ORD Research Integration:

Children's Health and Environmental Justice

Introduction

Goal: To optimize integration of ORD's research pertaining to Children's Health and Environmental Justice (CH/EJ) across ORD's national programs and thereby enhance support of EPA's cross-cutting strategy "Working for Environmental Justice and Protecting Children's Health."

The *EPA Strategic Plan (2011-15)* includes a cross-cutting strategy "Working for Environmental Justice and Protecting Children's Health." This strategy and two longstanding and complementary Executive Orders (EO-13045 on CH and EO-12898 on EJ) commit EPA to prevent and reduce harmful exposures and health risks for children and for underserved, disproportionately impacted low-income, minority and Tribal communities, and to support community efforts to build healthy, sustainable green neighborhoods. *EPA Plan EJ 2014* (2011) extends the mandate to include empowering communities to take action to improve their health and environment and establish partnerships to achieve healthy and sustainable communities.

ORD's current research portfolio includes CH/EJ in each of its National Programs (NP). In general, research on CH/EJ which is specific to program goals in Air Climate and Energy (ACE), Chemical Safety for Sustainability (CSS), Safe and Sustainable Water Resources (SSWR), Human Health Risk Assessment (HHRA) and Homeland Security (HS) serves to inform and influence the research in the Sustainable and Healthy Communities Program (SHC) which, in turn, integrates multiple stressors and factors (environmental, social and economic) as they converge on people in community settings in order to help inform decisions. At the same time, generalizable research in SHC on vulnerability factors and cumulative risk serves to influence and inform the priorities of and approaches taken by the other NPs. Coordination and integration of this research across EPA would:

- Clarify and strengthen ORD's commitment to research in CH/EJ to partners within and outside EPA;
- Provide a roadmap for prioritizing projects and tasks relevant to CH/EJ across National Programs to insure that the most important research questions are being addressed;
- Guide the most efficient and effective use of existing ORD expertise and inform workforce planning;
- Enhance engagement of EPA partners across Program Offices and Regions in setting research priorities; and
- Ensure continuity of these efforts as they evolve over time.

Integration : Research designed to target CH and EJ specifically is housed in SHC under Theme 2.2, "Improving Human Health and Well-being for Community Sustainability," which includes related three projects: *Enhancing Community Public Health; Enhancing Children's Health; and, Securing and Sustaining Environmental Justice.* Data and tools developed elsewhere in SHC also support these objectives by

informing sustainable community decisions (Theme 1) and integrating approaches to sustain the built and natural environment and the communities they support (Theme 4).

Major components of CSS, ACE, HHRA and SSWR are also directly relevant to CH/EJ goals, especially research on risks associated with chemicals and chemical mixtures as they pertain to susceptibility factors and life stage vulnerabilities. Inherent susceptibility factors under study include life stage attributes (developmental processes and accumulation of effects over the life course), genetic and epigenetic variables, and the presence of pre-existing diseases. Life stage is also a determinant of exposure, as are behaviors and lifestyle choices (e.g., smoking, diet) and attributes of the physical environment (e.g. temperatures, wind and dust). CSS includes significant activities related to improving exposure and effect models for prenatal and life stage- specific chemical risk (Virtual Embryo and pathway-based high-throughput screening for reproductive toxicants and endocrine disruptors), while ACE has significant research on respiratory (asthma) and cardiovascular impacts of air pollution related to life stage and experienced by vulnerable groups in real world scenarios. Further, HHRA health hazard assessments for specific environmental contaminants and mixtures include consideration of susceptible life stages and vulnerable groups. SSWR and HS research protects health across all life stages and focuses efforts on specific vulnerable communities.

SHC tools, models and case studies use the data and findings from the other ORD programs to evaluate and forecast the impacts of complex exposures and integrate multiple risk and protective factors as they converge in community settings. SHC research also addresses social determinants of disease and how to incorporate the role of non-chemical stressors into risk assessment. SHC develops tools and models for the Agency, as well as State, Tribal and local governments to use when taking actions, setting policies and making decisions needed to prevent, reduce and mitigate disproportionate health risks , proactively promote health and economically viability, and foster the protection and equitable distribution of ecosystem goods and services.

ORD's intramural research specific to CH/EJ is significantly augmented by extramural STAR grants in SHC, CSS and ACE:

- EPA-NIEHS Children's Environmental Health and Disease Prevention Research Centers (SHC) are integrated, trans-disciplinary, and cross cutting by design. They employ a life course approach, and many Centers conduct research in minority communities where they evaluate a variety of exposures such as pesticides, metals, PBDEs, phthalates and PCBs, as well as air pollutants in the everyday environments of pregnant women and their children, and link these with prevalent health outcomes such as asthma and neurodevelopmental deficits as they develop with age. Using participatory approaches and outreach cores, they also work directly with communities to identify and evaluate ways to reduce and mitigate exposures and risks.
- ORD funds grants in CSS on high-throughput test development and screens for Endocrine Disrupting Chemicals and developmental toxicants; in ACE on air pollution and birth outcomes/asthma (Clean Air Centers, and near road studies) and on air pollution and cardiovascular disease (Multi-Ethnic Study of Atherosclerosis and Air Pollution); and, in SHC on cumulative risk assessment approaches, public health indicators, determinants of health

disparities (a new collaboration with NIMHD), and Tribal Science with a current emphasis on indoor air quality and vulnerable groups.

- NCER-sponsors publically accessible webinars and workshops which include grantees, EPA scientists and other experts to facilitate communication on the research and accomplishments both among the grantees and to ORD scientists and EPA partners.

Numerous Outputs in the StRAPs apply to CH/EJ . The table appended illustrates how they are arrayed across programs, grouped by the general objectives described above.

Management Approach : SHC leads two workgroups charged with coordinating research in CH and EJ across ORD, each comprised of representatives from the other NP, with a few members common to both. Meeting monthly since last fall, these workgroups are evolving to include partners from the Offices of Children's Health Protection (OCHP) and Environmental Justice (OEJ) and representatives from EPA Program Offices and Regions. The ORD-CH workgroup works closely with OCHP and its Children's Health Protection Advisory Committee (CHPAC) by giving presentations and responding to CHPAC's letters to the Administrator. The ORD CH workgroup is developing a contemporary, more holistic, working model for CH protection to show how environmental and social factors interact with inherent and lifestage factors to determine children's health. Such a model can be used to guide future planning across ORD's programs by helping to identify key knowledge gaps to be filled over time. The ORD-EJ workgroup is surveying tasks across programs for their linkage with goals of *PLAN EJ 2014* and providing input to the National Environmental Justice Advisory Committee (NEJAC) and its newly established research workgroup. This NEJAC workgroup will advise ORD on how its research programs can best provide the scientific foundation needed to address and prevent environmental inequities. ORD scientists on both workgroups are providing expertise to EPA's Cumulative Risk Assessment Guidelines under development by EPA's Risk Assessment Forum. The EJ workgroup is also contributing to EJ Technical Guidance under development by ORD, the Office of Policy and the Office of Enforcement and Compliance Assurance which includes OEJ. Together these activities foster translation of ORD science into policy.

Challenges: The CH and EJ workgroups were formed recently and are still developing goals and operating approaches. While they include some members in common, they are currently working in parallel. An approach for linking NP-specific planning with cross cutting research frame works is needed to insure that expertise and resources are available for sustaining an integrated effort in CH/EJ across planning cycles. Finally, incorporation of EJ considerations is a relatively new objective in ORD's research programs and will require mobilizing and training staff with interest in EJ and health disparities to build expertise on these subjects. Identifying opportunities for collaborating with extramural scientists on EJ projects may provide an avenue for increasing our capacity in EJ.

Strengths: The inclusion of diverse partners in workgroup meetings has added greatly to our planning effectiveness. Communication of products broadly across ORD and EPA through webinars and remote accessible workshops has enhanced appreciation of these efforts across EPA. Attendance by ORD scientists at these workshops is also helping to build skills and increase expertise resulting in a broader knowledge base in CH and EJ.

Table: Outputs in the NP-STRAPs that apply to CH/EJ, arrayed by program and general objectives

Identify and Reduce Exposures and Risks of Contaminants for Susceptible Life Stages and Groups	SHC	CSS	ACE	HHRA	SSWR
Lifestage Specific Susceptibility to Specific Contaminants and Mixtures	Theme 2.2-- Improving human health and well-being for community sustainability: Health effects from early life exposures to environmental agents in animal models STAR Children's Centers (co-funded with NIEHS): exposures and effects of BPA, phthalates, manganese, PBDE, NO_2, ozone, arsenic in water and diet, air pollution and asthma/immunology; Air pollution: PM and PAH; ozone and endotoxin interactions; ETS.	Theme 2 -- System Models: Virtual embryo in silico model to predict developmental toxicity (2.2.2) Pathway- based high-throughput screening assays for chemicals with developmental, reproductive and endocrine toxicity (2.2.3) Methods and models to support EPA's Endocrine Disruptor Screening Program (2.5.1, 2.5.2)	Theme 1-- Assess impacts: Pollutant sources-exposures- effects linkages in at-risk groups Near Road (NEXUS) study, Air Pollution and childhood asthma in near roadway settings STAR CLARC – Emory and Georgia Tech – birth cohort studies STAR CLARC – Harvard U – air pollution and life stages HEI grants on AP exposure (pre- and	Theme 1 -- Individual IRIS (Integrated Risk Information System) assessments consider susceptibility and indentify windows of susceptibility (1.1.1) Theme 2 -- Health ISAs (Integrated Science Assessments) address potentially at risk populations, when data are available (2.1.1 thru 6, 2.2.1) Theme 1 -- Cumulative Risk: assessments for phthalates and PAH (1.1.1) Theme 2 -- Multipollutant Science Assessment (Health): Analysis of multipollutant impact	Theme 1 – Sustainable Water Resources: Health effects and risks for Chemical Contaminants List considering life stage factors Methods to evaluate human health risk to groups of drinking water contaminants, related to susceptible populations New models to forecast pathogen and chemical risk scenarios for alternative water disinfection strategies and complex chemical

			post-natal) and Children's Health MESA study on atheroschlerosis and air pollution	on human health, with life stage considerations (2.2.2) Theme 4 – Modernizing Riks Assessment: Quantitative Implications of Susceptibility on Dose-Response (4.2.3)	mixtures in drinking water (relevant but not specific to CH/EJ)
Lifestage Specific Exposure Factors	Theme 2.2: Children's exposure factors by EPA age groupings; includes dirt and dust ingestion metrics; pesticides in dust Children's Centers: cohorts of children evaluated at different ages and times – prenatal and life stage-specific exposures (environmental and biomarkers); cumulative exposures and risks over time as cohorts mature	Theme 2 – System Models SHEDS/exposure models using population distributions of physiological variables specific to life stages: height, weight, basal metabolic rates etc. (2.3.2) Theme 3 -- Biomakers Characterizing biomarkers of susceptibility Theme 4 – Cumulative Risk PCB exposures and	Theme 1 – Assess impacts: STAR CLARCs include significant exposure monitoring and modeling linked to outcomes	Theme 2 -- Health ISAs include exposure considerations for potentially at risk populations, when data are available (2.1.1 thru 6; 2.2.1) Theme 3 -- Exposure Factors Program: Addressing exposure factors relevant to specific lifestages . Web-based EXPO-BOX will include information on lifestage-specific exposure factors . (3.1.2, 3.1.3) Theme 3 – Community Risk & Tech Support:	Epidemiological Studies of DBPs and type of disinfection in relation to Adverse Reproductive Outcomes

		risks to children in schools and methods for remediation (4.2.2)		Comprehensive exposure assessment documents and EXPOBOX (3.1.4)	
Promote Health and Prevent Disparities in Community Settings	**SHC**	**CSS**	**ACE**	**HHRA**	**SSWR**
Cumulative Risk of Contaminants by Place and Setting	Theme 2.2: Health outcomes in vulnerable groups: asthma/CVD/near CAFOs New methods/models for Cumulative risk in communities Community and Tribal-Focused web-based Tools for identifying exposures, risks, and vulnerable groups STAR grants, Tribal Science—tribal specific factors and risks, indoor air		Theme 1 – assess impacts: Near road , rail and port: exposure and risk Health risks of wildfires – rural settings and SES factors	Theme 3 – Community Risk & Tech Support Qualitative and Quantitative Approaches to Grouping & Analyzing Risks from Chemical and Non-Chemical Stressors (3.3.1) Cumulative Risk Assessment Resources (3.3.2)	Birth defect rates and water based environmental compounds in Corpus Christi, TX, Region 6 RARE project Cyanotoxic effects on mammalian endpoints and biomarkers of exposure for human health risk assessment (relevant but not specific to CH/EJ)

	quality and CH Community Cumulative Assessment Tool: roadmap for assisting disproportionately impacted communities to assess community risks STAR Children's Centers, cumulative exposures and risks encountered in rural and urban communities				
Public Health Interventions relevant to CH/EJ Issues	Theme 2.2 Environmental factors contributing to asthma and cardiovascular disease: wildfires, CAFOs STAR Children's Centers: asthma diets, Integrative pest management; farm worker practices; prenatal education		Theme 1 -- Assess impacts: Interventions to reduce CVD from AP: antioxidants and omega-3 fatty acids HEI grant on policy-driven Air Quality improvement & CH Theme 2 -- Prevent & Reduce Emissions: Air monitoring		Theme 2: Sustainable water infrastructure systems: Gray water treatment for rural communities to protect reservoirs on the island of Puerto Rico (Region 2 RARE). Advancing public health through water infrastructure

	STAR Centers of excellence in EJ -- NIMHD collaboration		sensor technology to enhance near source compliance and assessment of community "hot spots."		for sustainability – STAR Grant (relevant but not specific to CH/EJ)
BENEFITS of Built Environment & Ecosystem Goods & Services	Theme 1.2: Assessing Community Sustainability Geospatial tools: National and Urban Atlas – EGS at various scales Theme 2.2: STAR grants on daycare and school settings Theme 4.2: Integrated approaches: Built and natural environments integrating health outcomes and impacts		Theme 2 -- Prevent & reduce emissions: Benefits of near road way design and barriers		New Drinking Water technologies for contaminants of interest to small systems (relevant to many poor rural communities) Framework for incorporating economic data and stakeholder and citizen preferences into the planning of green infrastructure in neighborhoods and communities. (relevant but not specific to EJ)
Social, Economic and Environmental Determinants of Health Disparities	Theme 2.2: Social and economic factors contributing to asthma and		Theme 1 -- Assess impacts: Vulnerability of people and	Theme 2 -- Health ISAs: address potentially at risk populations, when data are available	Leachate contamination of Alaska's tribal drinking water sources (Region 10

	cardiovascular disease STAR Tribal Science grants STAR Centers of excellence in EJ -- NIMHD collaboration) STAR grants, Cumulative risk incorporating role of non-chem stressors Community Cumulative Assessment Tool for EJ communities		ecological systems to climate change impacts STAR , key factors driving vulnerability STAR "cook stoves" grants, relation to health in the developing world	(2.1.1 thru 6; 2.2.1)	RARE)
Public Health indicators and Health Impact Assessment (HIA) approaches	Theme 2.2: Public Health conditions and indicators STAR grants on Environmental Public Health Indicators of CH and vulnerability Case studies in communities and tribes to improve HIA including vulnerable groups and lifestages				Community-wide health status and trends: real-time monitoring and epidemiology using sewage chemical information (relevant but not specific to CH/EJ)