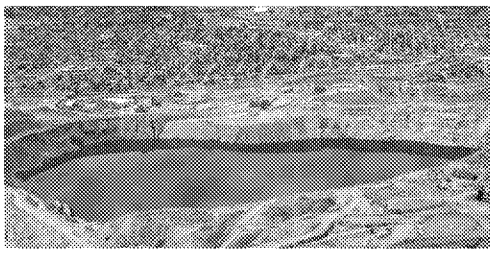
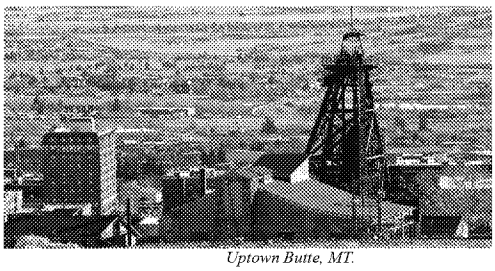
Evaluating Environmental Health Risk Perceptions for Better Community Engagement



Berkeley Pit

Photo courtesy of Donald Stierle.



Uptown Butte, MT.

MIKE ALBANS

ED_014362_00000665-00001

Research Group

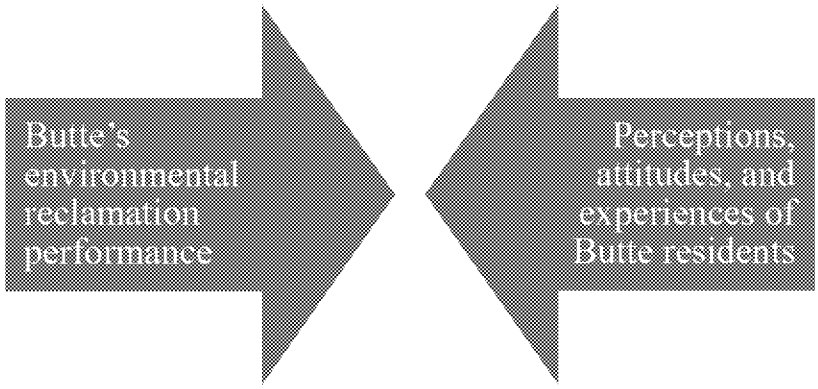
- Raja Nagisetty, Ph.D., P.E., Project Director, Montana Tech
- Bill MacGregor, Professor Emeritus, Co-D, Montana Tech
- Dan Autenrieth, Ph.D., Montana Tech
- Sarah Storey, Montana Tech
- Loran Brooks, Montana Tech
- Janice Hogan, CTEC
- Xufei Yang, Ph.D., P.E. Montana Tech
- Eric Raile, HELPS lab, MSU
- Montana INBRE Program, MSU

Research reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number **P20GM103474**.

Outline

- Introduction/Background
- Objectives
- Methodology
- Results
- Discussion

Introduction – hypothesis of a gap



Objectives

The goal of the study is to evaluate a potential gap between community perceptions and official documentation by responsible agencies at the Butte, MT superfund site.

The objectives of the study are:

- Perceptions literature review and database development
- Surveying community perceptions using mail-in survey approach, interviews and focus groups
- Strategies for better community engagement

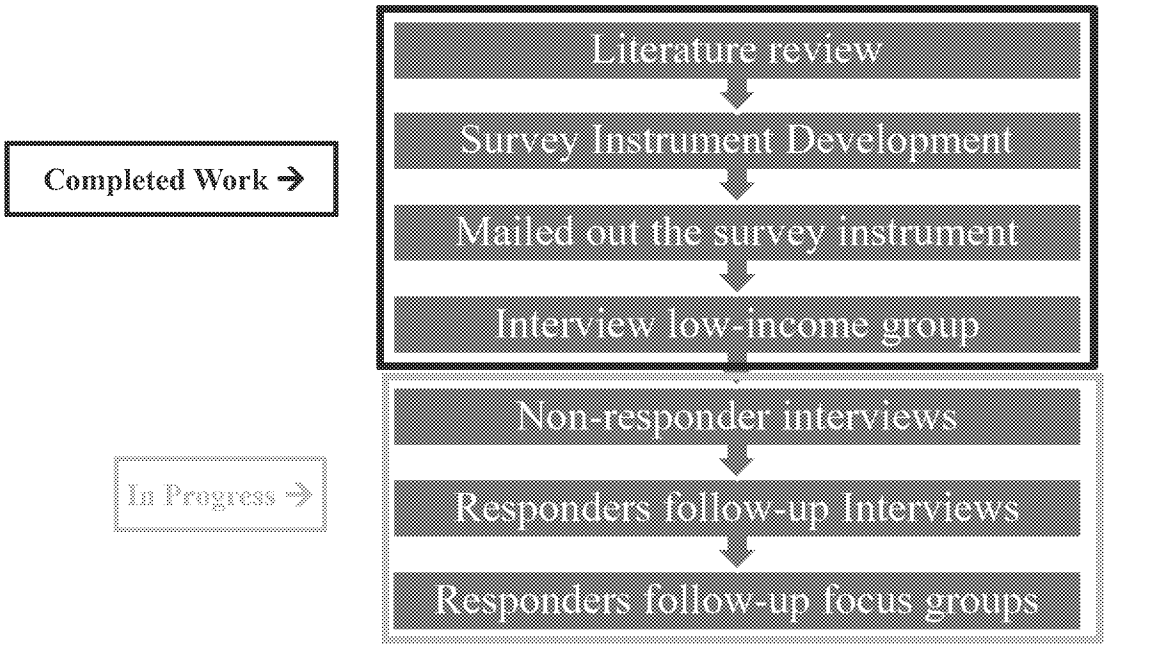
Methodology

Results are data-driven and from scientific methods

No bias in selecting participants or analyzing responses

Limitations

Methodology



Survey Questionnaire

- General Environmental Health Perceptions in Butte (n=6)
- Specific Environmental Health Perceptions in Butte (n=9)
- Perceptions Related to Superfund Activities in Butte (n=6)
- Effectiveness of Superfund Activities to Protect Health in Butte (n=3)
- Respondent Information (n=10)

Survey Questionnaire

- General Environmental Health Perceptions in Butte (n=6)
- Specific Environmental Health Perceptions in Butte (n=9)
- Perceptions Related to Superfund Activities in Butte (n=6)
- Effectiveness of Superfund Activities to Protect Health in Butte (n=3)
- Respondent Information (n=10)

General Environmental Health Perceptions in Butte

1. What do you believe about the overall quality of the **drinking water** in Butte?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

2. What do you believe about the overall quality of the **soil** in Butte?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

3. What do you believe about the overall quality of the **air** in Butte?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

4. What do you believe about the overall quality of the **environment** (including the drinking water, soil, and air) in Butte?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

5. What do you believe about the overall **mental health** of Butte residents?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

6. What do you believe about the overall **physical health** of Butte residents?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

Specific Environmental Health Perceptions in Butte

7. What do you believe about the quality of the **drinking water** in Butte as it relates to mining waste contamination (such as from lead, arsenic, and mercury)?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

8. What do you believe about the quality of the **soil** in Butte as it relates to mining waste contamination?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

9. What do you believe about the quality of the **air** in Butte as it relates to mining waste contamination?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

10. What do you believe about the quality of the **environment** (including the drinking water, soil, and air) in Butte as it relates to mining waste contamination?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

11. What do you believe about the **mental health** of Butte residents as it relates to mining waste contamination?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

12. What do you believe about the **physical health** of Butte residents as it relates to mining waste contamination?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

13. What do you believe about the protection of the **drinking water** in Butte as it relates to Berkeley Pit water contamination?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

14. What do you believe about the protection of the **environment** (including the drinking water, soil, and air) in Butte as it relates to Berkeley Pit water contamination?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

15. What do you believe about the quality of the **fruits and vegetables grown** in Butte as it relates to mining waste contamination?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

Perceptions Related to Superfund Activities in Butte

16. How familiar are you with the following Butte Superfund projects designed to protect human health?

	Very Familiar	Familiar	Somewhat Familiar	Unfamiliar
Removal of Parrot Tailings near the Civic Center	○	○	○	○
Containment of mine waste in Uptown railroad beds	○	○	○	○
Residential Metals Abatement Program (RMAP)	○	○	○	○
Construction of grass-covered caps on mine dumps	○	○	○	○
Containment of contaminated water in the Berkeley Pit	○	○	○	○

17. The Butte area was added to the list of Superfund sites in 1983 to enable clean-up efforts of historic mining activities. How do you rate the effort of the Superfund process to protect human health from mining waste contamination (such as from lead, arsenic, and mercury) in Butte?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

18. How do you rate the effectiveness of the input from Butte residents in shaping Superfund clean-up decisions and actions?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

19. How do you rate the effort of the U.S. Environmental Protection Agency (EPA) to protect human health during the Butte Superfund process?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

20. The Residential Metals Abatement Program (RMAP) is designed to reduce harmful exposures from sources of mining waste contamination (such as from lead, arsenic, and mercury) to residents within the general Uptown Butte area. How do you rate the efforts of RMAP to protect human health in Butte?

○ Very Good ○ Good ○ Somewhat Good ○ Somewhat Bad ○ Bad ○ Very Bad

21. The Superfund process requires "community acceptance" for all Superfund sites. How much emphasis do you believe the EPA places on the comments, requests, and suggestions received from Butte residents?

○ The EPA actively engages with Butte residents' input when making environmental remediation decisions.
○ The EPA attempts to factor Butte residents' input when making environmental remediation decisions.
○ The EPA does little to respond to Butte residents' input when making environmental remediation decisions.
○ The EPA ignores Butte residents' input when making environmental remediation decisions.

Effectiveness of Superfund Activities to Protect Health in Butte

22. How do current Butte children's blood-lead levels (concentrations of lead in the blood) compare to the current United States (U.S.) average?

○ Higher than the U.S. average ○ Same as the U.S. average ○ Lower than the U.S. average ○ I don't know

23. How do blood lead levels of children currently living in Uptown Butte compare to those of children currently living in the Flats?

○ Higher than the Flats ○ Same as the Flats ○ Lower than the Flats ○ I don't know

24. Cancer incidence rate is the number of new cancers occurring in a population during a year. How do Butte residents' current cancer incidence rates compare to the current United States (U.S.) average?

○ Higher than the U.S. average ○ Same as the U.S. average ○ Lower than the U.S. average ○ I don't know

Respondent Information

25. How long have you lived in the Butte area?

○ Fewer than 5 years ○ 6 to 20 years ○ More than 20 years

26. What is your age?

○ Less than 18 years old ○ 18 to 39 years old ○ 40 to 64 years old ○ 65+ years old

27. What is your highest level of educational achievement?

○ Some high school ○ High school diploma or equivalency degree ○ Associate's diploma or equivalent degree
○ Bachelor's degree or higher ○ Other (please specify) .....

28. What was your total household income before taxes in 2017?

○ Less than $26,420 ○ $26,420 to $28,779 ○ $28,780 to $41,319 ○ $41,320 or more

29. Including yourself, how many persons lived in your household in 2017?

○ Number.....

30. Which best describes you?

○ Female ○ Male ○ Other (please describe): .....

31. Which category best describes you? (Please mark all that apply).

○ Caucasian ○ American Indian ○ Alaska Native ○ Asian ○ Native Hawaiian or Other Pacific Islander
○ Black or African American ○ More than one race ○ Other (please describe): .....

32. Are you Hispanic?

○ Yes ○ No

33. Where do you get environmental health information related to Butte? (Please mark all that apply).

○ Local news ○ Family and friends ○ EPA meetings ○ EPA reports ○ Local community groups
○ Social Media (Facebook, Twitter, etc.) ○ Other (please describe): .....

34. May we contact you if we have follow-up questions?

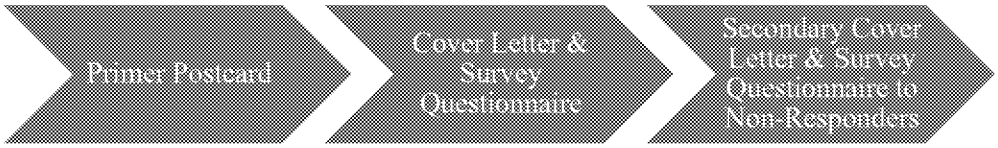
○ Yes ○ No

Survey Questionnaire – Instrument validity and reliability

- Face/Content Validity
  - Over 40 subject matter experts reviewed and provided feedback
  - Revisions were made based on feedback
- Internal Consistency
  - 30 Butte residents, outside of mailing pool
  - Responses within the overall environmental health and mine-waste related environmental health were compared
  - Cronbach Alpha value of 0.7 or greater is good
  - Cronbach Alpha = 0.86 and 0.84 consecutively
- Test/Re-Test Reliability
  - 30 college students
  - Surveys given one week apart
  - Intraclass Correlation Coefficient calculated
  - ICC>0.9 = excellent correlation
  - ICC = 0.969,

Survey Questionnaire Distribution

- 550 residents of Butte, MT
  - randomly selected by MSU HELPS Lab
- Response Rate: n=163



Results-Mean Differences

Table 1: General and Mining Waste-Related Environmental Health Perceptions of Butte, Montana Survey Respondents (n=163 survey respondents)

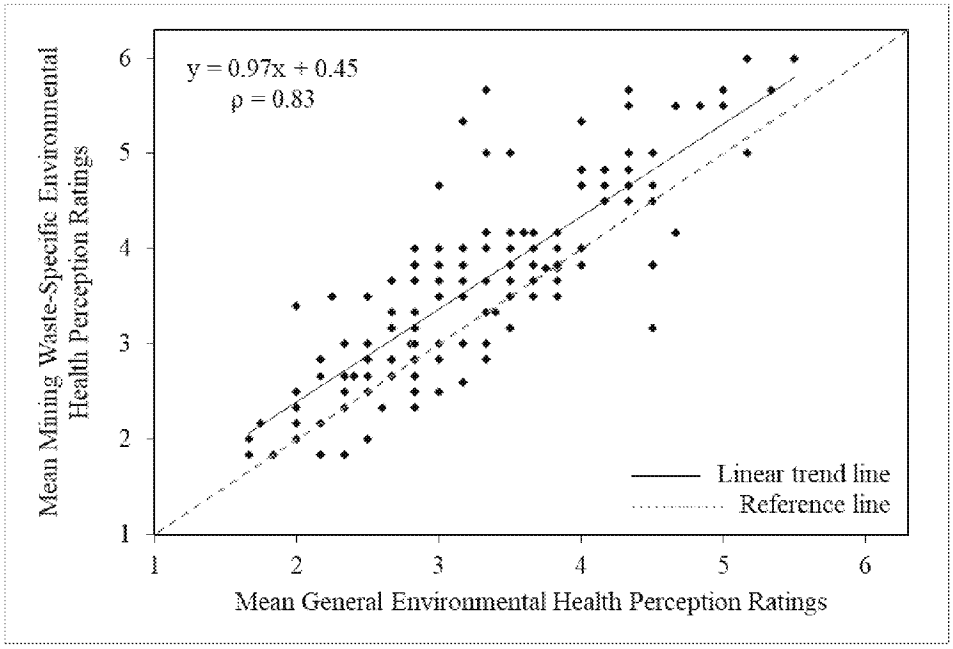
Survey Question Topic	Question Focus	Question Rating[a] Mean (SD)	Mean Difference	P-Value[b]
Drinking Water	General	2.71 (1.21)	-0.43	<0.001*
	Mine waste-related	3.14 (1.35)		
Soil	General	3.81(1.03)	-0.27	<0.001*
	Mine waste-related	4.08 (1.03)		
Air	General	3.11 (1.11)	-0.58	<0.001*
	Mine waste-related	3.69 (1.14)		
Overall Environment	General	3.27 (1.00)	-0.48	<0.001*
	Mine waste-related	3.75 (1.08)		
Mental Health	General	3.21 (0.99)	-0.21	0.003*
	Mine waste-related	3.42 (1.05)		
Physical Health	General	3.42 (0.94)	-0.17	0.001*
	Mine waste-related	3.59 (1.05)		

[a]*Rating based on a six-point scale, with 1 being a very good perception and 6 being a very bad perception*

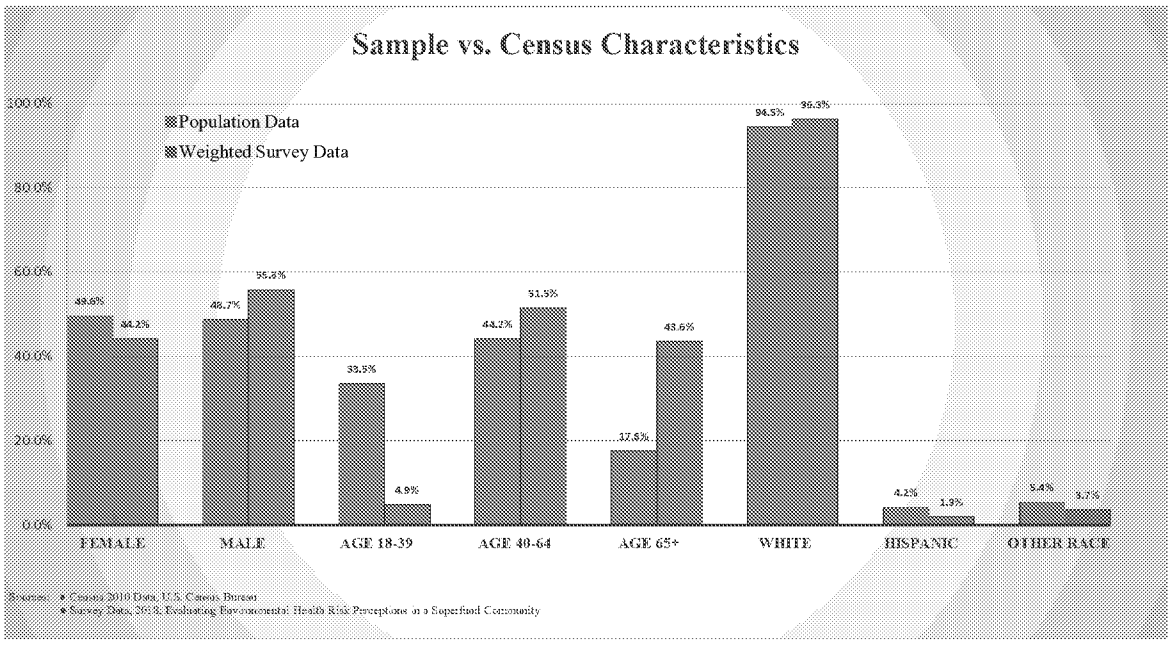
[b]*Result of a paired, two-sided Wilcoxon Signed-Rank test*

**This comparison was statistically different at the α=0.05 significance level*

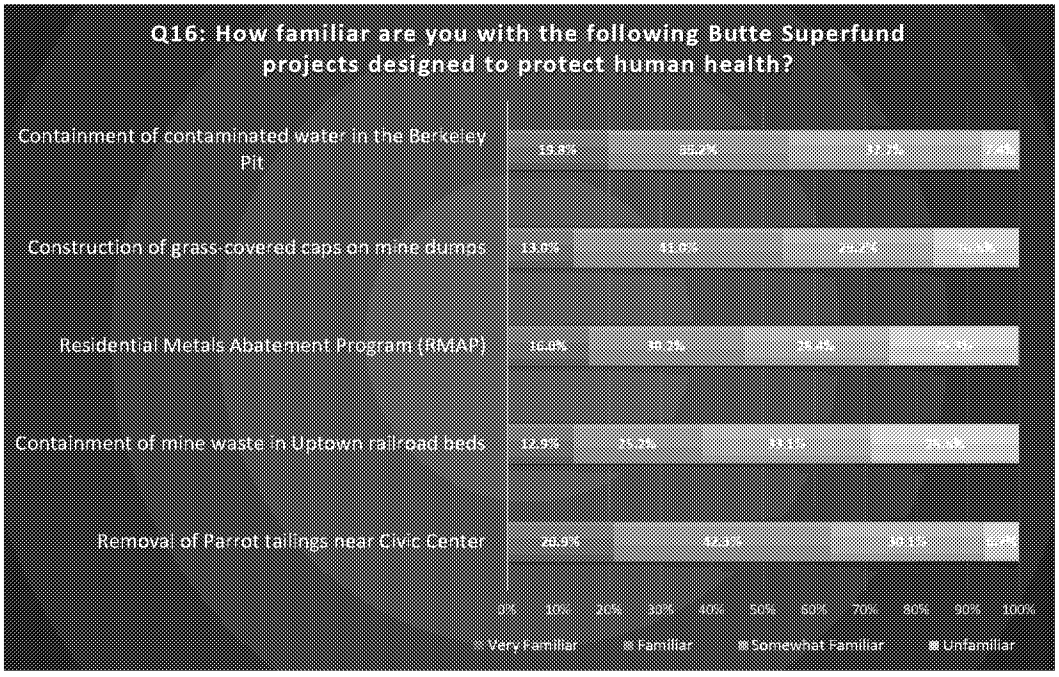
Results- General Vs Mine-waste specific



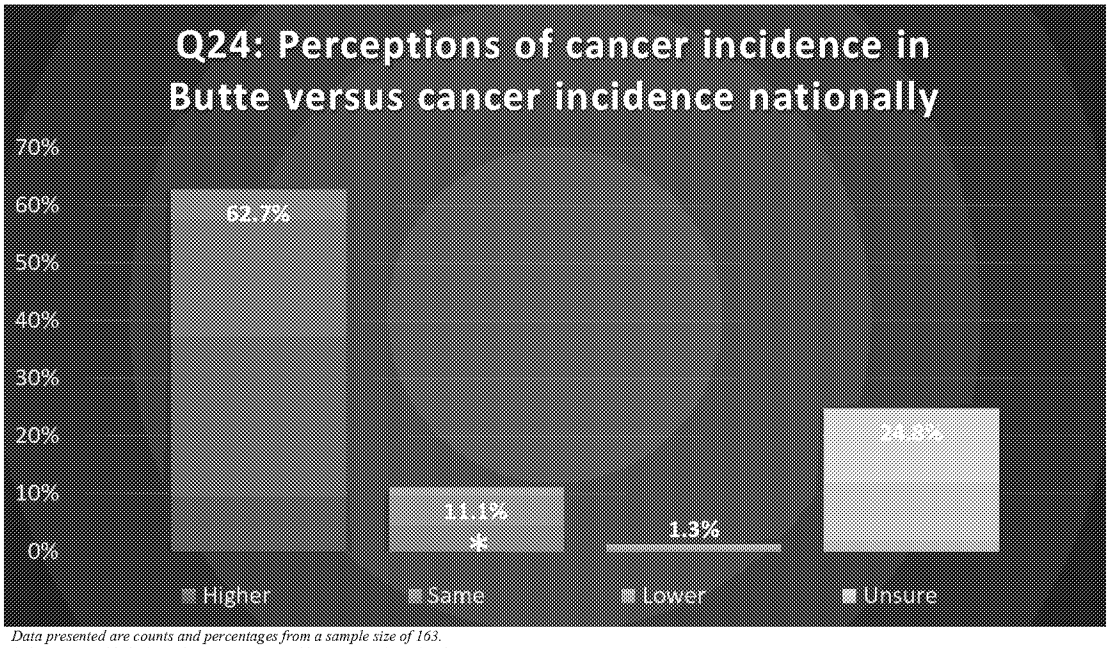
Results-Representativeness



Results – Familiarity

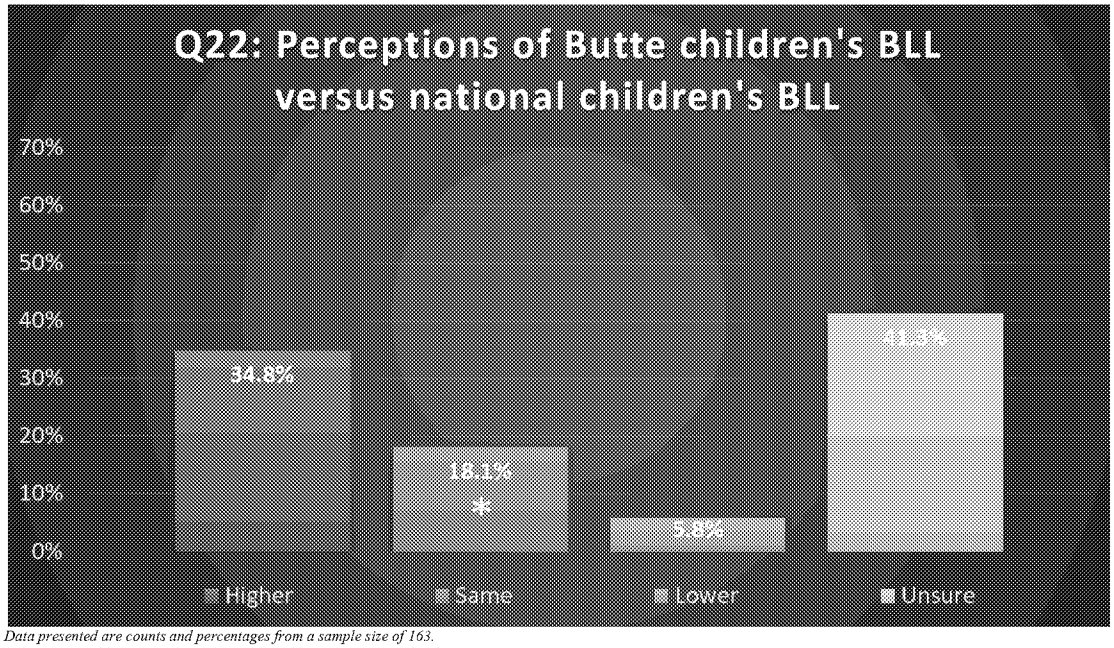


Results-Health Data



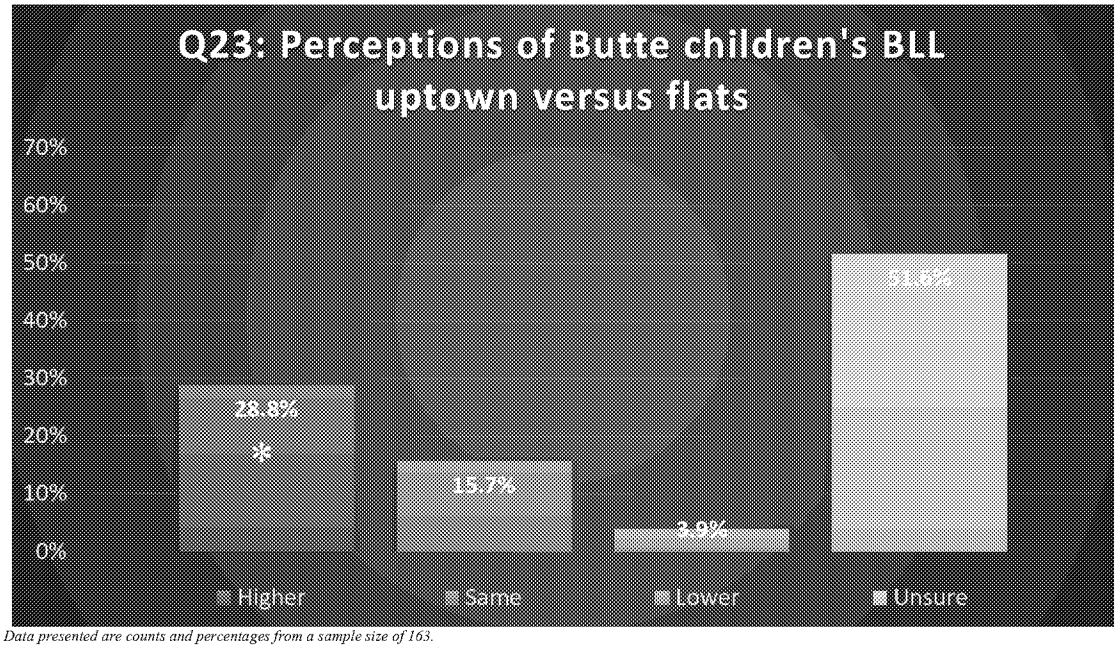
Data presented are counts and percentages from a sample size of 163.
**The EPA's published conclusions are denoted by an asterisk on the chart.*
BLL = Blood Lead Levels

Results-Health Data



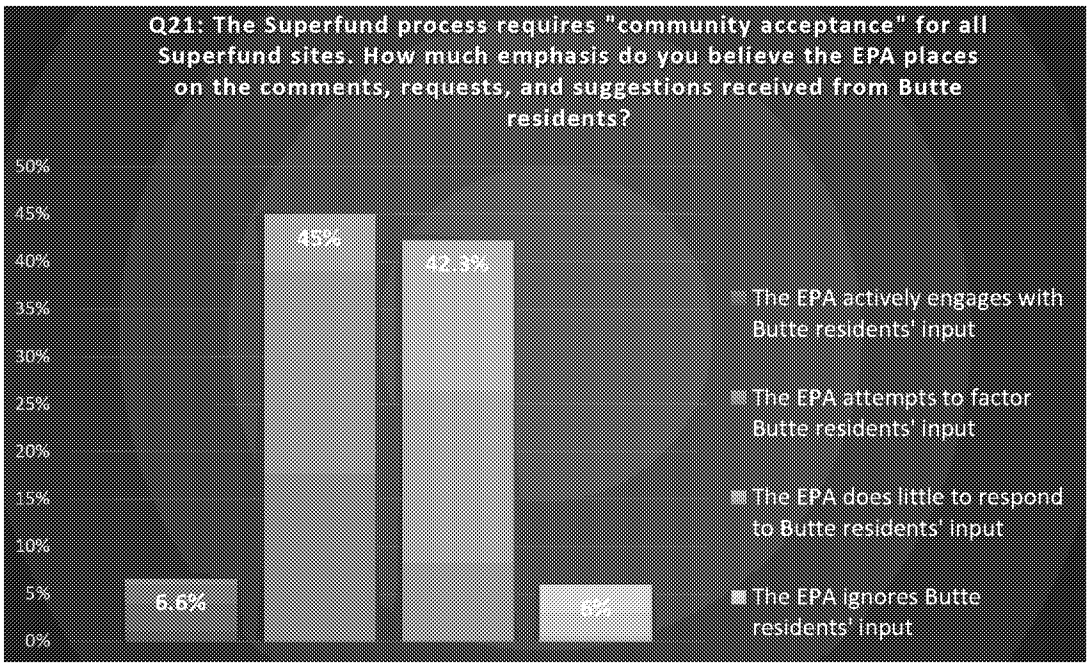
Data presented are counts and percentages from a sample size of 163.
**The EPA's published conclusions are denoted by an asterisk on the chart.*
BLL = Blood Lead Levels

Results-Health Data

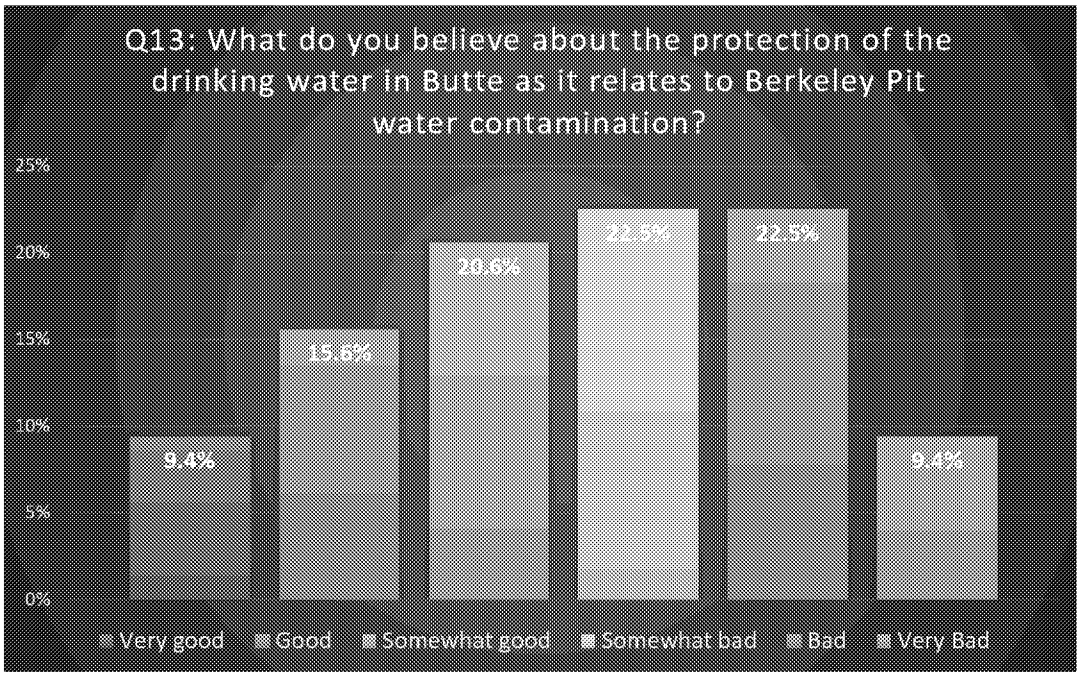


Data presented are counts and percentages from a sample size of 163.
**The EPA's published conclusions are denoted by an asterisk on the chart.*
BLL = Blood Lead Levels

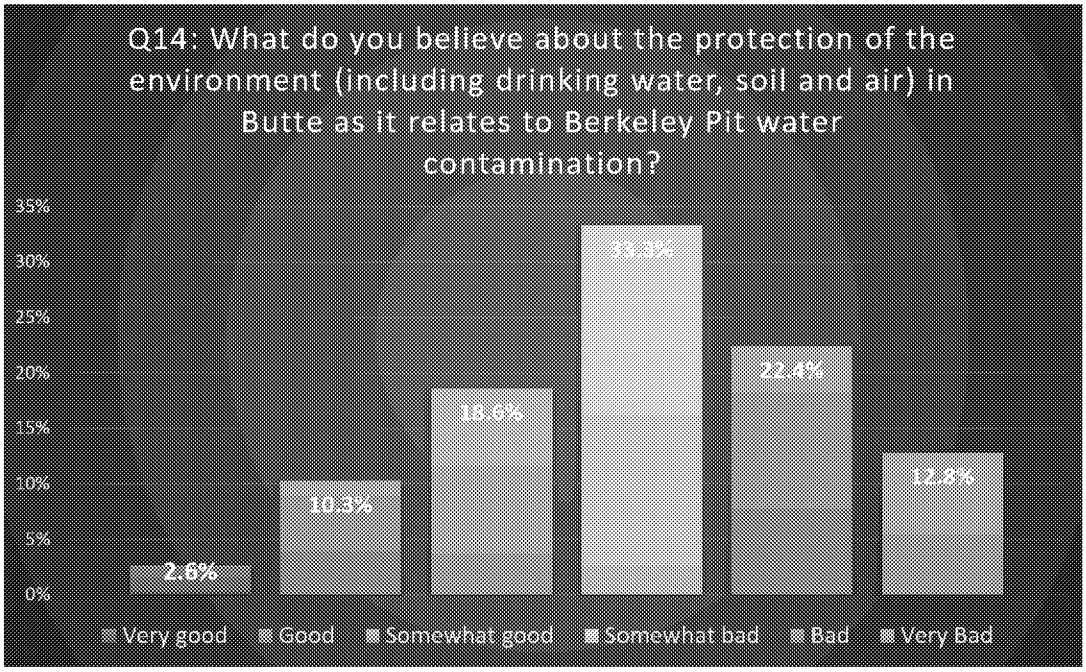
Results-EPA emphasis on input



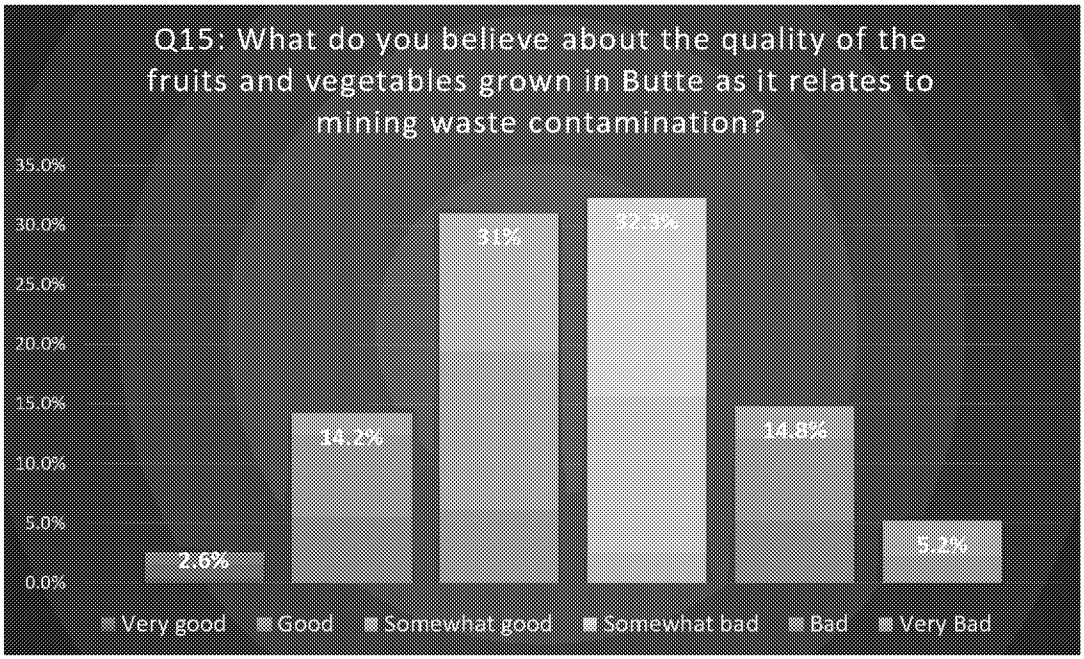
Results-Drinking water contamination



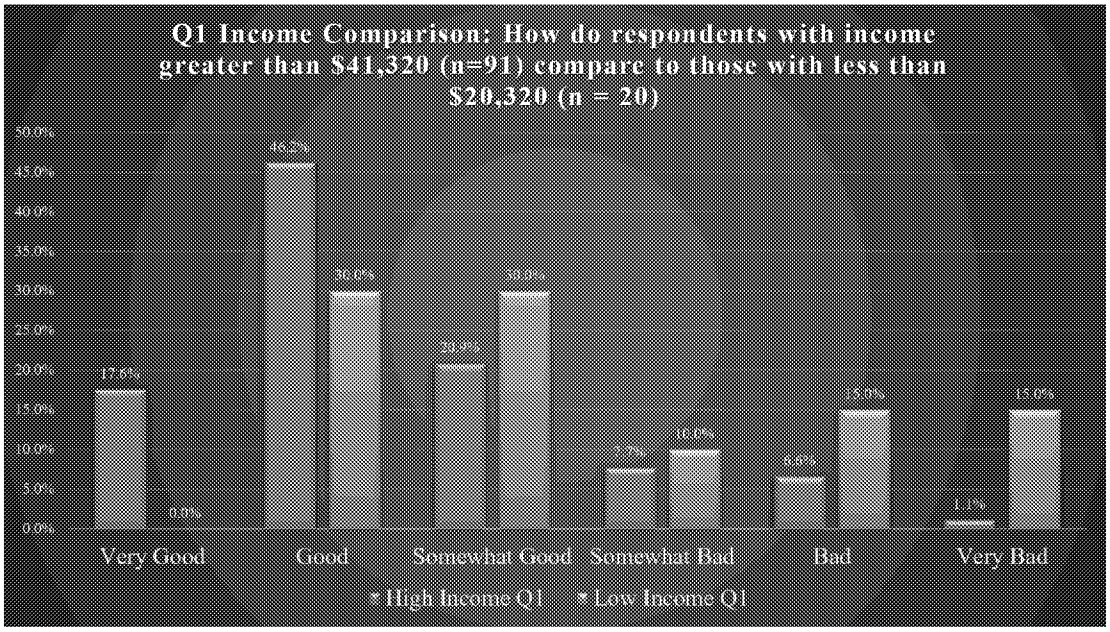
Results-Protection of environment related to Berkeley Pit



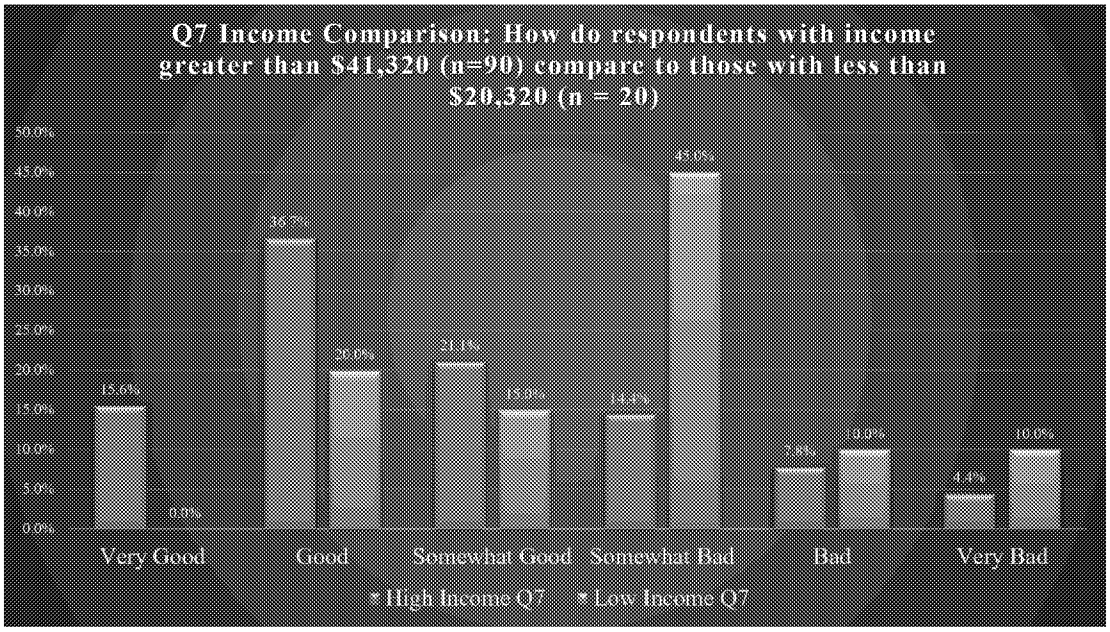
Results-Fruit and vegetable quality



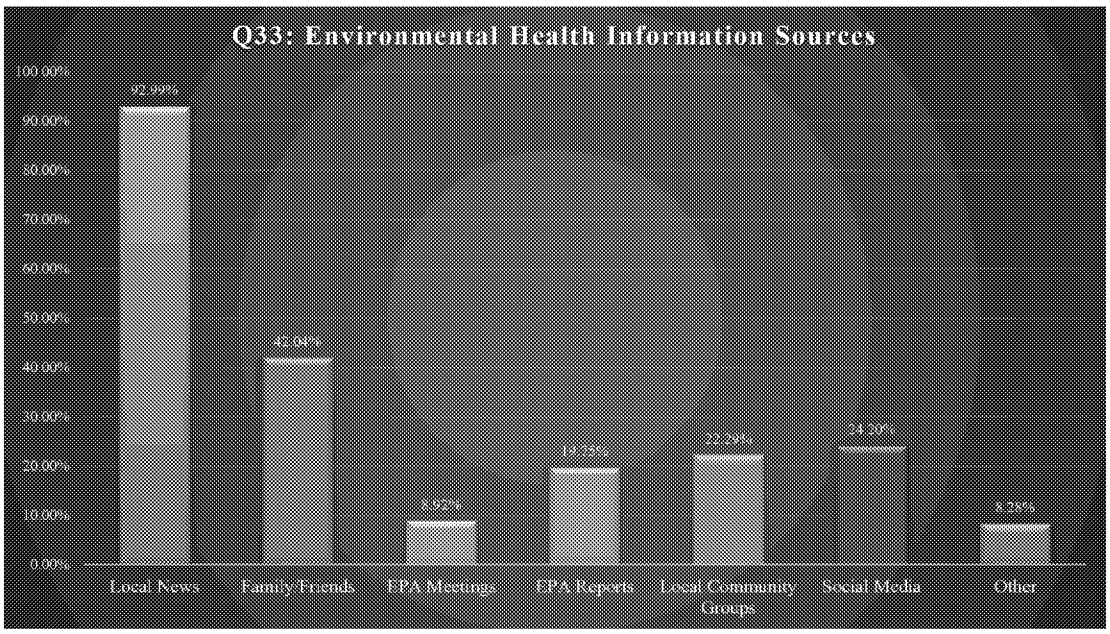
Results-Drinking water



Results-Drinking water related to mine-waste



Results-Where respondents get information?



Conclusions

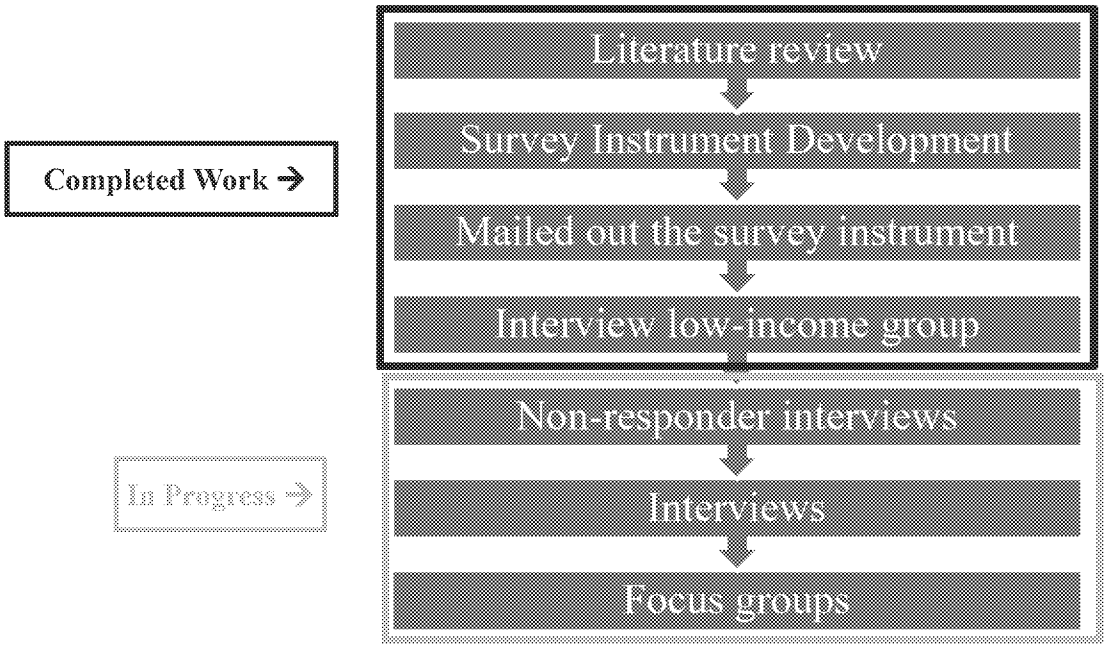
- General Environmental Health Perceptions in Butte (n=6) and Specific Environmental Health Perceptions in Butte (n=9)
  - There is a strong disconnect between overall environmental health perceptions compared to mine-waste related environmental health perceptions

- Perceptions Related to Superfund Activities in Butte (n=6)
  - Perceptions were positive for
    - Q17:Effort of Superfund to protect human health-60%
    - Q18:Effectiveness of input in shaping decisions/actions-61%
    - Q20:Efforts of RMAP to protect human health-69%
  - And 50% for Q19:Effort of EPA to protect human health during Superfund process
  - Most people were Familiar/Somewhat Familiar with Superfund projects

- Effectiveness of Superfund Activities to Protect Health in Butte (n=3)
  - Low percentage of agreeance with published health data
  - Many participants are 'unsure', which means information gap

- Respondent Information (n=10)
  - Sample was representative of Butte people, except for age
  - Q33: Most people get information from local news

Discussion-Future Work



QUESTIONS?

7/1/2023

Test