts. UCG's experiences and lessons learned from Flint should be applied to build capacity to respond to the next PHE.

LPPS GUIDANCE

- NCEH/ATSDR is to be commended on its rapid and in-depth response to the Flint water crisis. Most notably, the *MMWR* article includes solid data on the distribution of BLLs. However, the broader public health community should improve its communications and delivery of "lead poisoning" messaging to the Flint community. For example, the detection of children's BLLs ≥ 5 $\mu\text{g}/\text{dL}$ contributed to the mayor declaring a PHE in Flint, but other cities throughout the country with a similar or higher incidence of childhood BLLs are not given a PHE designation. Public health messaging should clearly articulate that the increase in children's BLLs in Flint was due to political and EJ issues rather than medical factors. Most notably, the public health of a disadvantaged community was not protected due to a conscious, economic decision that was made at the local level to switch to an untreated water system in Flint. Moreover, lead-based paint in the pre-1978 housing stock in Flint presents a much greater risk to children than lead in water. If the focus will be placed on health impacts, primary prevention should be targeted to children with BLLs ≥ 5 $\mu\text{g}/\text{dL}$ in other communities throughout the country.

Dr. Breyse asked the participants to join him in congratulating Dr. Knutson on her official appointment as the new NCEH/ATSDR Deputy Director. Her appointment is being finalized and will become effective within the next two weeks.

Dr. Breyse commended the former ACCLPP for developing the “Educational Interventions for Children Affected by Lead” report. The document continues to serve as the basis of efforts by the U.S. Department of Education to increase early education interventions and services to children impacted by lead throughout the country.

Dr. Breyse noted that an additional next step for NCEH/ATSDR will be to continue developing a syndromic surveillance model with the capacity to predict BLLs in children without reported BLLs. The key inputs of the model include current locations of lead service lines, the race and gender of lead-exposed children, and the time of the year lead exposures typically occur. The model ideally will help to facilitate long-term follow-up in this population of children.

Reconsideration of the Strategy for the NCEH Lead Surveillance Program

Sharunda Buchanan, PhD, MS

Director, NCEH Division of Emergency and Environmental Health Services
Centers for Disease Control and Prevention

Dr. Buchanan described issues that CDC currently is considering to modify or improve the existing strategy for the Lead Surveillance Program. The original Congressional appropriation for the CLPPP in the late 1980s authorized CDC to conduct comprehensive activities in three major areas.

- Develop programs and policies to prevent childhood lead poisoning (CLP) and other housing-related health hazards.
- Educate the public and healthcare providers about CLP and other housing-related health hazards.
- Provide funding to state and local health departments to determine the extent of CLP poisoning by (1) screening children for elevated BLLs (EBLLs); (2) helping to ensure that lead-poisoned infants and children receive medical and environmental follow-up; and (3) developing neighborhood-based efforts to prevent CLP.

The major milestones of the CDC CLPPP are summarized as follows. In the 1980s-2010, full funding was allocated to CDC to conduct a comprehensive program with >40 grantees that focused on universal screening of high-risk children ≤ 6 years of age and case management for those with EBLLs. CDC established ACCLPP to provide external expertise and guidance on conducting the CLPPP. In 2010, level funding was allocated and the shift was made to targeted screening of high-risk children in communities based on local epidemiologic data.

In 2012, funding was decreased by 93% (or from \$35 million to \$2 million) and led to the loss of extramural programs and termination of ACCLPP. In 2014, HHS allocated \$15 million to CDC from the Prevention and Public Health Fund. Of this appropriation, CDC allocated \$11 million to 29 states, 5 cities and the District of Columbia for a 2014-2016 Funding Opportunity Announcement (FOA). The 35 grantees are funded to eliminate CLP by creatively targeting resources and implementing program initiatives in three key areas.

- Build and strengthen lead surveillance systems to identify neighborhoods and populations of children who are disproportionately affected by high BLLs.
- Educate parents and clinical providers in target areas about the importance of blood lead testing for children <6 years of age.
- Collaborate with institutional and community-based partners to initiate, promote and evaluate CLP prevention activities.

In 2015-2016, the Flint water crisis occurred and caused CDC to reconsider its existing lead surveillance capacity for 2017 and beyond to address and prevent similar incidents from occurring in the future. CDC is focusing on five major areas in this regard.

First, an automated syndromic surveillance system with an electronic alert would allow CDC to review blood lead test data in real time before an incident occurs in communities. CDC would notify the state or locality to conduct an investigation when a blood lead alert is triggered in the syndromic surveillance system. CDC has been using Flint as a case study to develop the model and plans to deploy the system to states and localities after the system is pilot tested, evaluated and refined.

Second, enhanced lead surveillance will increase screening rates of high-risk children and allow states and localities to eliminate lead sources prior to exposure. CDC is exploring the possibility of including “enhanced surveillance” language in the new lead FOA. CDC also will provide grantees with guidance on conducting small-area prevalence studies with a uniform approach.

Third, CDC will continue its cross-sector collaborations with federal, state and local partners, including EPA, HUD, American Water Works Association, state/local water utilities, and state/local departments of environmental quality. CDC and its partners have identified several issues that will play an important role in advancing existing lead surveillance capacity, such as health-based changes to the EPA Lead and Copper Rule, health department notifications, changes in water sources or water chemistry, and exceedances of the 15 ppb standard for lead in water.

Fourth, enhanced data reporting will require improvements in several areas.

<i>Program Component</i>	<i>Improvements Needed</i>
Laboratory limit of detection (LOD) capacity	<ul style="list-style-type: none"> • Increased epidemiological support • Increased information technology (IT) support to improve state reporting systems, including the shift from paper-based to electronic systems
Laboratory timeliness	<ul style="list-style-type: none"> • System modifications to report near real-time data
State/local program timeliness	<ul style="list-style-type: none"> • Capacity to report near real-time data
Requirements	<ul style="list-style-type: none"> • More uniform reporting requirements

Fifth, secondary and tertiary prevention will help to identify and implement policies, systems and environmental changes to minimize lasting effects of lead exposure in children through case management, social services and educational interventions. Overall, CDC is striving to scale up

the CLPPP as a national program in all 50 states to achieve the Healthy People 2020 goal of eliminating CLP.

BSC DISCUSSION: ENHANCED LEAD SURVEILLANCE CAPACITY

Dr. Brown provided additional details on CDC's ongoing efforts to enhance lead surveillance capacity in response to the BSC's specific questions.

- In terms of lead funding, the \$2 million increase from the 2014-2016 FOA (\$15 million) to the new FOA (\$17 million) will allow CDC to award more funds to grantees. Multiple small-area prevalence studies have been conducted throughout the world and are known to be effective. The straightforward, population-based cluster design of these studies involves collecting real-time environmental and blood lead samples from the homes of children. The cost of each small-area prevalence study is ~\$45,000 and can be completed in ~3 weeks. However, grantees will need to partner with schools of public health, nursing schools and/or other local entities for data collection.
- In terms of the new lead FOA, applicants must document their lead problem based on children's BLLs, high-risk areas in the jurisdiction and other factors. Applicants also are required to demonstrate their capacity to address the problem and provide evidence of existing relationships with key partners, such as HUD, housing authorities and environmental quality departments. With the exception of a few cities and the District of Columbia, CDC awards lead CoAg to states that subcontract with local communities. For example, the Michigan Department of Health and Human Services would be the recipient of the CDC CoAg. Michigan would then allocate a portion of its CoAg funds to the Genesee County Health Department to address the high-risk community of Flint. However, the ability of states to award subcontracts is extremely limited at this time due to the dramatic reduction in CDC's average CoAg amount from ~\$1 million to ~\$250,000 per grantee.
- In terms of cross-sector collaborations, CDC and EPA are continuing their longstanding partnership to notify local health departments of addresses of water utility systems that exceed the 15 ppb standard for lead in water.

BSC GUIDANCE

- CDC should award funds to grantees to conduct small-area prevalence studies on water utility systems that far exceed the lead in water standard. Current water quality data show that multiple water utility systems throughout the country are not complying with Lead and Copper Rule monitoring requirements and have water lead levels 200-1,000 ppb.

LPPS GUIDANCE

- CDC should reconsider its proposed strategy of improving laboratory LOD by increasing epidemiological and IT support. LODs tremendously vary because laboratories use different techniques and calculation methods. This problem is more profound than in the past because laboratories are now measuring BLLs at much lower levels. CDC should consider the following strategy to better characterize the distribution of LODs. Laboratories should be funded to conduct small-area prevalence studies with a uniform approach of using inorganic mass spectrometry rather than less accurate techniques. A clear distinction should be made between clinical reporting (e.g., LODs are required to be

- reported on forms) and research or surveillance reporting (e.g., laboratories report actual values derived by the instrument).
- CDC should consider additional strategies in its ongoing efforts to improve lead surveillance.
 - Universal screening should be considered as the preferred approach.
 - Predictive modeling should be conducted with various data sources (e.g., data on children BLLs, housing and socioeconomic status) to identify communities at highest risk for exposure. The predictive model should be designed to produce data to empower communities.
 - Placed-based predictive modeling should be conducted to help health departments convene a coalition of key entities at the local level to implement changes and interventions to prevent CLP.
 - Caution should be taken in interpreting the meaning and implementing the requirements of the Lead and Copper Rule due to its complexity. CDC should use its leadership role in advising EPA on the upcoming revision to the Lead and Copper Rule to ensure the updated regulation is streamlined and effective.
 - CDC's proposed strategies to improve lead surveillance through blood lead testing of children <6 years of age and education are sound overall. However, these approaches do not address CDC's previous guidance to develop a long-term primary prevention plan to abate lead paint in pre-1978, low-income housing and replace lead service lines. Studies already have demonstrated that a \$10 billion investment in lead-based paint abatement programs would be cost-effective and result in positive benefits in terms of gains in IQ, education, business productivity and other factors. The BSC should issue a formal recommendation to CDC to invest and/or leverage resources from other sources to develop and implement a primary prevention plan. The former ACCLPP sent a letter to the HHS Secretary and CDC Director in February 2013 to emphasize the tremendous cost-savings to society from lead paint abatement. (Several LPPS members applauded to show their support for Dr. Kosnett's comments.)

CDC's Response to the Emergence of Zika Virus in the United States

Coleen Boyle, PhD, Mshyg

Director, National Center on Birth Defects and Developmental Disabilities
Centers for Disease Control and Prevention

Dr. Boyle described CDC's role in the Zika outbreak response. CDC's activation of its EOC in January 2016 rapidly shifted from level 2 to the highest level in a one-week period. To date, CDC has deployed >1,200 staff to numerous countries for the Zika outbreak response, including the United States, Puerto Rico, Brazil, Colombia, Mexico and Panama. CDC's key partners in the response include the World Health Organization and Pan American Health Organization.

The Zika virus represents the first time in history that a mosquito has caused severe and devastating developmental and reproductive outcomes. Moreover, the complexities, unknowns and uncertainties of the basic science and epidemiology of the Zika virus have presented multiple challenges in CDC's management of the response.

Zika is an arbovirus and flavivirus that emerged in 1947. Zika includes Asian and African strains, but the Asian strain that has been circulating in the Americas is the source of the current outbreak

and likely was imported from French Polynesia to Brazil through soccer games in 2014. Zika initially was recognized seven months before the first children with microcephaly were born in Brazil. The outbreak then spread to Colombia and other Central American countries.

CDC published an *MMWR* article in June 2016 with recommendations on screening the blood supply in Puerto Rico. The article reported that 1% of all blood donors were RNA-positive for the Zika virus with active infection. The contaminated blood supply has contributed to 4%-5% of new infections (or ~1,000 individuals) per month.

CDC posted maps on the CDC.gov website to illustrate its best estimates of the potential range of the two types of mosquitoes that carry the Zika virus in the United States. As the most efficient vector for the Zika virus, the *Aedes aegypti* mosquito is a fairly voracious daytime biter of humans that causes human-mosquito-human transmission of disease. The *Aedes aegypti* is an urban mosquito that is difficult to control and eliminate from a vector perspective due to its survival in locations with a high concentration of humans and growth in miniscule amounts of water.

The *Aedes albopictus* mosquito is a potential carrier of the Zika virus and is more widespread in the United States. The majority of Zika cases from this mosquito will be travel-associated rather than locally transmitted cases. CDC is closely collaborating with partners in state/local health departments and large metropolitan cities, particularly those in California, Florida, Hawaii and Texas, to prepare for the importation of additional travel-associated Zika cases.

The status of Zika cases as of June 22, 2016 is summarized as follows. To date, 819 travel-associated Zika cases have been reported in the United States, including 265 cases in pregnant women, 11 sexually transmitted cases, and 4 cases of terminated pregnancies/birth defects in newborns. To date, 6 travel-associated and 1,854 locally acquired Zika cases have been reported in U.S. territories (primarily Puerto Rico), including 216 cases in pregnant women and 4 cases of terminated pregnancies/birth defects in newborns.

CDC is conducting body fluid studies in Puerto Rico and Colombia to better understand the transmission of the Zika virus and the length of its survival in urine and semen. Preliminary data show that the virus can survive in semen for up to 64 days. CDC also published a special report in *The New England Journal of Medicine* on April 13, 2016, "Zika Virus and Birth Defects: Reviewing the Evidence for Causality."

Dr. Boyle presented photographs to illustrate the severity of microcephaly in two infants in Brazil infected with Zika. The attack of the virus on brain tissue causes the volume of the brain to decrease, the skull to collapse and tissue to fold. CDC's Zika prevention approach for the United States primarily has focused on protecting pregnant women. Since January 2016, CDC has engaged 1,265 staff to provide scientific, technical and programmatic leadership and support, operations, logistics and a presence in the field.

As of June 8, 2016, CDC has deployed 179 staff to Puerto Rico due to widespread outbreaks of the Zika virus in the territory. CDC has been providing technical assistance and expertise to the Puerto Rico Department of Health in the areas of vector control, personal protection for pregnant women and women of childbearing age (e.g., Zika prevention kits), access to effective contraception, risk communication and community engagement. CDC also is focusing on specific areas in the United States that are likely to have clusters of local transmission, but widespread outbreaks are not anticipated.

CDC's Zika surveillance covers pregnant women, birth defects in infants and mosquitoes. CDC will soon award Zika CoAgS to states in three categories: emergency preparedness, laboratory and epidemiologic capacity, and pregnancy and birth defects monitoring. CDC is collecting data to increase knowledge and take action on Zika and pregnancy. CDC collaborated with state, local, tribal and territorial health departments to establish the U.S. Zika Pregnancy Registry, Zika Active Pregnancy Surveillance System in Puerto Rico, and enhanced surveillance of pregnant women with Zika in Colombia.

The U.S. Zika Pregnancy Registry will play an important role in ensuring that all pregnant women with potential infection, including those who are asymptomatic, are monitored. Registry data will be used to better estimate the number of at-risk pregnancies, enhance understanding of possible adverse outcomes, facilitate planning services for affected families, and update recommendations for clinical care. Among pregnant women who have been tested and have laboratory evidence of Zika virus infection to date, 51% have been asymptomatic in the United States and 34% have been asymptomatic in U.S. territories.

CDC's current guidance and messaging on Zika are summarized as follows. Human-mosquito-human transmission of Zika requires the individual to have active disease. Zika testing is recommended for all pregnant women in Puerto Rico and all women who have traveled to areas where local endemic transmission of the virus is active. Women with active Zika virus should avoid becoming pregnant for eight weeks. Pregnant women whose partners have traveled to Zika endemic areas should use condoms for the duration of their pregnancies

BSC DISCUSSION: CDC'S ZIKA OUTBREAK RESPONSE

Dr. Boyle provided additional details on CDC's response to the Zika outbreak in response to specific questions posed by the BSC members.

- Differences in vulnerability to the Zika virus across the three trimesters of pregnancy.
- The common belief in the medical community in Puerto Rico that the pesticide interaction is not solely due to the Zika virus.
- CDC's plans to obtain and maintain data from blood banks that are screening and purifying the blood supply.
- The development of vector control plans by Florida and other states or localities that have reported travel-associated Zika cases in pregnant women in the United States.

BSC GUIDANCE

- CDC should disseminate accurate, plain-language messaging to the public to minimize fears regarding sexual transmission of the Zika virus: "Zika can be sexually transmitted, but the virus is not the same as HIV infection. There is no specific medicine or vaccine to treat Zika. The body will naturally eliminate the Zika virus after a certain period of time."

LPPS GUIDANCE

- CDC should conduct studies on the developmental and reproductive toxicity and safety of mosquito repellants in pregnant women and women of childbearing age. The studies should be designed to measure unintended consequences from the use of and exposure to pesticides in the long-term. Data from the new Zika pregnancy registries should be collected to build the evidence base in this area and make recommendations on protecting these populations.

Public Comment Period

Dr. Cibulas opened the floor for public comments; no participants responded.

CDC's Blood Lead Reference Value

Mary Jean Brown, ScD, RN

Chief, Lead Poisoning Prevention Program
Centers for Disease Control and Prevention

Advice Requested from the BSC by NCEH/EEHS:

1. What are the implications of establishing a new BLRV that is lower than 5 µg/dL?
2. Should the BLRV be used as a combined case definition/benchmark?
3. Are other metrics available that might be useful to help measure progress toward reaching the national goal of eliminating EBLs in children by 2020, particularly in communities with the highest lead exposures?
4. Can state and local surveillance data that provide smaller estimates than national data be modeled and used as surrogates of population-based estimates generated by the National Health and Nutrition Examination Survey (NHANES)?

Dr. Brown presented an overview of CDC's current decision-making process regarding the BLRV. The former ACCLPP voted to approve two key recommendations to CDC in 2012. First, eliminate and replace the terminology of "blood lead level of concern" (i.e., ≥ 10 µg/dL) with a reference value based on the 97.5th percentile of the distribution of BLLs in children 1-5 years of age as measured by NHANES. Second, reevaluate the BLRV every four years.

ACCLPP issued recommendation 1 due to the public's inaccurate interpretation of "BLL of concern" as CDC's lack of concern for children's BLLs < 10 µg/dL. Recommendation 2 was issued due to the dramatic decrease in BLLs over the past 30 years. ACCLPP acknowledged that two NHANES cycles would be needed to ensure the sample was an adequate size and had sufficient statistical power to review the BLRV. CDC concurred or concurred in principle with ACCLPP's recommendations.

In response to ACCLPP recommendation 1, CDC changed its guidance in May 2012 to recommend the use of a BLRV ≥ 5 µg/dL. In response to ACCLPP recommendation 2, CDC is now reviewing data from the 2011-2012 and 2013-2014 NHANES cycles. NHANES is a continuous, cross-sectional representative survey of the non-institutionalized U.S. civilian population. NHANES has a complex probability design and is conducted in two-year cycles. During each NHANES cycle, ~10,000 participants, including ~1,200 children 1-5 years of age, are interviewed and physically examined. Blood specimens are collected from 850 (or ~69%) young children.

CDC's current review of the BLRV includes $< 1,900$ blood lead test results for children 1-5 years of age from the two most recent NHANES cycles. The CDC Elemental Analysis Laboratory uses inductively coupled plasma mass spectrometry (ICP-MS) to measure BLLs. The LODs of BLLs in the NHANES cycles were 0.25 µg/dL (2011-2012) and 0.1 µg/dL (2013-2014). The CDC

laboratory calculated the distribution of BLLs for children 1-5 years of age to determine the 97.5th percentile, geometric mean BLLs, and 95% confidence intervals. Pairwise t-tests were conducted to identify significant differences between geometric mean BLLs.

Subgroups of the sample with known disparities were analyzed by age, gender, race/ethnicity, poverty-to-income ratio and household income. The family poverty threshold indicator was categorized as either <1.3 or \geq 1.3 times the Federal Poverty Level (FPL). Laboratory statisticians found that two blood lead tests were below the LOD. All of the analyses included sample cycles to account for unequal probabilities due to oversampling of particular subgroups in the cohort.

Data from the 1999-2010 NHANES cycles showed a decrease in BLLs in each subsequent cycle. The same trend was observed in the 2011-2014 NHANES cycles. Based on the upper limit of the BLRV in the 2011-2014 NHANES cycles, 2.5% of children in the United States had BLLs \geq 3.5 $\mu\text{g}/\text{dL}$. The current BLRV is lower than children's BLLs \geq 5 $\mu\text{g}/\text{dL}$ in the 2007-2010 NHANES cycles. The range of the confidence interval of the current BLRV \geq 3.5 $\mu\text{g}/\text{dL}$ is 2.7%-4.7%.

Of 1,531 children who were tested in the 2011-2014 NHANES cycles, 45 had BLLs \geq 3.5 $\mu\text{g}/\text{dL}$, 6 had BLLs 10-44 $\mu\text{g}/\text{dL}$, and 0 had BLLs \geq 45 $\mu\text{g}/\text{dL}$. CDC's review of the current BLRV has been limited due to the small cohort of only 45 children with BLLs \geq 3.5 $\mu\text{g}/\text{dL}$ and sparse data on BLLs at higher levels. The extremely small number of children with BLLs \geq 3.5 $\mu\text{g}/\text{dL}$ is a remarkable public health success and demonstrates the effectiveness of previous interventions in protecting children.

CDC's review of the current BLRV included analyses of the prevalence of children's BLLs based on specific characteristics. However, standard errors of \geq 30 resulted in prevalence estimates of children 1-5 years of age with BLLs \geq 3.5 $\mu\text{g}/\text{dL}$ that were statistically unreliable for several characteristics: male children and all children 3-5 years of age; children in non-Hispanic white, Mexican American and other racial/ethnic groups; children with a poverty-to-income ratio \geq 1.3 times the FPL; and children in household incomes <\$20,000 and \geq \$20,000.

Despite the statistical unreliability of prevalence estimates for certain characteristics, CDC observed disparities in the 2011-2014 NHANES cycles that were similar to those in previous cycles. Most notably, BLLs \geq 5 $\mu\text{g}/\text{dL}$ in non-Hispanic black children continue to be higher than in other racial/ethnic groups. Higher BLLs are associated with the poverty-to-income ratio, but this relationship is not statistically significant. NHANES estimates and 95% confidence intervals at or above the BLRV 5 $\mu\text{g}/\text{dL}$ showed steady decreases in the prevalence of BLLs: 8.65% (1999-2002 cycles), 4.11% (2003-2006 cycles), 2.64% (2007-2010 cycles), and 1.2% (2011-2014 cycles).

CDC conducted analyses to determine geometric mean BLLs in children 1-5 years of age based on specific characteristics. In the 2003-2006 NHANES cycles, non-Hispanic black children and younger children in the 1-2 year age group had higher geometric mean BLLs. The relationship between poverty status and higher geometric mean BLLs was significant.

Geometric mean BLLs were lower in the 2007-2010 NHANES cycles based on the BLRV 5 $\mu\text{g}/\text{dL}$. Differences in geometric mean BLLs based on race/ethnicity and the poverty-to-income ratio decreased as well. These differences were even smaller in the 2011-2014 NHANES cycles. NHANES estimates and 95% confidence intervals showed steady declines in geometric mean BLLs: 1.94 $\mu\text{g}/\text{dL}$ (1999-2002 cycles), 1.61 $\mu\text{g}/\text{dL}$ (2003-2006 cycles), 1.33 $\mu\text{g}/\text{dL}$ (2007-2010

cycles), and 0.86 µg/dL (2011-2014 cycles). Decreases in geometric mean BLLs from the 1999-2002 to the 2011-2014 cycles were significant.

In terms of geometric mean BLLs by race, confidence intervals for non-Hispanic blacks have begun to overlap. These data indicate that all children, particularly those at highest risk, have benefited from efforts to regulate, control or eliminate lead sources from children's environments (e.g., paint, toys and other consumer products). The current strategy of controlling and eliminating lead sources from children's environments should be maintained, but implemented much more frequently.

Dr. Brown asked the BSC to provide input in response to the four questions that were distributed in advance of the meeting. She noted that the BSC's guidance would be helpful in CDC's ongoing decision-making process regarding the use and interpretation of the BLRV for healthcare providers, parents, educators and other stakeholders with an interest in BLL interventions for children.

For purposes of the discussion, Dr. Brown explained that refugee children are not well represented in NHANES. Refugee children have significant exposures to lead in their countries of origin and the United States. As a result, data sources other than NHANES are needed to identify children in high-risk communities.

BSC GUIDANCE

Question 1: Implications of a lower BLRV

- Concerns regarding the ability to apply a lower BLRV to public health practice should be addressed. For example, existing LeadCare II and III instruments do not have the capacity to measure BLLs 2.5 µg/dL in the field.
- The "as low as reasonably achievable" principal that has been adopted by and is widely accepted in the industrial hygiene community should be considered in the decision-making process to lower the BLRV.
- CDC should invest more resources in health education and communication. For example, pediatricians should inform parents of BLLs <5 µg/dL in their children and provide parents with educational materials. These resources should help parents to identify and remove the lead source from the child's environment and prevent BLLs <5 µg/dL from increasing to >5 µg/dL.
- Resources should be targeted to addressing EJ issues. Similar to the previous NHANES cycles in 1992-2002, the most recent cycles in 2011-2014 are still showing disparities in childhood BLLs by race/ethnicity, poverty and household income.
- Emphasis should be placed on identifying lead "hot spots" to strengthen the focus on the environment rather than children in the environment.

LPPS GUIDANCE

Question 1: Implications of a lower BLRV

- CDC, its grantees and the world-renowned laboratory are to be applauded for their outstanding public health achievement of decreasing childhood BLLs to the lowest levels ever recorded in U.S. history. However, the current capabilities of commercial, hospital and public health laboratories in the United States should be considered in the decision-making process to lower the BLRV. ICP-MS instruments cost ~\$180,000 and require a high level of skill to use. At this time, only 19% of laboratories use ICP-MS and >50% of laboratories use some form of LeadCare technology to measure and report blood lead test

results. Because LeadCare devices do not have the level of precision to measure a low BLL of 2.1 µg/dL at this time, a tremendous amount of false-positive, false-negative and uncertain blood lead test results likely will be reported. Laboratories and hospitals that typically use furnace atomic absorption also will be challenged in measuring and reporting BLLs at these lower levels. A lower BLRV will be extremely difficult to implement in public health practice and also will increase the potential for contamination. The poor performance of current analytical techniques in measuring a low BLL of 3.5 µg/dL also should be considered in the decision-making process to lower the BLRV. For example, the federal government regulates the performance of blood lead testing laboratories. With a lower BLRV of 3.5 µg/dL, laboratories that report non-detectable blood lead test results or those in the range of ± 7.5 µg/dL would be “competent” based on existing federal standards. Even if a more rigorous federal standard of ± 2 µg/dL is implemented, laboratories that report blood lead test results in the range of 1.5-5.5 µg/dL still would be “competent.” Overall, CDC’s use of a state-of-the-art ICP-MS instrument in a controlled study with highly skilled laboratorians does not reflect the actual laboratory infrastructure in the field.

- The BSC should submit a formal recommendation to CDC to invest resources and collaborate with the Centers for Medicare & Medicaid Services to change the current federal standard for laboratories to measure and report blood lead test results at lower levels.
- From a toxicological perspective, the BLRV should be lowered from 5 to 3.5 µg/dL. The relationship between lower BLLs and IQ benefits to children is well documented in the literature. Compared to other EH problems, the highest quality epidemiological data have been collected and the largest number of prospective cohort birth studies have been conducted on lead.
- From a regulatory perspective, a potential change in the BLRV every four years will present tremendous challenges. For example, EPA has a long history of relying on CDC’s recommendations to issue guidance and regulations, such as the lead in soil screening level at Superfund sites, action level in the Lead and Copper Rule, and EPA/ HUD standard for dust lead levels on floors. EPA still has not fully implemented the 2012 recommendation for the BLRV ≥ 5 µg/dL in all of its guidance and regulations, but CDC is now considering the possibility of establishing an even lower BLRV.
- From a parental perspective, the public health and clinical communities have not given parents clear and simple messaging on potential health effects to their children from different BLLs (e.g., a BLL of 1 µg/dL versus 5 µg/dL) or the impact of a lower BLRV on their individual children (e.g., a BLRV of 5 µg/dL versus 3.5 µg/dL).
- Children with BLLs ≥ 10 µg/dL in the past and children with BLLs ≥ 5 µg/dL in the present typically reside in the same high-risk communities. A lower BLRV might dilute primary prevention efforts and overlook children in these high-risk communities by targeting interventions to broader areas.

Question 2: Use of the BLRV as a combined case definition/benchmark

- The BLRV should be tracked and used as a benchmark to measure progress. However, EPA likely will be unable to base its guidance and regulations on a BLRV that is subject to change every four years.

Dr. Breyse asked the BSC and LPPS to consider several issues in its ongoing discussions to provide CDC with guidance on the BLRV. A groundswell of support is underway nationally to eliminate lead because no “safe” threshold has been defined to date. Health effects from BLLs

<5 µg/dL are well documented in the literature. CDC could implement creative approaches to lower the BLRV, such as a phased-in period, the establishment of incremental targets until laboratory technology is developed to measure lower BLLs, and the creation of protocols that require more than one measurement in the clinical setting.

Dr. Perry confirmed that during its separate meeting on the following day, the LPPS would have an opportunity to engage in a more in-depth discussion on the four questions posed by Dr. Brown. Based on the initial discussion, both the BSC and LPPS emphasized the need to maintain a strong focus on primary prevention if a decision is made to lower the BLRV. She also confirmed that the BSC looks forward to considering and taking a formal vote on any recommendations proposed by the LPPS.

Dr. Perry announced that she would present a draft recommendation for the BSC's review and comment on the following day. The recommendation would advise NCEH/ATSDR to take a more active role in evaluating the health effects of pesticides recommended by CDC for pregnant women to use against Zika and identify current data gaps in the use of these chemicals.

With no further discussion or business brought before the BSC, Dr. Cibulas recessed the meeting at 4:30 p.m. on June 28, 2016.

June 29, 2016 Opening Session: Welcome-BSC Meeting Reconvenes

William Cibulas, Jr., PhD, MS

Deputy Associate Director for Science, NCE/ATSDR
BSC Designated Federal Official (DFO)

Dr. Cibulas opened the floor for introductions and confirmed that the 13 voting members and *ex-officio* members in attendance constituted a quorum for the BSC to conduct its business on June 29, 2016. He reconvened the proceedings at 8:34 a.m. and welcomed the participants to day 2 of the BSC meeting.

Dr. Cibulas announced that BSC meetings are open to the public and all comments made during the proceedings are a matter of public record. He reminded the voting members of their responsibility to disclose any potential individual and/or institutional conflicts of interest for the public record and recuse themselves from voting or participating in these matters. None of the BSC voting members publicly disclosed conflicts of interest for any of the items on the June 29, 2016 published agenda.

Dr. Cibulas announced that logistical issues prevented NCEH/ATSDR from convening the separate LPPS meeting. Meetings of all FACA-chartered committees and subcommittees must be published in the *Federal Register* with advance notice to the public, but this requirement was not met. NCEH/ATSDR would make every effort to reschedule the in-person LPPS meeting before the next BSC meeting.

Dr. Breyse made some introductory remarks regarding the first presentation. He asked the participants to join him in welcoming Dr. John Decker, NCEH/ATSDR Associate Director for Science, who has lead responsibility for coordinating PFAS activities across NCEH and ATSDR.

Dr. Breyse emphasized that ATSDR is particularly interested in the BSC's advice on responding to community concerns, addressing potential risks from exposures, and providing guidance on possible health effects based on the best available evidence. At this time, millions of Americans are drinking bottled water due to contaminants in their water supplies that are at or above the levels recommended by EPA health advisories.

ATSDR's Strategy to Address PFAS in the Environment

Lynn Wilder, PhD, CIH

ATSDR Division of Toxicology and Human Health Sciences (DTHHS)

Frank Bove, PhD

Senior Epidemiologist

ATSDR Division of Toxicology and Human Health Sciences (DTHHS)

Advice Requested from the BSC by ATSDR/DTHHS:

1. Is ATSDR's proactive outreach and current group of partners appropriate for the PFAS strategy?
2. What are the most effective messages that ATSDR should provide to communities regarding PFAS biomonitoring and breastfeeding?
3. What should be the key issues in ATSDR's health studies when selecting health endpoints from priority data gaps?
4. What steps should ATSDR take to prepare for PFAS issues in the future (e.g., small municipal water systems with <10,000 connections and small-chain PFAS)?

Drs. Wilder and Bove presented an update on ATSDR's strategy to address PFAS in the environment.

Dr. Wilder presented a map to illustrate the locations of large municipal water systems in the United States and U.S. territories with PFAS and perfluorooctane sulfonate (PFOS) levels less than, at or above 70 ppt. The EPA Unregulated Contaminant Monitoring Rule 3 requires large municipal water systems to test for compounds that are believed to be emerging contaminants. Based on these outcomes, EPA will issue a lifetime health advisory. However, the EPA rule does not cover small municipal water systems or private wells. Dr. Wilder also presented a map to illustrate the locations of PFAS manufacturing, military or other types of facilities where ATSDR and its partners have conducted site-specific activities to date.

ATSDR's strategy of active engagement and collaborative support to address PFAS in the environment is based on three key components. Component 1 is ATSDR's technical assistance and support to states and other partners. ATSDR updated its website with fact sheets, up-to-date scientific data on PFAS and links to state activities (www.atsdr.cdc.gov/pfc/index.html). Community messages, technical information and summaries of the PFAS literature are being disseminated to states as well.

ATSDR is conducting exposure assessments by reviewing environmental data, reaching conclusions and formulating recommendations to address PFAS. The NCEH laboratory is providing additional support and expertise to states in the area of PFAS biomonitoring.

Educational materials and other resources on PFAS for physicians will be posted on the CDC.gov website in the near future. The draft PFAS ToxProfile™ will be finalized in April 2017.

Component 2 is internal and external coordination. Internal coordination efforts focus on the process to triage incoming requests on PFAS between NCEH and ATSDR in a consistent manner. External coordination efforts focus on ATSDR's responses to requests submitted by partners on various PFAS-related issues.

- National Toxicology Program (NTP) (PFAS toxicity)
- U.S. Food and Drug Administration (PFAS levels in bottled water)
- NIOSH (worker exposures to PFAS)
- U.S. Department of Defense (PFAS site assessments)
- EPA (water, children's health and Superfund sites)
- State laboratories (biomonitoring of PFAS)
- New PFAS activities with additional partners: ASTHO and other state health officials, Pediatric Environmental Health Specialty Units, and American Academy of Pediatrics

Component 3 is ATSDR's ongoing research to identify and fill key data gaps in PFAS to address community concerns. These studies are focusing on maternal PFAS and breastfeeding to determine the half-life of this chemical in mothers and nursing infants; the half-life of PFAS in children; pharmacokinetic modeling of PFAS; and a feasibility assessment of PFAS health studies.

In addition to the three components of the strategy, ATSDR also is incorporating PFAS data into the Tracking Network, identifying PFAS exposure pathways other than municipal water systems and drinking water (e.g., fish); and addressing small-chain PFAS in smaller municipal water systems and private wells.

Dr. Bove presented an update on ATSDR's feasibility assessment of a children's health study that primarily focuses on the Pease Tradeport, New Hampshire site to address key concerns raised by the Community Advisory Board (CAB). The CAB held its most recent in-person meeting in May 2016. ATSDR implemented a blood sampling program at the Pease Tradeport site to evaluate PFAS levels in children and adults. Test results have been collected to date from 396 children <18 years of age, including test results for 366 children <12 years of age.

Dr. Bove requested the BSC's input on the study design that ATSDR is considering at this time. The sample size would include 350 children from Pease Tradeport daycare centers and 175 unexposed children from other daycare centers as the control group. Consent for the previous blood sampling program at the Pease Tradeport site was limited to PFAS levels in the blood. For the proposed children's study to evaluate health endpoints, ATSDR would be required to obtain re-consent from the current Pease Tradeport population of children for additional sampling and new consent from children in the control group for initial blood sampling.

The health endpoints would include lipids, thyroid function, uric acid, sex hormones (e.g., testosterone and estradiol), puberty/delays in puberty, immune outcomes, and IQ and other neurobehavioral parameters. ATSDR is considering these endpoints because other children's health studies documented in the literature have designs that are similar to the proposed Pease Tradeport study in terms of sample sizes and health effects in children from contaminants. The published studies also reported consistent findings. However, the proposed Pease Tradeport

sample size would be too small to address attention deficit hyperactivity disorder. Efforts to study immune outcomes would be difficult as well due to the lack of existing data in this area.

BSC DISCUSSION: ATSDR'S PFAS STRATEGY

Drs. Wilder and Bove provided additional details on ATSDR's strategy to address PFAS in the environment in response to specific questions posed by the BSC members.

- Existing data that indicate PFAS in private wells is a concern.
- The strategy to analyze co-exposures to PFOS, PFAS and perfluorooctanoic acid (PFOA) in the proposed Pease Tradeport children's health study.
- Efforts to ensure that none of the children in the control group have been exposed (e.g., children who reside in communities with unknown exposure sources or children who might have consumed bottled water from contaminated municipal water systems).
- The role of the CAB in recruiting an adequate population of children to ensure that target sample sizes for the exposed and control groups will be achieved for the Pease Tradeport children's health study.

BSC GUIDANCE

Question 2: Messaging

- Existing data should be utilized to inform the development and delivery of risk communication messaging. Published studies reported a probable epidemiologic link between PFOA exposure and health outcomes in communities. Findings from systematic reviews of human and animal studies were applied to design a structured framework and reach conclusions. NTP will finalize its draft report on immunotoxicity associated with PFOS and PFOA in the near future after the public comment period is closed.
- Public health focuses on endpoints at the population level, but communities are more interested in their personal risks at an individual level. Risk communication messaging of PFAS biomonitoring results should inform the public that epidemiologic studies are limited due to their population-based design.

Question 4: Preparation for future issues

- Small-chain PFAS should be a major focus of NCEH/ATSDR's future activities because these water systems are not part of the phase-out of extreme or persistent environmental contaminants. ATSDR should collaborate with EPA and NTP to enhance the published literature on small-chain PFAS.

LPPS GUIDANCE

Question 1: Proactive outreach and partners

- ATSDR should take a leadership role at the federal level by issuing plain-language documents to clearly explain and articulate EPA health advisories to the public, such as EPA's methodology to derive at contaminant levels and the relationship between these levels and health risks.

Question 2: Messaging

- Messaging regarding "probable" risks and the magnitude of "actual" risks from exposure should be communicated to the public. Clear messaging on the nature of the problem would help to minimize fear, decrease anxiety and increase understanding of risk to the exposed population.

Question 3: Health studies

- The concepts of the proposed Pease Tradeport children's health study likely will not generate clinically relevant information. The proposed study appears to focus on health messaging and important scientific studies to strengthen the existing evidence base, but no emphasis is placed on clinically relevant health outcomes.

Dr. Perry noted that the BSC did not address all of the questions posed by Drs. Wilder and Bove, particularly messaging regarding PFAS in breastfeeding mothers. Because ATSDR is still developing and refining its strategy to address PFAS in the environment, she encouraged the BSC members to submit additional feedback to Dr. Cibulas (wic1@cdc.gov) for distribution to Drs. Wilder and Bove.

NCEH's Strategy for an Integrated Safe Water Program

Judith Qualters, PhD, MPH

Director, NCEH Division of Environmental Hazards and Health Effects
Centers for Disease Control and Prevention

Dr. Qualters described NCEH's strategy to develop an integrated safe water program. A consolidated approach is necessary at this time because the proposed reorganization of NCEH calls for the merger of EEHS and EHHE. As a result, the two NCEH programs will need to consolidate their individual water-related services, science and priorities to strategically develop and grow an integrated safe water program over time.

Historical water disinfection efforts have led to a dramatic decline in waterborne diseases since 1900, but recent events emphasize the need for continued public health action on federally regulated drinking water systems: the chemical spill in West Virginia; harmful algal blooms (HABs) in Ohio; and lead-contaminated drinking water in Flint, Michigan. Moreover, significant gaps still need to be addressed on the health impacts of contaminants for the 12% of the U.S. population that continue to use federally unregulated drinking water (FUDW) systems. Both NCEH and ATSDR extensively collaborate with internal CDC partners to conduct water-related activities.

The CDC Safe Water Program budget is ~\$8 million at this time, but the actual operating budget is ~\$6 million. The major milestones in CDC's funding over time to conduct water-related activities are highlighted below.

- 1997: Discovery of *pfisteria piscicida* in Chesapeake Bay
- 1998: Congressional appropriation to CDC to address possible estuary-associated syndrome and initiate a water program
- 2003: Program expansion to address additional HAB issues
- 2008: Change in funding to officially launch a safe water program
- 2010-2013: CoAg awards to states to address FUDW systems and private well initiatives

NCEH took several steps to develop a CDC-wide water strategy and determine water priorities. Internal and external feedback was solicited to implement both "bottom-up" and "top-down" approaches. Strategic planning efforts were initiated with leadership by CDC centers/institutes/

offices and additional planning by NCEH divisions and branches. Resource needs in terms of both funding and staff were thoughtfully considered. Extensive input provided by the BSC during the May 2014 meeting was implemented whenever possible.

- Engage in ongoing federal efforts to provide education and address adverse health outcomes from the disposal of medications in sewer systems.
- Explore the possibility of contributing to epidemiologic studies that have reported a higher lifetime risk of developing asthma among infants who learn to swim before 6 months of age, swimmers at older ages, and chlorinated pool workers.
- Conduct research on the potential ability of hydraulic fracturing liquids to contaminate surface groundwater and drinking water.
- Develop guidelines or a standardized checklist of well water testing codes and collaborate with national professional associations to test the effectiveness of various dissemination methods.
- Expand the Tracking Network database with data from a broader range of sources (e.g., National Oceanic and Atmospheric Administration, National Science Foundation and USGS).
- Collaborate with federal partners and non-governmental stakeholders to compile challenges, experiences and lessons learned from the West Virginia MCHM chemical spill into a case study.

Based on these previous efforts, the 2015-2020 NCEH/ATSDR Safe Water Strategic Plan was drafted with the following guiding principles.

Mission

- Improve the health of Americans by promoting safe water through public health leadership, partnerships, surveillance, science, programs and interventions

Goal

- Improve decision-making to decrease threats to water systems and reduce exposures to waterborne contaminants

Objectives

- Identify, characterize and monitor water-related exposures and health outcomes to guide actions that protect public health
- Enhance water programs and practices of state, tribal, local, territorial (STLT) and other partners
- Strengthen the ability to prepare for, respond to, and recover from PHEs that impact drinking water

Dr. Qualters presented an overview of EHHE's current water activities. The mission of EHHE is to "protect people from environmentally-related illness, disability and death through surveillance, research and action." EHHE is using the 2015-2020 NCEH/ATSDR Safe Water Strategic Plan as a guide to implement the Clean Water for Health Program by identifying and characterizing water exposures, health risks and economic impacts.

In terms of identifying and prioritizing drinking water issues, EHHE administered a survey to states and tribes. In terms of filling information gaps to better understand impacts and drive action, EHHE used data from the USGS National Water Quality Assessment Program, University of Utah

and other sources to model arsenic, uranium and nitrate levels in private wells. The disease and economic burdens of exposure to arsenic in FUDW systems were analyzed as well.

In terms of conducting studies, EHHE analyzed NHANES data to compare biomarker levels of non-infectious drinking water contaminants in regulated water systems and private wells. Data from the Water Systems Council Wellcare Hotline were collected and used to assess issues among private well owners. The effectiveness of mitigation strategies in reducing arsenic exposure in homes was evaluated.

A generic information collection request form for submission to the Office of Management and Budget was developed to enable timely studies related to private well owners. The national and state portals in the National EPH Tracking Program were expanded to gather additional data on community water systems, groundwater, the potential impact of climate change on private wells, and HABs in the use of recreational water.

EHHE is providing technical expertise for STLT health departments to build capacity to address drinking water issues. Most notably, modules were disseminated to inform outbreak response training. An evaluation was conducted on the effectiveness of private well education programs in collaboration with the University of Illinois and National Ground Water Association. In this effort, toolkits will be developed for state and tribal public health practitioners to improve well water outreach and education programs. Based on the modeling activities, tools also will be designed for STLT health departments that are likely to be affected by non-infectious contaminants.

EHHE is continuing to prepare for and respond to environmental emergencies that impact drinking water. Technical assistance and expertise, such as the development of a cyanoHABS toolkit, were provided to Toledo, Ohio to address HABs. Epidemiologic and staff support was provided to West Virginia and Flint, Michigan in the field to assist their efforts in analyzing health impacts and responding to health questions regarding contaminated drinking water.

A CASPER on drought was conducted due to emerging concerns regarding impacts on the quality and quantity of drinking water and food security. The White House released the “Federal Action Plan of the National Drought Resilience Partnership” in March 2016 with an emphasis on several key drought activities.

- Modify climate datasets for public health use
- Conduct a review of state health department drought plans
- Identify local public health knowledge, practices and gaps related to drought
- Conduct a CASPER to identify knowledge, attitudes and practices of drought-affected populations
- Develop a guidance document for states to assess the health consequences of drought
- Release a drought FOA for STLT health departments to identify adverse health outcomes and improve drought resiliency and preparedness among private well owners

The White House action plan specified several drought implementation activities that would warrant a leading or supporting role by CDC. In terms of data collection and integration, CDC will develop data models to identify populations that are at risk for drought health effects. In terms of drought planning and capacity building, CDC will provide support to STLT health departments. In terms of tracking and integrating data, CDC will create decision support tools to inform rural water contingency planning efforts. To date, 13 applicants have responded to CDC’s drought FOA.

EHHE is maintaining its long history with and special focus on tribal populations. An evaluation was conducted and a survey was administered to the Navajo Nation to identify current drinking water sources and exposures. An assessment was performed to identify uranium and other contaminants in the drinking water of private wells with and without interventions on the Spokane, Washington Indian Reservation. A partnership was established with the National Tribal Water Center to achieve three key objectives: (1) identify priority drinking water issues and collect unregulated drinking data on tribal lands; (2) develop a strategic plan to address priority drinking water issues; and (3) create a toolkit to better engage and address the needs of tribal communities.

EHHE awarded a contract to the Johns Hopkins Bloomberg School of Public Health in 2015 to convene an expert panel that was charged with addressing future and emerging issues for private wells. The expert panel focused on the following objectives to fulfill its charge: identify current and emerging threats to FUDW in private wells; determine methods to assess threats and related health risks; and propose approaches for interventions and outreach. The expert panel submitted a report to EHHE in July 2015 with 28 recommendations to improve the Clean Water for Health Program, but its guidance in five major categories is outlined below.

- Focus the broad scope of current water activities and clearly articulate NCEH/ATSDR's role in safe water initiatives.
- Raise awareness, enhance engagement and strengthen partnerships at the national level to foster the evidence base and address disparities.
- Address research and information needs to better understand emerging contaminants and characterize private well users.
- Build outreach, increase capacity and promote sound stewardship through training, tools and other resources to encourage private well owners to conduct testing and take action.
- Support water testing through innovative analytic methods.

Sharunda Buchanan, PhD, MS

Director, NCEH Division of Emergency and Environmental Health Services
Centers for Disease Control and Prevention

Dr. Buchanan presented an overview of EEHS's water activities. The mission of EES is to "improve the evidence-based practice of environmental health in state, local and tribal public health agencies and related professionals to serve and protect the health of all people in the United States." EEHS's technical assistance and guidance to health departments include the following activities: identify and address routine water systems failures; respond to drinking water emergencies and outbreaks; disseminate tools and guidelines to help communities protect their water sources; and provide support for developing and implementing interventions that prevent water-related hazards or exposures.

The types of water systems under EEHS's purview include private wells and small unregulated drinking water systems; water distribution systems; building permits for plumbing systems and cooling towers; and recreational water venues. The Vessel Sanitation Program also conducts investigations to address water safety issues on cruise ships. Dr. Buchanan summarized EEHS's water programs, activities and key areas of focus.

EEHS maintains a strong public health focus on private drinking water systems because 1 in 9 Americans use private wells as their drinking water source, but 1 in 5 sampled private wells are contaminated with ≥ 1 chemicals at levels that are considered to be unsafe. Moreover, the proportion of bacterial, chemical and other outbreaks associated with private water sources has increased over the past 45 years. Of all local health departments in the country, only 56% regulate, inspect or license drinking water sources in their communities.

EEHS's current five-year CoAg for the Safe Water for Community Health (Safe WATCH) Program includes awards to 14 state and 5 local health departments totaling \$12.3 million. Safe WATCH grantees are funded to improve their state and local water programs by identifying gaps based on EPH performance standards; take actions to address and reduce identified exposures to contaminants from wells and other private water sources; disseminate water testing recommendations to increase awareness among homeowners; and develop tailored interventions based on contaminants found in private wells.

Success stories of a few Safe WATCH grantees are highlighted as follows. An Iowa county that strengthened its ability to reduce exposure to arsenic from private well water benefited 450,000 private well users. New Hampshire targeted water testing and treatment interventions for arsenic to at-risk populations. Connecticut identified 151 wells with elevated levels of arsenic and uranium and collected and organized private well water data to be shared electronically with disease prevention programs. Connecticut is following up with these programs to determine whether well owners took public health actions to prevent exposures to contaminants.

EEHS has strengthened its focus on *Legionella* due to the increasing number of individuals with Legionnaires' disease and the ability of *Legionella* to grow in poorly maintained buildings. Based on recent data, ~5,000 persons are diagnosed with Legionnaires' disease and at least 20 outbreaks are reported annually. Buildings with large water systems (e.g., hotels, long-term care facilities and hospitals) are the major contributors to these outbreaks.

EEHS brings an environmental assessment component to bear in its collaborations with internal CDC partners on conducting *Legionella* outbreak investigations and developing training materials for states. For example, EEHS published the June 2016 CDC *VitalSigns*TM report and issued an illustration on the use of effective water management programs in buildings to help prevent or reduce the risk of Legionnaires' disease outbreaks.

EEHS and an extensive group of partners and stakeholders developed the Model Aquatic Health Code (MAHC) to focus on morbidity, mortality and injuries from recreational water sources. Drowning is a leading cause of unintentional injury-related deaths for children 1-14 years of age. Injuries from pool chemicals account for nearly 5,000 ED visits annually. Waterborne illness outbreaks associated with pools and aquatic facilities have dramatically increased from an average of 12 per year in 1991-1995 to 41 in 2006-2010. A recent study reported that routine inspections frequently resulted in immediate closure of public aquatic venues because of health hazards.

The MAHC is a guidance document that includes recommendations for state and local agencies to reduce illness and injuries related to non-residential aquatic facilities and public pools by incorporating science-based practices into pool programs. However, the MAHC is not a federal law. EEHS will release the second edition of the MAHC in July 2016. The Conference for the Model Aquatic Health Code was established in 2013 as a non-profit organization to collect, assess

and convey national input to CDC on revisions to the MAHC that should be considered for adoption.

EEHS provides technical assistance, guidance and onsite support to EH practitioners who perform critical functions during emergency response and recovery, such as conducting shelter assessments, testing drinking water supplies, conducting food safety inspections and controlling disease-causing vectors. Most notably, EEHS played an instrumental role in Hurricanes Sandy, Irene and other major storms; the cholera outbreak in Haiti, *Campylobacter* in water in Arizona; dissemination of a drinking water advisory toolkit to state and local partners; and the Flint water crisis. EEHS conducts surveillance to identify and address emerging issues and contaminants at state and local levels.

Dr. Buchanan requested guidance from the BSC on NCEH's next steps in developing a comprehensive water strategic plan. The strategic plan must be designed to reflect the upcoming consolidation of EHHE and EEHS, emerging issues and technologies, and the need to leverage limited resources. Despite these future changes, however, efforts must still be targeted to growing the CDC Safe Water Program budget.

Dr. Breyse asked for the BSC's input specifically from an OD perspective. Safe water initiatives include a vast array of entities and stakeholders, such as other CDC programs and federal agencies, state/local agencies, academia, healthcare organizations, community groups and non-governmental organizations. However, NCEH's role in safe water that is unique from any other group should be identified. A clear delineation of NCEH's niche in this area would help OD to target and invest resources, achieve the greatest impact, and scale up the Safe Water Program at the national level.

BSC GUIDANCE

- NCEH should apply its unique skill sets and capabilities to water-related areas that are not addressed by EPA, such as unregulated water systems or other issues excluded from the Safe Drinking Water Act.
- NCEH should explore strategies to overcome barriers to obtaining access to results when private wells are tested. These data would place NCEH in a better position to deliver risk communication messages and submit private well samples to the CDC laboratory for more in-depth evaluation.
- NCEH should continue to leverage its existing expertise to grow the Safe Water Program. Most notably, CDC's niche is its well-known and recognized national role as a public health leader and partner with other agencies at federal, state and local levels and communities.
- NCEH should compile data to document its successes, accomplishments, results and outcomes in reducing water-related exposures based on funding that has been allocated to STLT health departments over time. This approach will help NCEH to maintain the focus on preventing exposures from important contaminants in water (e.g., *Legionella*, PFOA and PFOS) and identify programmatic gaps in its current safe water activities. NCEH should apply the CDC CLPPP model in this effort. Most notably, the CDC CLPPP has gathered data from its grantees to document the tremendous public health success in dramatically decreasing children's BLLs over time.
- NCEH has developed an impressive set of tools for its funded STLT health departments: a toolkit to improve well water outreach and education programs, a cyanoHABS toolkit, decision support tools to inform rural water contingency planning efforts, and a drinking

water advisory toolkit. However, NCEH should conduct a rigorous evaluation of these essential resources to facilitate broader implementation and adoption on a national scale.

- NCEH should leverage its existing partnership with USGS to gather data that the National Water Quality Assessment Program has collected over the past few decades. The program is extremely receptive to new and creative ideas for data collection.

Public Comment Period

Dr. Cibulas opened the floor for public comments; no participants responded.

Formal BSC Recommendation to NCEH/ATSDR

Dr. Perry returned to her suggestion on the previous day for the BSC to submit a formal recommendation to NCEH/ATSDR regarding its role in CDC's response to the Zika outbreak. She presented the following draft language for the BSC's review, comment and formal adoption.

The BSC recommends that NCEH/ATSDR collaborate with other CDC units engaged in the Zika outbreak response to evaluate the health effects of DEET and other mosquito repellants currently being recommended by CDC for use in pregnant women. The evaluation should include current knowledge of the reproductive, teratogenic and developmental effects of the recommended chemicals to ensure that chemical control guidelines protect health as much as possible in the context of current evidence. Due to existing unknowns regarding the health effects of pesticide use among pregnant women, NCEH/ATSDR should consider implementing monitoring strategies to capture potential adverse health effects of increased mosquito repellant use among large numbers of pregnant women in the U.S. population.

Dr. Breyse provided his perspectives on the BSC's draft recommendation. Dr. Frieden already has asked NCEH/ATSDR to review the toxicology of all chemicals that are being sprayed to protect individuals from the Zika virus. CDC is uncertain at this time whether aggressive mosquito control, particularly in Puerto Rico, is the best approach. Most notably, local newspapers in Puerto Rico have reported community opposition and resistance to CDC's proposed strategy of implementing aggressive mosquito control.

Dr. Perry explained her rationale for proposing the draft recommendation in response to Dr. Breyse's comments. NCEH/ATSDR and CDC should extensively consult on vector control guidance that will be released for pregnant women. The draft recommendation advises NCEH/ATSDR to review agents that are currently recommended by CDC, apply its toxicologic expertise, and rely on epidemiologic studies to evaluate the current state of knowledge of these chemicals. Evaluations on the health effects of DEET, including its impact on children, have been limited to date.

Dr. Perry noted that the draft recommendation also advises NCEH/ATSDR to give more broad and long-term consideration on evaluating exposures to and health effects from mosquito repellants. This approach would position NCEH/ATSDR and CDC to offer prudent guidance on protecting pregnant women from mosquitoes based on the current evidence.

GENERAL CONSENSUS: Dr. Breyse confirmed that NCEH/ATSDR would take action on the BSC's recommendation as proposed by Dr. Perry.

Updates by the BSC *Ex-Officio* Members

Douglas Trout, MD

Associate Director for Science
Division of Surveillance, Hazard Evaluations and Field Studies
National Institute for Occupational Safety and Health

Dr. Trout reported that the presentations NCEH/ATSDR made over the course of the two-day BSC meeting are well aligned with NIOSH's key areas of focus. These complementary activities present opportunities for NIOSH and NCEH/ATSDR to strengthen their longstanding partnership.

NIOSH awards CoAgs to >40 states to collect occupational blood lead surveillance data because lead continues to be an important hazard in the workplace. NIOSH is continuing to prioritize primary prevention from an occupational perspective by focusing on take-home lead exposures to children. NIOSH published an article in the July 17, 2015 edition of the *MMWR*, "Investigation of Childhood Lead Poisoning from Parental Take-Home Exposure from an Electronic Scrap Recycling Facility-Ohio, 2012."

NIOSH is actively addressing important occupational health issues and risks to workers related to hydraulic fracturing, including silica, other chemicals and various processes. NIOSH is increasing its focus on climate change and released a new publication in February 2016, *Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments*. Several efforts are underway at NIOSH to protect outdoor workers from the Zika virus.

NIOSH is continuing to extensively use the National EPH Tracking Network as a resource to improve its current occupational health surveillance. A National Academies review is being conducted at this time on NIOSH's occupational health surveillance systems. Guidance from this effort will help NIOSH to develop smarter, more cost-effective occupational health surveillance systems.

Kristina Thayer, PhD

Director, NTP Center for the Evaluation of Risks to Human Reproduction
National Institute of Environmental Health Sciences

Dr. Thayer summarized several NTP activities that were discussed during the June 15-16, 2016 NTP Board of Scientific Counselors meeting (<http://ntp.niehs.nih.gov/go/9741>).

NTP has been conducting experiments in rats and mice on potential health hazards from cell phone radiofrequency radiation (<http://ntp.niehs.nih.gov/go/cellphone>). NTP's release of initial findings from the study in May 2016 generated an extensive amount of media attention. NTP found low incidences of tumors in the brains and hearts of male rats, but not in female rats. Studies in mice are continuing.

NTP is evaluating exposure scenarios and health effects related to shift work at night, artificial light at night, and circadian disruption. NTP convened an expert panel in March 2016 to provide recommendations on conducting a synthesis of the complex literature on this topic (http://ntp.niehs.nih.gov/go/workshop_ALAN).

NTP held a Botanical Dietary Supplements Safety Workshop in April 2016 to focus on mixtures of supplements in the marketplace (http://ntp.niehs.nih.gov/go/workshop_botanicals).

NTP posted its draft report on immunotoxicity associated with PFOS and PFOA. The document will undergo peer review in July 2016 (<http://ntp.niehs.nih.gov/go/749926>).

NTP initiated research on synthetic turf/recycled tire crumb rubber that will include short-term *in vivo* and *in vitro* toxicology studies over the next 18 months.

NTP is considering experimental research on glyphosate to address conflicting conclusions from recent assessments. The research would focus on formulations with glyphosate.

NTP is conducting a literature review of human, animal and mechanistic data on neurological outcomes from fluoride that focused on learning and memory. NTP's systematic review of animal data was a component of this effort and will be released within the next week (<http://ntp.niehs.nih.gov/go/785076>).

The findings indicated adverse effects from fluoride on learning and memory in animals at levels that were higher than those used for community water fluoridation. Based on these results, NTP is conducting experimental studies to analyze developmental exposures to fluoride at lower concentrations. NTP's research on fluoride will be compiled into an integrated systematic review that is anticipated for release in 2018.

Wayne Cascio, MD

Director, Environmental Public Health Division
U.S. Environmental Protection Agency

Dr. Cascio reported that the presentations NCEH/ATSDR made over the course of the two-day BSC meeting are relevant to EPA's mission. EPA has redesigned its research agenda and products with a much stronger focus on public health. The EPA Environmental Quality Index is national in scope and is based on five domains at the county level. The EPA Community-Focused Exposure and Risk Screening Tool (C-FERST) is an online tool to inform communities about their environmental and public health issues. Both of these resources are publicly available on the EPA.gov website.

EPA recently signed a memorandum of understanding that will support a project for county public health officials to pilot C-FERST and promulgate wildfire smoke dye. EPA's testing of two commercially available water filters in Flint showed that use of the filters could eliminate lead from water and protect vulnerable populations, including pregnant women and children. EPA is providing support for the toxicology assessment of recycled tire crumb rubber.

EPA is preparing and planning for upcoming changes at this time to address its mandate in the 2016 TSCA amendments: release new risk-based safety standards, evaluate chemicals with a clear and forceful deadline, and allocate funding to support these activities. EPA will host a webinar on TSCA on June 30, 2016.

BSC Discussion of Future Agenda Topics

Melissa Perry, ScD, MHS, BSC Chair

Chair, Department of Environmental and Occupational Health
George Washington University School of Public Health and Health Services

Dr. Perry led the BSC in a review of future agenda topics and action items that were raised over the course of the meeting.

AGENDA TOPICS AND ACTION ITEMS	
Presenter	Topic
Dr. Breyse	NCEH/ATSDR OD updates: Strategic Plan, upcoming reorganization of NCEH, and proactive planning and coordination to launch an EH response to PHEs
Dr. Donna Knutson	UCG's lessons learned in federal coordination efforts, preparedness and emergency response based on its experiences in Flint
Dr. Sharunda Buchanan Dr. Mary Jean Brown	NCEH's new model of a lead syndromic surveillance system to predict BLLs in children
Dr. Matthew Strickland	(Distribution in advance of the next BSC meeting): LPPS's report and recommendations to the BSC on NCEH's next steps in lead surveillance and the BLRV
NCEH/ATSDR OD	Status report on the new Fracking Workgroup, including nominations of industry representatives and water experts to serve as members
NCEH/ATSDR OD	Update on the CDC response to the Zika outbreak in the context of the BSC's formal recommendation on NCEH/ATSDR's role in this effort
NCEH	Update on NCEH's role in wildfire responses
Dr. Kristina Thayer	(Inclusion in the <i>ex-officio</i> report): Update on NTP's systematic review and research on neurological outcomes from fluoride
Responsibility	Action Step
Dr. Judith Qualters	Provide the BSC with the results of collaborative activities by EHHE, the University of Illinois and National Ground Water Association on private well education programs

Mr. Ranchod made several observations as an outgoing BSC member.

- Dr. Cibulas is to be commended for his leadership and outstanding efforts in improving the organizational structure of BSC meetings. Most notably, PowerPoint slide sets and other materials are distributed to the BSC members in advance of meetings. Moreover,

the BSC now has much more discussion time during meetings to formulate guidance and input to NCEH/ATSDR.

- The presenters posed key questions for the BSC to address during the December 2015 meeting. This model should be retained to allow the BSC to focus its discussions on providing feedback that would be most useful and helpful to each NCEH/ATSDR program. Consideration also should be given to designating a BSC member who would serve as the lead for each discussion.
- The BSC formally approved the establishment of a new Fracking Workgroup two years ago. NCEH/ATSDR should take rapid actions at this time in this regard, particularly in light of ongoing water safety issues in Flint.

Mr. Ranchod thanked NCEH/ATSDR for providing him with the opportunity to serve on the BSC. As a member without an MD, PhD or MPH, he hoped that his non-medical, non-scientific and private-sector perspective was helpful and useful to NCEH/ATSDR and the BSC over the past four years.

Dr. Kosnett thanked NCEH/ATSDR for inviting the LPPS members to attend and provide input during the BSC meeting. However, he asked NCEH/ATSDR to update the BSC webpage on the CDC.gov website as soon as possible. The webpage only includes the roster of the LPPS membership at this time. The LPPS charter/charge and meeting minutes are not posted.

Closing Session and Adjournment

The participants joined Dr. Cibulas in applauding Dr. Perry for her outstanding leadership as the BSC Chair. The participants also applauded the NCEH/ATSDR OD staff (Ms. Sandra Malcom, Ms. Shirley Little and Ms. Amanda Malasky) for their tremendous efforts in organizing and making logistical arrangements for the BSC meeting.

Dr. Perry thanked the BSC and LPPS members for providing NCEH/ATSDR with valuable input and expertise over the course of the meeting. She also thanked the NCEH/ATSDR program staff for their extremely informative presentations and continued dedication and commitment to conducting high-quality, impressive EPH activities for the nation.

With no further discussion or business brought before the BSC, Dr. Perry adjourned the meeting at 11:26 a.m. on June 29, 2016.

I hereby certify that to the best of my knowledge, the foregoing Minutes of the proceedings are accurate and complete.

Date

Melissa Perry, ScD, MHS
Chair, NCEH/ATSDR Board of Scientific
Counselors



Attachment 1: Participants' Directory

BSC Members Present

Dr. Melissa Perry, Chair
Dr. Lisa Alvarez-Cohen
Dr. Hillary Carpenter
Dr. Kim Dietrich
Dr. Sharron LaFollette
Sanjay Ranchod, Esq.
Dr. Matthew Strickland
Dr. Phillip Williams
Dr. Robert Wright

BSC Members Absent

Dr. Deborah Cory-Slechta
Ms. Nsedu Witherspoon

BSC Ex-Officio Members Present

Dr. Wayne Cascio
U.S. Environmental Protection Agency

Dr. Bonnie Richter
U.S. Department of Energy

Dr. Kristina Thayer
National Institute of Environmental Health
Sciences, National Toxicology Program

Dr. Douglas Trout
National Institute for Occupational Safety
and Health

LPPS Members in Attendance

Ms. Elizabeth Colón
Dr. Nathan Graber
Dr. Michael Kosnett
Dr. Mark Maddaloni
Dr. Patrick Parsons

Designated Federal Official

Dr. William Cibulas, Jr.
Deputy Associate Director for Science,
NCEH/ATSDR

NCEH/ATSDR Director

Dr. Patrick Breysse

CDC/NCEH/ATSDR Representatives

Dr. Ileana Arias
Ms. Loretta Asbury
Dr. Lina Balluz
Ms. Rae Benedict
Dr. Pamela Protzel Berman
Dr. Tegan Boehmer
Dr. Frank Bove
Dr. Mary Jean Brown
Ms. Caroline Brunton
Dr. Sharunda Buchanan
Ms. Maggie Byrne
Ms. Marissa Chan
Dr. Selene Chou
Ms. Kimball Credle
Ms. Stephanie Davis
Ms. Kristine Day
Dr. Rey de Castro
Dr. John Decker
Dr. Scott Deitchman
Dr. Gerard Dublin
Ms. Pauline Edwards
Dr. Alisha Etheredge
Ms. Taylor Etzel
Ms. Cherie Gray
Ms. Olivia Harris
Ms. Emma Hines
Mr. James Hodge

Mr. Jeff Jarrett
Ms. Laurie Johnson
Dr. Robert Jones
Dr. Chinaro Kennedy
Dr. Donna Knutson
Mr. Peter Kowalski
CDR Jasen Kunz
Ms. Shirley Little
Dr. George Luber
CAPT Hugh Mainzer
Ms. Amanda Malasky
Ms. Sandra Malcom
Dr. Josephine Malilay
Ms. Stephanie McKissick
Ms. Sarah Merkle
Ms. Michele Monti
Dr. Susan Moore
Dr. Edward Murray

Mr. James Nowicki
Dr. James Pirkle
Dr. Judith Qualters
Dr. Helen Rogers
Ms. Perri Ruckart
CAPT John Sarisky
Ms. Adina Spertus-Melhus
Ms. Pamela Wigington
Dr. Lynn Wilder
Dr. Sharon Williams-Fleetwood
Dr. Ellen Yard

Member of the Public

Dr. Anita Meyer
U.S. Department of Defense



Attachment 2: Glossary of Acronyms

ACCLPP	Advisory Committee on Childhood Lead Poisoning Prevention
ACE	Assessment of Chemical Exposure
APHA	American Public Health Association
ASTHO	Association of State and Territorial Health Officials
BLLs	Blood Lead Levels
BLRV	Blood Lead Reference Value
BRACE	Building Resilience Against Climate Effects
BSC	Board of Scientific Counselors
CAB	Community Advisory Board
CASPER	Community Assessment for Public Health Emergency Response
CDC	Centers for Disease Control and Prevention
C-FERST	Community-Focused Exposure and Risk Screening Tool
CLP	Childhood Lead Poisoning
CLPPP	Childhood Lead Poisoning Prevention Program
CO ₂	Carbon Dioxide
CoAg	Cooperative Agreement
DFO	Designated Federal Official
DOT	U.S. Department of Transportation
DTHHS	Division of Toxicology and Human Health Sciences
EBLLs	Elevated Blood Lead Levels
ED	Emergency Department
EEHS	Emergency and Environmental Health Services
EH; EPH	Environmental Health; Environmental Public Health
EHHE	Environmental Hazards and Health Effects
EJ	Environmental Justice
ELC	Epidemiologic Laboratory Capacity
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
FACA	Federal Advisory Committee Act
FOA	Funding Opportunity Announcement
FPL	Federal Poverty Level
FUDW	Federally Unregulated Drinking Water

HABs	Harmful Algal Blooms
HCDI	Healthy Community Design Initiative
HIA	Health Impact Assessment
HUD	U.S. Department of Housing and Urban Development
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
IT	Information Technology
LOD	Limit of Detection
LPPS	Lead Poisoning Prevention Subcommittee
MAHC	Model Aquatic Health Code
<i>MMWR</i>	<i>Morbidity and Mortality Weekly Report</i>
NCEH/ATSDR	National Center for Environmental Health/ Agency for Toxic Substances and Disease Registry
NCIRD	National Center for Immunization and Respiratory Diseases
NHANES	National Health and Nutrition Examination Survey
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
NYC	New York City
OD	Office of the Director
PFAS	Per-/Polyfluoroalkyl Substances
PFCs	Perfluorinated Compounds
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PHE	Public Health Emergency
SAFE Watch	Safe Water for Community Health
STLT	State, Tribal, Local, Territorial
SVI	Soil Vapor Intrusion
TSCA	Toxic Substances Control Act
UCG	Unified Coordination Group
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VA	U.S. Department of Veterans Affairs