# Environmental Toxicology Training for African American Residents and Community Leaders Using Participatory- Based Methods

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# Reference

Becker, A., Suther, S., Harris, C., Pawlowicz, G., Disney-Tucker, G., Dutton, M., Close, F., Hilliard, A., Gragg, R. (2018). Community-Based Participatory Research at Jacksonville Florida Superfund Ash Site: Toxicology Training to Improve the Knowledge of the Lay Community. *Florida Public Health Review 15, 61-74*

http://www.ut.edu/uploadedFiles/Academics/CNHS/Health_Sciences_and_Human_Performance/Public_Health/Florida_Public_Health_Review/FPHRBecker%202018.pdf

# Environmental Justice

- Fair treatment of all people regardless of race, ethnicity, income, national origin resulting from industrial, municipal and commercial operations (NRC,1999)
- Significant input from the community and the community takes leadership role as health advocates (Frumpkin, 2015)
- 27.8% of all incinerator ash sites and 45.9% of inactive incinerators have low income and low property value (Faber & King, 2005)
- EPA uses containment more frequently in African American populations and permanent removal in white populations (Lavelle & Coyle, 1992)
- Small amount of the budget (3%) to population health (Satcher & Higginbotham, 2008)

# Community Mistrust

- When first listed- Community most concerned with  management, remediation, site-specific issues, health effects and environmental monitoring. Over next five years it shifts to exposure assessment, reduction methods, route of exposure and contamination of soil, air, water (Ramirez-Anderson et al., 2015)
- Community mistrust- lack of communication and information, method of remediation related to logic, process, and effectiveness, health effects, monitoring, exposure reduction
- Workers going to local restaurants with muddy boots, children playing in the most contaminated areas around flooded areas with the highest contamination, and breaking into enclosements playing and tunneling in piles of contaminated soil
- Contaminated schools and playgrounds
- The REEACH initiative attempted to remedy this by development of the environmental toxicology training, physician training and community outreach with assistance from student interns


WARNING
NO TRESPASSING
CONTAMINATED AREA
AVOID CONTACT WITH
SOIL & WATER
FOR INFORMATION
Call 630-ASH7

# Community Stressors

- Disparities can be intensified by stressors related to economic, social and environmental stressors (Gordon, 2013)
- Additional stressors are poverty, racial discrimination, crime, malnutrition and substance abuse (Adler & Rehkapf, 2008)
- Links have been established leading to premature mortality (Jerrett et al., 2009)
- Community level and individual vulnerability including residential location, neighborhood resources, community stress, behavioral factors and chemical exposure (Morello-Fresch et al. 2001)
- Preexisting conditions, biological traits, age, genetics exposure (Morello-Fresch et al. 2001)
- Increased absorption of lead stressors include socioeconomic status, paternal education, home hygiene, smokers in home, nutritional status, locally grown produce and play area cover, hours spent outside, pica behavior and child's age (Panhandle Health District, 1986; TerraGraphics, 1987)

# Jacksonville Ash Sites

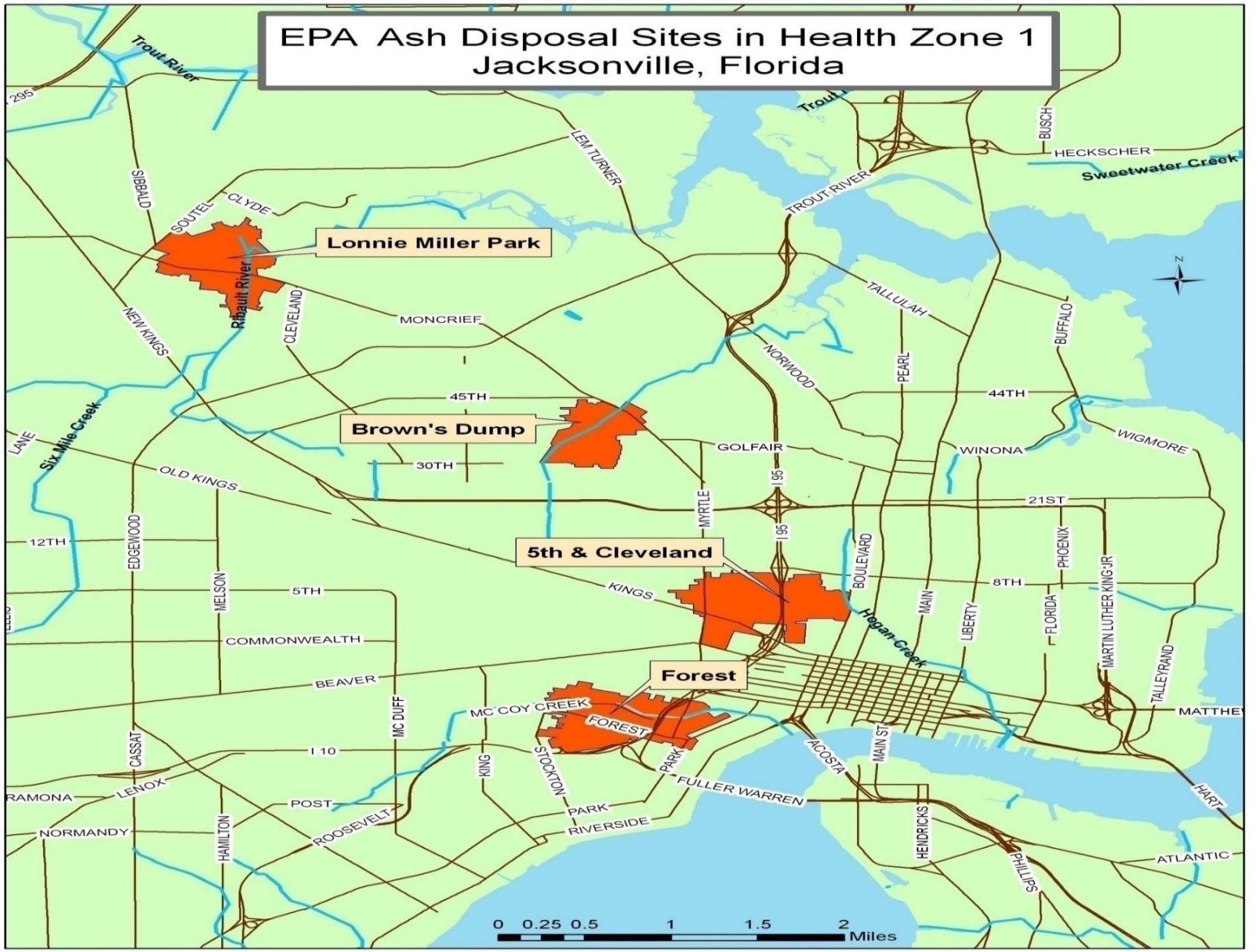
*Four Ash Sites:*

- Brown's Dump – (1949- 1955) – 50 acres – Bethune Elementary School now sits on – public health hazard due to high concentrations of metals

- Fifth and Cleveland Street Incinerator - (1943-1969) – municipal waste buried on site (9 acres) – developed as city park, daycare center and housing east of site – (high levels of metals)

- Forest Street Incinerator – 10.5 acres (1941) high soil lead, arsenic and PAH levels

- Lonnie C. Miller Sr. Park – (100 acre) – high levels of arsenic, lead, manganese, PAHs, dioxins and furans


EPA Ash Disposal Sites in Health Zone 1
Jacksonville, Florida
Lonnie Miller Park
Brown's Dump
5th & Cleveland
Forest
Trout River
Ribault River
Six Mile Creek
Hogan Creek
Sweetwater Creek
SIBBALD
SOUTEL
CLYDE
LEM TURNER
TROUT RIVER
BUSCH
HECKSCHER
NEW KINGS
CLEVELAND
MONCRIEF
TALLULAH
NORWOOD
PEARL
BUFFALO
45TH
44TH
GOLFAIR
WINONA
WIGMORE
30TH
LANE
OLD KINGS
MYRTLE
I 95
21ST
12TH
EDGEWOOD
MELSON
5TH
KINGS
BOULEVARD
PHOENIX
8TH
MAIN
LIBERTY
FLORIDA
MARTIN LUTHER KING JR
COMMONWEALTH
BEAVER
MC DUFF
MC COY CREEK
FOREST
PARK
TALLEYRAND
MATTHE
I 10
CASSAT
KING
STOCKTON
ACOSTA
MAIN ST
RAMONA
LENOX
POST
FULLER WARREN
HART
NORMANDY
HAMILTON
ROOSEVELT
RIVERSIDE
HENDRICKS
PHILLIPS
ATLANTIC
0 0.25 0.5 1 1.5 2
Miles

# Demographics from 2000 Census in Health Zone 1

- Health Zone 1 is inclusive of zip codes: 32202,32204,32206,32208,32209,32251
- 122,280 with 71% African American
- 73% of properties built before 1978
- 29,226 families, 12.8%< than 9 years old, 7% < than 5 years old
- 43% of children live in poverty

# Vulnerable Population

- Groups of people who are more at risk from illness due to exposure to toxicants or contaminants than the average healthy person:
  - Infants and children
  - Chronically ill
  - Seniors
  - Pregnant women

# Contaminants of Concern

# Ash Sites & Contaminants

| Ash Sites | Toxicants evaluated (toxicants not evaluated) |
|---|---|
| 5th & Cleveland | Arsenic, lead, Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Dibenzofurans (PCBs) (Chlorinated Dibenzo-Dioxin (Dioxins)) |
| Brown's Dump | Arsenic, lead, copper, PCBs, Dioxins |
| Forest Street Incinerator | Lead (Arsenic, PCBs, Dioxins, PAHs) |
| Lonnie C. Miller Park | Copper (Lead, Arsenic, Dioxins, PAHs, PCBs) |

| Health Consultation | Toxicants of Public Health Concern | Interventions/Recommendations |
|---|---|---|
| **1. U.S. D.H.H.S., ATSDR, 5th& Cleveland Street Incinerator, (1996)** | Maximum Level of 3,950 ppm in soil | ▪ Cover ash with gravel, compost and grass<br>▪ Sample for complex organic contaminants and lead 0-3 inches<br>▪ Lead levels above 400 ppm (EPA clean-up residential goal) |
| **2. U.S., D.H.H.S., ATSDR, 5th&Cleveland Street Incinerator, (2003a).** | Maximum Level of 4400 ppm in garden soil | ▪ EPA recommends good gardening and food preparation practices<br>▪ Peak lead levels in collard and mustard greens 0.30 ppm greens.<br>▪ No unacceptable risk of consuming vegetables from soil <500 ppm |
| **3. U.S., D.H.H.S., ATSDR, 5th and Cleveland Street Incinerator, (2003b).** | Samples >400 ppm of lead in three locations around the baseball field | ▪ ATSDR recommends that the prohibition of organized sports at Emmett Reed Park until a permanent exposure control measures are implemented |
| **4. U.S., D.H.H.S., ATSDR, Brown's Dump, (1997).** | Maximum Level of 78800 ppm, 45% of 103 samples > than 500 ppm,> 5000 around Moncrief Creek | ▪ Remove 6" of soil around basketball court, playground area, and between two southern Bethune Elementary buildings.<br>▪ Installed fence around parking lot in front Bethune elementary, lock gate in back of school<br>▪ Restrict access to Moncrief Creek, post signs, repair fence<br>▪ 194 children screened for lead at Pre-K, elementary, Bessie Circle, Moncrief Village and Palm Terrace. (4.1%> 10 µg/dl) |
| **5. U.S. D.H.H.S., ATSDR, Brown's Dump, (1999).** | Residential 2% ≥ 2000 ppm, 30% ≥ 400 ppm, Basketball court peak 1900 ppm with 5 other samples < 400 ppm, Head Start < 400 ppm, Butterfly Park 400-540 ppm | ▪ Cover area that exceed 400ppm with mulch, soil or sod<br>▪ Additional sampling recommended for lead<br>▪ Limit children's exposure in areas > than 400 ppm<br>▪ Offer blood lead testing for children > than 400 ppm |
| **6. U.S., D.H.H.S, ATSDR, Forest Street Incinerator, (1997).** | Maximum Level of 2,930 mg/kg of soil and all other metals below ATSDR Soil Comparison Values and Low levels of lead and chromium detected in shallow ground water | ▪ Restrict access<br>▪ Sample site surface soil for complex organic chemicals<br>▪ Test vegetables grown in contaminated soil<br>▪ 178 children screened for lead at Head Start School |
| **7. U.S., D.H.H.S., ATSDR, Lonnie C. Miller Park, (1999).** | Elevated levels of arsenic, lead, copper were detected, Elevated organic toxicants above background. | ▪ Additional surface soil sampling<br>▪ New sampling data to reflect current site conditions<br>▪ Sampling sites where children play<br>▪ Levels detected not likely to cause acute or chronic health effects |

# Clean up was based on Lead Levels

- Due to maximum levels detected up to 78,800 ppm in park areas
- Maximum levels detected in flooding areas > than 5000 ppm
- Up to 4,400 PPM in garden soil
- Residential areas 2% above 2000 ppm
- Blood levels are increased by 1 to 8 µg/dl for every 1000 ppm lead in soil
- EPA clean up level in soil is at 400 ppm or above

# Cancer Risk

- Cancer-estimated risk in soil
    - *Arsenic* – 0 to 1 case per million people
    - *PAH* – 0 to 1 cases per million people
    - *PCB* – 0 to 1 case per million people
- Cancer-estimated risk in water
    - Arsenic – 0-1 case per 10 million people
    - PAH- 0-1 case per 10 million people
    - *Lead* not evaluated as a carcinogen
    - *Very low risk levels – no expected effects near ash sites*
- The clean-up process is designed to remove the link to the exposure pathway.
- National Cancer Institute reports 445.7 cancers per 100,000 in general population

# Mixture of Toxicants

| Chemical | Body Responses Illicited | | | | |
|---|---|---|---|---|---|
| | MET | RB | END | OS | IM |
| PCBs | X | X | X | X | X |
| TCDD | – | X | X | – | X |
| Di-*n*-butyl phthalate | X | X | X | X | – |
| Chlorpyrifos | X | X | X | X | – |
| Parathion | X | X | X | X | X |
| PAHs | X | X | X | X | X |
| *p*-Nonyl phenol | X | X | X | X | – |
| Benzene | X | X | X | X | X |
| Styrene | X | X | X | X | X |
| Mercury | – | X | X | X | X |
| Lead | – | X | X | X | X |

MET, metabolized by the body; RB, receptor binding; END, endocrine disrupting; OS, oxidative stress producing; IM, immune system suppressants. "X" denotes illicited responses and "–" denotes no known response.

From: Human Toxicology of Chemical Mixtures by Harold I. Zeliger, 2011

# Racial and Ethnic Environmental Approaches to Community Health (REEACH)


Institute of Public Health
Environmental Science Institute
Training
Research
Fugacity Model Caltox
Health Professional Students
Modeling/Tracking
Rapid Inquiry Facility
Duval County Health Department
Florida Department of Health
Health Care Providers
Environmental Medicine Training
Community Engagement
Community Leader
Layperson Toxicology Curriculum
Train-the Trainer
FAMU
Interns
Technical Assistance
Education & Awareness
Northside Community
Environmental Health and Toxicology Program

# Community-Based Participatory Research

- CBPR shown to be effective in African American community (Coglins & Smith, 2017)
- Transfer of expertise and empowerment across community and academic partnerships (Jones & Wells, 2007)
- Through designing, delivering and evaluating intervention/prevention strategy (Jones & Wells, 2007)
- Train-the-trainer mechanism-using trusted community leaders to deliver training to community
- Question and answer session to answer all questions from the community
- REEACH provided Community Environmental Toxicology Curriculum (CETC), Environmental Medicine Training Program (EMTP) and Internship Program for Public Health Students (IPPHS)

# Community, Local, State and Federal Partners

REEACH Community partners

- Eastside Environmental Council- Environmental health, redevelopment, healthy community
- Jacksonville Community Council- dialogue, research, consensus, leadership
- Jacksonville Urban League-education, health, quality of life, career development, counseling
- Jacksonville Citizens Planning Advisory Committee- Communication with residents, businesses, neighborhoods, community organizations, education institutions and other CPAC Districts

REEACH City and Local partners

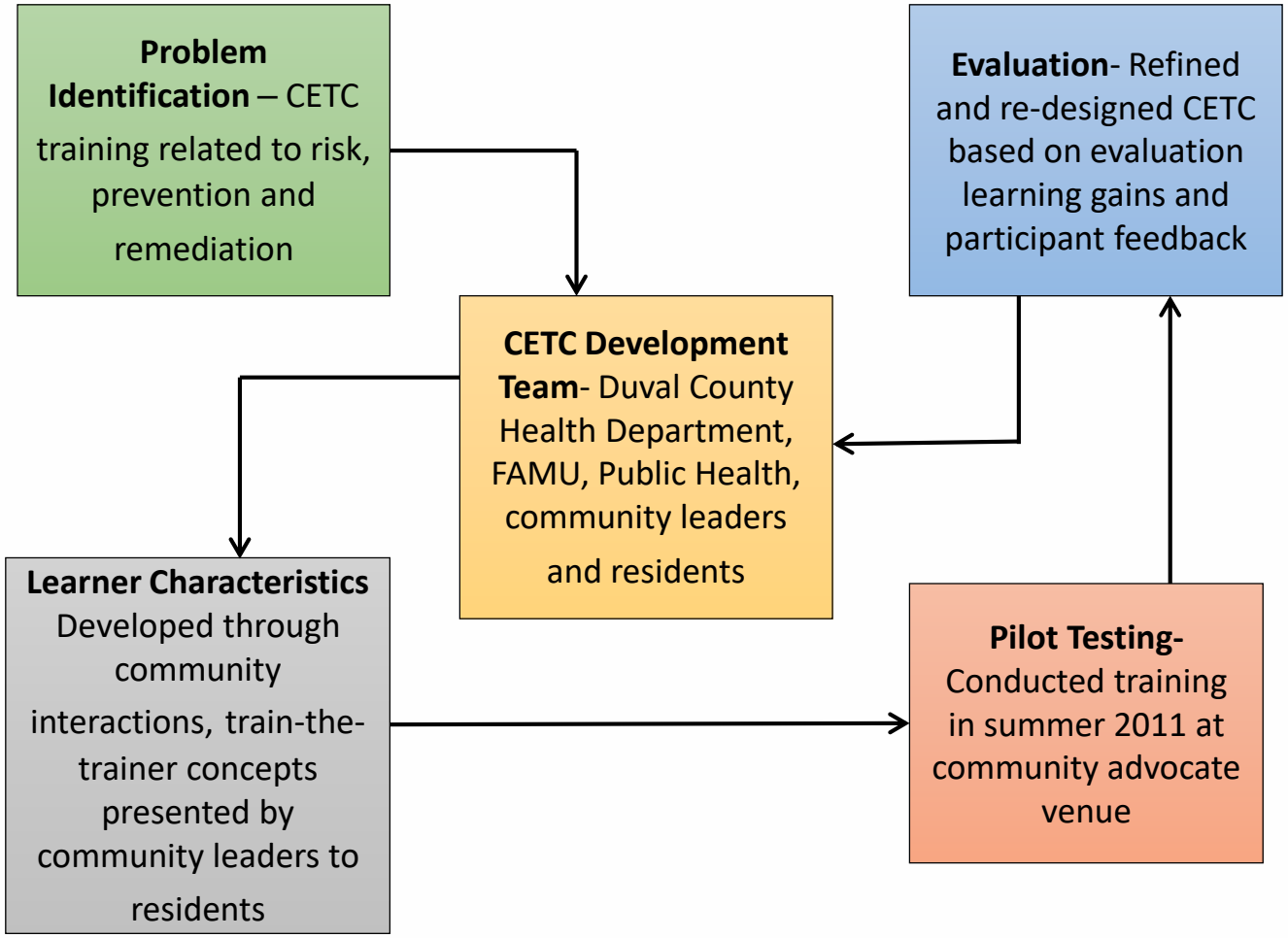
- City of Jacksonville, Project New Ground- agreement between city and EPA for long term clean- up, removal and replacement of contaminated soil which is above established standards
- DOH-Duval- Work locally with all organizations through collaboration, health fairs and community well-being by reducing health risks
- City of Jacksonville-Housing and Neighborhood Committee- affordable housing, resident involvement, community development
- Northwest Jacksonville Community Development Corp-Promotes revitalization, education, planning, rehab. of housing

REEACH State and Federal Partners

- Environmental Protection Agency- Environmental monitoring, research, and enforcement related to contamination
- Agency for Toxic Substances Registry- prevent harmful exposures and disease related to toxic substances through public health assessments, health surveillance and dissemination of education and training material and community concerns
- Florida Department of Environmental Protection- Lead agency in environmental management protect air, water and soil

# Community Environmental Toxicology Curriculum (CETC)

# CETC Development and Outreach Education




(Kern et al., 1998)

# Children Vulnerability

- Rapid cell division, developing organs→ malformation or organ shut down
- Larger surface area
- Drink more water, eat more food and breathe more air per body weight than adults
- Less than 5 years→absorb more lead
- Nutritional deficiencies may cause rapid lead absorption in children less than 6 years old
- Play close to the ground…may put objects in their mouth

# Outline for CETC

- Module 1- Reviews key toxicology terms and concepts
- Module 2- Reviews human exposure, environmental pathways, remediation and risk assessment
- Module 3-discusses how to reduce risk
- Appendix 1-Reviews each ash site and human health consultations and recommendations
- Appendix 2- contains human health concerns related,  to the ash sites
- Appendix 3- contains federal, state and local and community organizations partnering in REEACH
- Appendix 4- Fact sheets on the contaminants in the ash sites

# CETC based on previous ATSDR Toxicology for Communities developed by FAMU

- https://www.atsdr.cdc.gov/training/toxmanual/modules/1/outline.html.
- The difference is the CETC attempts to be more specific for the Jacksonville Ash Site' contamination and exposure scenario.

# REEACH Video

- http://pharmacy.famu.edu/iph-education-outcome

# FAMU, Faculty Delivering Training to Community Leaders(Train-the-Trainer)


**Faculty and Community Trainer Discuss Training before the Presentation**

# Pre-test and Post-test Questions

| |
|---|
| **Questions(Module 1)** |
| 1) The term toxicant is used when talking about toxic substances that are produced by or are a by-product of man-made activities. T/F |
| 2) Contact with contaminants such as lead and arsenic is <u>not</u> a public health concern for the Jacksonville Ash Site areas. T/F |
| 3) Chronic toxicity is classified as an exposure to a chemical or other substance over an extended period of time. T/F |
| 4) The larger the amount of exposure and the greater the dose of a substance, the greater the observed response or effect on an organism. T/F |
| 5) Which of these groups is usually designated as one of the most vulnerable for exposures to toxic substances? Multiple Choice |
| 6) Children can be vulnerable to lead exposure because they... Multiple Choice |
| **Questions (Module 2)** |
| 7) An exposure pathway includes which of the following? Multiple Choice |
| 8) What are at least four of the most likely ways residents can be exposed to contamination in the Jacksonville Ash Site? List |
| 9) Risk assessment includes all of the following: Multiple Choice |
| 10) What is the greatest environmental risk to exposure to **<u>lead</u>** related to the Jacksonville ash sites? Multiple Choice |
| 11) Removing at least 2 feet of soil and replacing it with non-contaminated soil planted with grass can reduce exposure and risk. T/F |
| **Test Your Knowledge(Crossword)** |
| 1) What group is most vulnerable to lead exposure? Hint: Young people (1 Across)? |
| 2) What term is used to describe long term exposure? Hint: Opposite of acute (5 Across)? |
| 3) What is the acronym of the agency responsible for funding of the ash cleanup in Jacksonville? Hint: 3 letters (6 Across)? |
| 4) What heavy metal is most widespread and prevalent at the Jacksonville ash sites? Hint: Greatest effect on young children (1 Down)? |
| 5) What term is used to describe the poisonous or deadly effects of a chemical on the body? Hint: Starts with T and ends with C (1 Down)? |
| 6) What term is used to describe short term exposure? Hint: Opposite of chronic |

# Learning Gains

## Community Residents

| Pretest | Posttest | Post – Pre | 100 – Pre | Individual Gain |
|---|---|---|---|---|
| 62 | 56 | -6 | 38 | -.16 |
| 90 | 97 | 7 | 10 | .70 |
| 59 | 97 | 38 | 41 | .93 |
| 97 | 97 | 0 | 3 | .00 |
| 89 | 82 | -7 | 11 | -.64 |
| 89 | 88 | -1 | 11 | -.09 |
| 100 | 94 | -6 | 0 | .00 |
| 41 | 94 | 53 | 59 | .90 |
| 53 | 82 | 29 | 47 | .62 |
| 41 | 47 | 6 | 59 | .10 |
| **Average learning gain for the group = .24** | | | | |

## Community Leaders

| Pretest | Posttest | Post – Pre | 100 – Pre | Individual Gain |
|---|---|---|---|---|
| 83 | 97 | 14 | 17 | .82 |
| 35 | 20 | -15 | 65 | -.23 |
| 53 | 91 | 38 | 47 | .81 |
| 85 | 92 | 7 | 15 | .47 |
| **Average learning gain for the group = .47** | | | | |

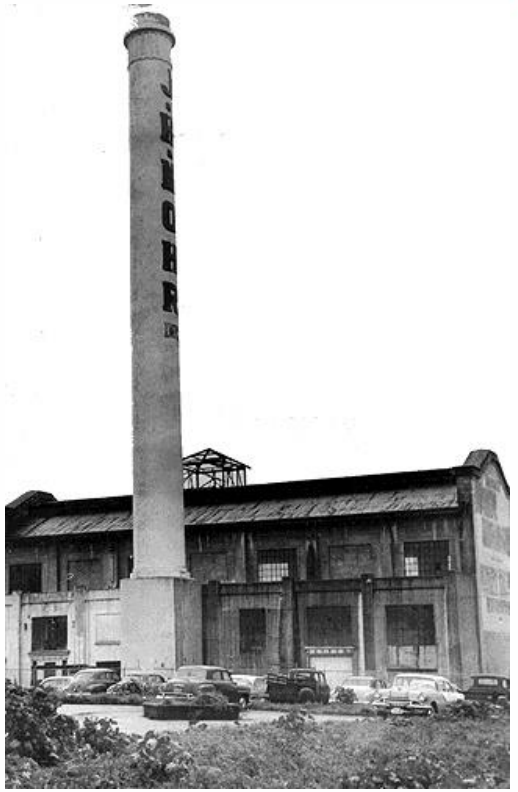
# Community Toxicology Training Survey

| Questions | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| The Community Toxicology Curriculum is a useful tool for promoting awareness of potential environmental risks in our community. | 13 (81%) | 3 (18%) | - | - | - |
| The written materials that I received were useful for guiding me through my own training session. | 13 (81%) | 3 (18%) | - | - | - |
| The training prepared me to lead a discussion group on potential environmental risks in our community. | 11 (68%) | 4 (25%) | 1 (6.3%) | - | - |
| The training included a clear explanation of what is expected of me as a Community Trainer. | 13 (81%) | 3 (18%) | - | - | - |
| The training was well-organized and time was used efficiently. | 14 (87%) | 1 (6%) | 1 (6%) | - | - |
| The facilitator's used clear, simple language that I could understand. | 14 (87%) | 1 (6%) | 1 (6%) | - | - |
| The length of the training was appropriate for the amount of material that was presented. | 11 (68%) | 4 (25%) | 1 (6%) | - | - |
| There was enough time to ask questions. | 12 (75%) | 3 (18%) | 1 (6%) | - | - |
| There was enough variety in the training format (e.g., presentations, discussions) to keep my interest. | 9 (56%) | 6 (37%) | 1 (6%) | - | - |
| The people who trained me were knowledgeable and able to effectively explain important information. | 14 (87%) | 2 (12%) | - | - | - |
| The training was implemented in a culturally sensitive manner. | 13 (81%) | 2 (12%) | 1 (6%) | - | - |
| Overall, I feel satisfied with the training that I received. | 14 (87%) | 2 (12%) | - | - | - |

# Environmental Medicine Training Program (EMTP)

# Module 1

- 1900's Until 1960's, City of Jacksonville burned solid waste
  - Produced Ash
- Dumped at four major locations
  - Jacksonville Ash sites
- Affected Zip codes: 32202, 32204, 32206, 32208, 32209 and 32254 (Health Zone 1)



# Module 2

* Basics of Toxicology
  - Terminology
  - Dose-Response
  - Exposure Routes

# Module 3 – The 4 Steps

1. Hazard Identification
   - Collect data to determine whether a substance is toxic
2. Dose-Response Assessment
   - Calculate the dose at which harmful effect will occur
3. Exposure Assessment
   - Examines amount, frequency, length of time, and route
4. Risk Characterization
   - Calculate the dose at which harmful effect will occur

# Module 3 – Exposure History Form

**Just say "ACHHOO"…**

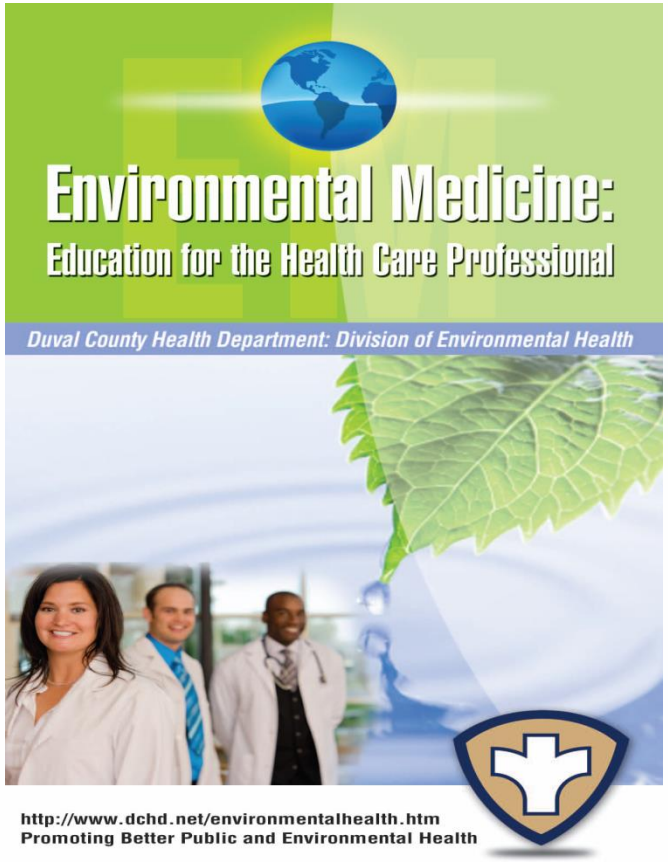
- **Activities**
- **Community**
- **Household**
- **Hobbies**
- **Occupation**
- **Oral**

# Module 4

ROLE-PLAYING ACTIVITY

* **Environmental Contaminants of Concern - Case Studies for:**
  - Lead
  - Arsenic
  - Dioxins
  - Polycyclic Aromatic Hydrocarbons (PAHs)

# “Pocket Guide” Developed for the Medical Provider Training Program



# Internship Program for Public Health Students

# REEACH Public Health Outreach

# REEACH Project Health Fair

# Risk Assessment and Exposure

# Three Types of Environments to Consider in Ash Site Exposure

- *Contamination present in the environment* (e.g. water, soil, air, home, work)
- *Contamination gets into the body* (e.g. skin, lungs, by-mouth)
- *Personal environment* This environment may contribute to illness but can be controlled by a person (e.g. hygiene, diet, smoking)
- *Socioeconomic environments:* Increased exposure to contamination due to such factors as low-income, race, sense of community, and others

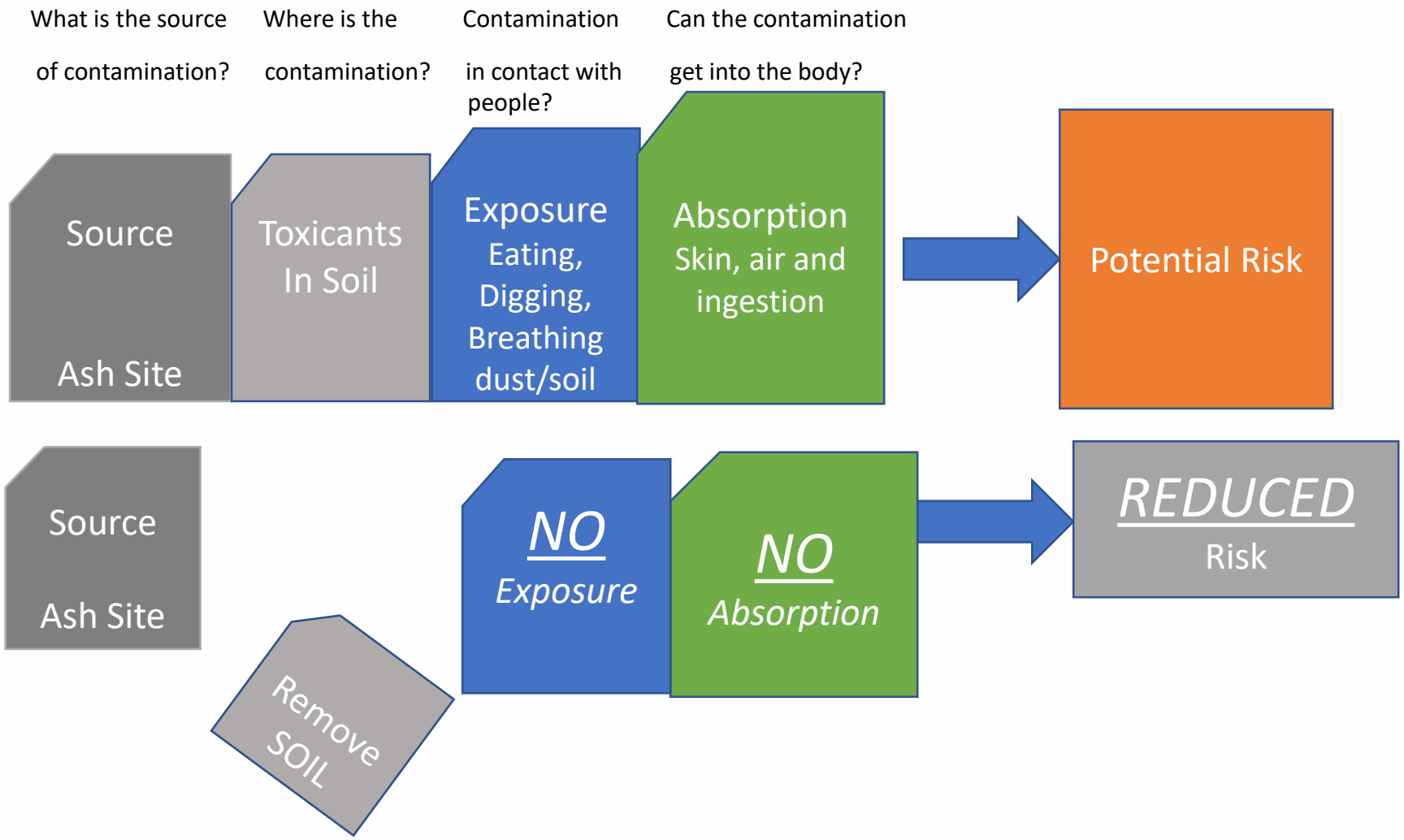
# Jacksonville Ash Site Sources of Contamination and Exposure

- **Soil-** *direct contact* and *gardening* practices (air, eat and breath)
- **Surface water-** through *swimming* and *fish consumption*
- **Groundwater** contamination and exposure to *contaminated groundwater* from shallow wells (There are a limited number of shallow wells near the ash site)
- **Occupational exposure** from site *clean-up* and contamination through *secondary contamination*

# Complete Exposure Pathway

- *Known source* of contamination (Ash sites)
- *Movement of contamination* (toxicants detected in soil, groundwater, surface water, creek sediment)
- *Place to come in contact* (residential, swimming, fishing, playing in park)
- *Entry into body* (toxicants may be swallowed, come in contact with through skin or through breathing the toxicant)

# If No Exposure, Due to Removal of Media (Soil), There is Reduced Risk



# Limitations Predicting Risk to Exposure and Outcome

- Exposure information related to air
- Large range of concentration in soil
- Behavioral factors related to exposure
- Contributions of community stressors
- Difficult to do a dose-response and exposure assessment
- Health surveillance-difficult to do a medical assessment

# Remediation of Lead in Soil and Home Exposure

- Community-wide clean-up recontaminated within a year (CH2MLHill, 1991)
- 60-80% of lead in homes originated from soil (TerraGraphics, 2000)
- Lead exposure- 40% dust, 30% community soil, 30% neighborhood including yards (TerraGraphics, 2000)
- Household hygiene, number of adults living in household, number of hours that children play outside can increase blood lead levels (von Lindern et al., 2003)
- Erosion of clean barriers that cap contamination will recontaminated remediated areas (Sheldrake & Stifelman, 2003)
- Flooding and drainage improvements can also reduce recontamination (Sheldrake & Stifelman, 2003)
- Maintain, repair, flooding, erosion, deposition of contaminated soil and an inspection program can reduce recontamination (Sheldrake & Stifelman, 2003)
- Lead Health Intervention Program through door-to-door follow-up including education at schools, parents and health care providers (TerraGraphics, 2000)

# Methods to Monitor, Evaluate and Reduce Lead Exposure

- Expand blood lead testing in children above 5µg/dl for exposure assessment
- Sampling for lead in homes and an evaluation related to source of contamination and exposure through environmental health and medical experts
- Expand to include exposure modification in Community Toxicology Curriculum
- Develop an inspection team to monitor barriers and recommend repair
- Improve drainage to prevent recontamination from flooding and erosion
- Promote decontamination of homes through cleaning programs and training

# Frequently Asked Questions

- Is it safe to eat fruit/vegetables/nuts from plants or trees grown in contaminated soil?
- Is it safe to eat fish caught in contaminated waters?
- What are the additive effects of the contaminants? (i.e. one chemical alone does not significantly increase my risk for health effects, but what if I have Lead, Arsenic, PCB, PAH and dioxin in my soil?)
- Is it safe for my children to play outside in the yard?
- Is my drinking water safe?
- Will the cleanup procedure create any health concerns? (i.e. from contaminated dust)

# Thank You

**Florida A&M University**
**Racial and Ethnic Environmental Approaches to Community Health (REEACH)**
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