Missile Community Cancer Study (MCCS) Update

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AFGSC/CC
January 2025

Missile Community Cancer Study Objectives

Assess the as-is environmental state at the three active Missile Wings.

Identify the risk of exposure to our Airman and develop institutional processes to document and communicate potential risks for Airman and their families.

Understand the scope of potential exposures, 1976 through current day, and document exposures for DoD, separated and retired members, families, and VA partners.

Environmental Sampling **DOEHRS/ILER** **Epidemiology Review**

MCCS Timeline/Recap

December 2022 - Space Force Guardian and Former Missileer started an important dialogue: *Do Missileers have an increased cancer risk?*

February 2023
AFGSC/CC Directs Study via USAFSAM
AFGSC Commander initiates the Missile Community Cancer Study (MCCS) to assess potential risk factors and cancer prevalence in missile-related career fields.

March – May 2023
Site Visits & Town Halls
AFGSC and USAFSAM design a 2-track study environmental and epidemiological – based off missile alert facility sight visits and missile community member feedback.

June – July 2023
Round 1 Environmental Sampling
USAFSAM completes 1st of 3 rounds of environmental sampling, testing for known hazardous materials at every active MAF within AFGSC; begins combing data bases for epidemiological trends.

Aug – Oct 2023
PCBs Identified & Mitigation Efforts Completed
Results from round 1 of sampling identify PCB levels above Environmental Protection Agency recommended standards at 4 sites. These sites are immediately closed until cleaning and mitigation efforts are complete.

Oct – Nov 2023
Round 2 Environmental Sampling
USAFSAM completes 2nd of 3 Rounds of environmental sampling and begins the analysis of electronic medical data from 2001-2021 for Air Force Specialty Codes which work in/around MAFs

February 2024
Phase 1A Epidemiology Results
A very small data set found no increase incidence of Non-Hodgkin Lymphoma. Potential trend towards increase breast and prostate cancer.

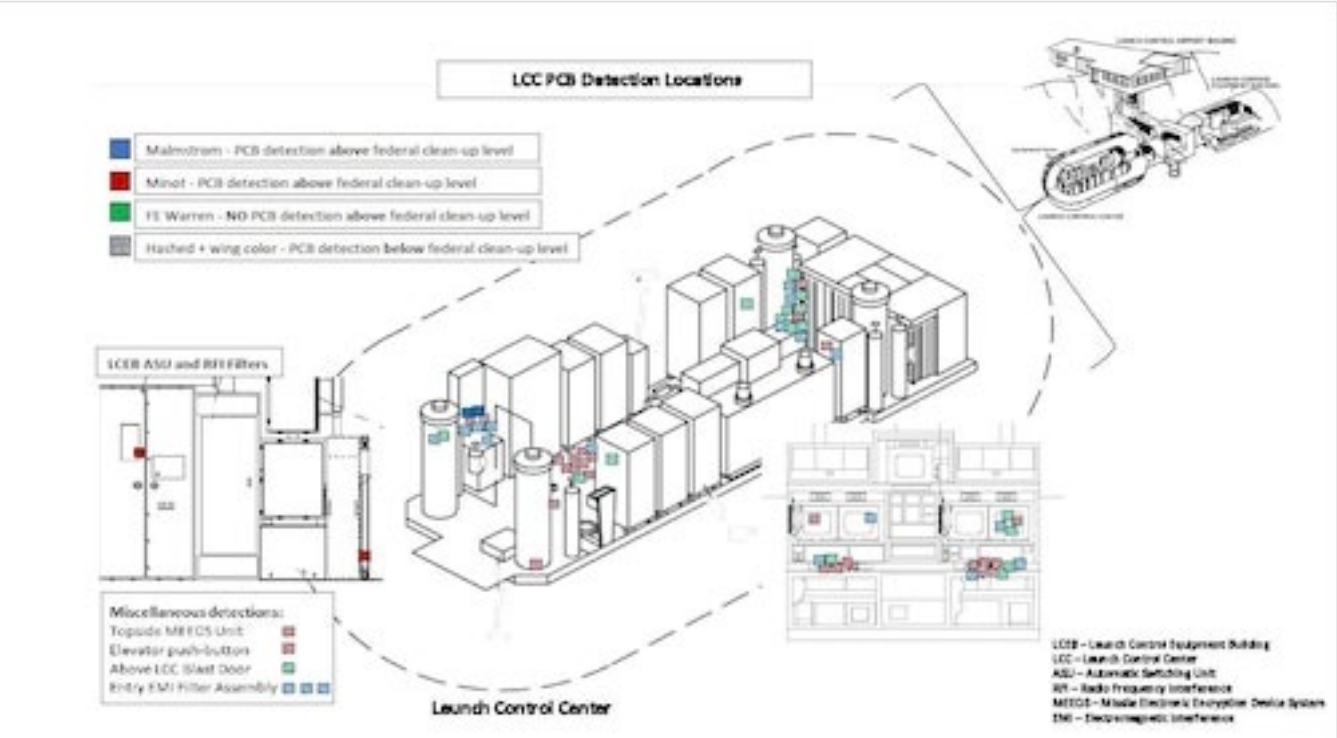
Fall 2024
Round 3 Environmental Sampling
Phase 1B Epidemiology Results
An expanded dataset did not identify an elevated incidence of non-Hodgkin lymphoma nor any of the 13 other individual cancers.

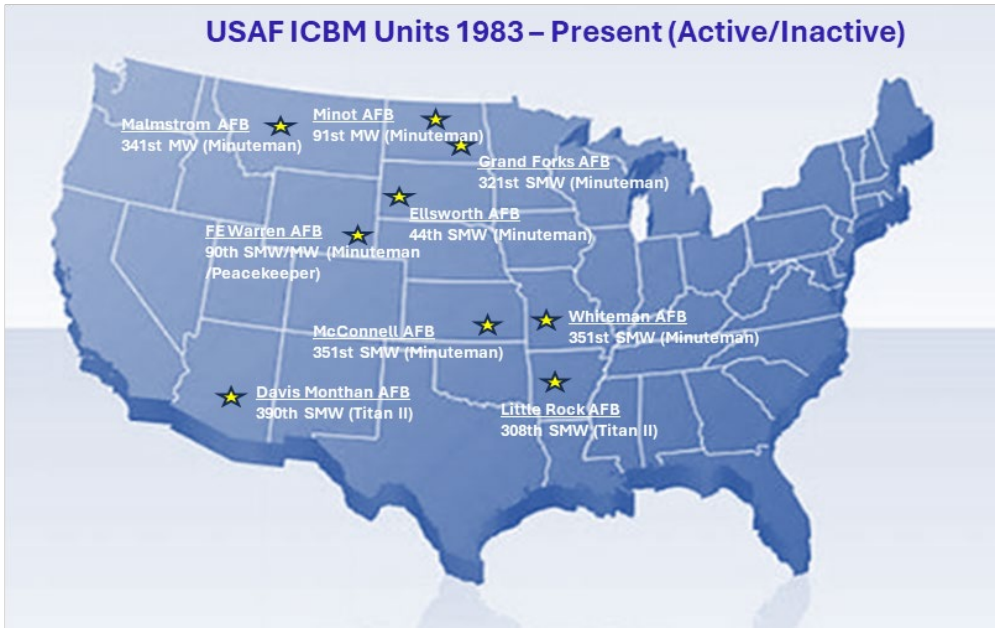
January 2025
Phase 1C Epidemiology Results

Jan 2023	Feb 2023	March 2023	April 2023	May 2023	June 2023	July 2023	Aug 2023	Sept 2023	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	March 2024	April 2024	May 2024	June 2024	July 2024	Aug 2024	Sept 2024	Oct 2024	Nov 2024	Dec 2024	Jan 2025

Ongoing Efforts

- **PCB response protocols standardization complete**
  - Maintenance Technical Orders (TOs)
  - Civil Engineer Manuals
  - Signage

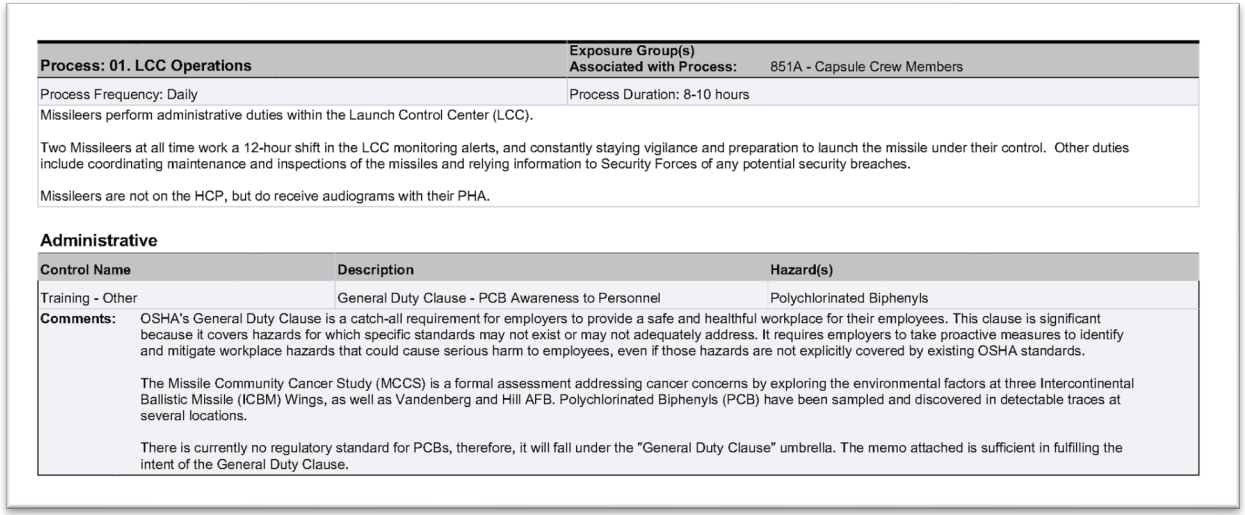




- MAF environmental upgrades & Deep Cleaning contract in progress
- PCB Cleaning contract awarded
- **Launch Facility** (LF) PCB sampling integrated into inspection processes

DOEHRS - Hazard Documentation

- **Missile Community – Defense Occupational & Environmental Health Readiness System**
  - Missile units routinely monitored for other health hazards were updated to include PCBs (e.g., thermal stress, hazardous noise, radiation, chemical hazards)
  - Roles or units that were not typically tracked for health hazards were created and included PCBs as a hazard (e.g., Chefs, Capsule Crew)
  - Sampling data collected by USAFSAM was entered in the DOEHRS Environmental Health (EH) module to align the development of location-specific data for the Individual Longitudinal Exposure Record (ILER)



Process: 01. LCC Operations	Exposure Group(s) Associated with Process:	851A - Capsule Crew Members
Process Frequency: Daily	Process Duration: 8-10 hours	

Missileers perform administrative duties within the Launch Control Center (LCC).

Two Missileers at all time work a 12-hour shift in the LCC monitoring alerts, and constantly staying vigilance and preparation to launch the missile under their control. Other duties include coordinating maintenance and inspections of the missiles and relying information to Security Forces of any potential security breaches.

Missileers are not on the HCP, but do receive audiograms with their PHA.

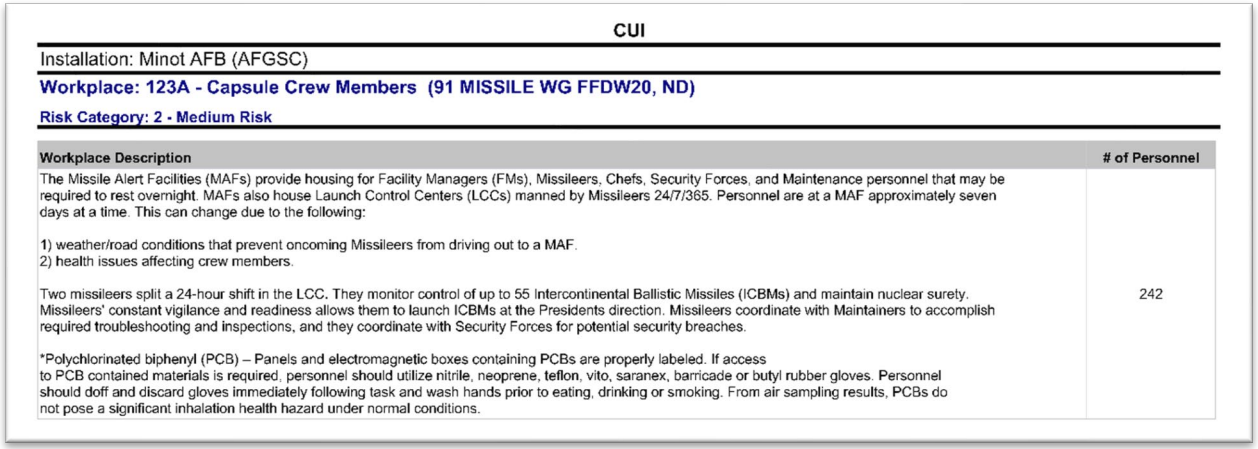
Administrative

Control Name	Description	Hazard(s)
Training - Other	General Duty Clause - PCB Awareness to Personnel	Polychlorinated Biphenyls

Comments: OSHA's General Duty Clause is a catch-all requirement for employers to provide a safe and healthful workplace for their employees. This clause is significant because it covers hazards for which specific standards may not exist or may not adequately address. It requires employers to take proactive measures to identify and mitigate workplace hazards that could cause serious harm to employees, even if those hazards are not explicitly covered by existing OSHA standards.

The Missile Community Cancer Study (MCCS) is a formal assessment addressing cancer concerns by exploring the environmental factors at three Intercontinental Ballistic Missile (ICBM) Wings, as well as Vandenberg and Hill AFB. Polychlorinated Biphenyls (PCB) have been sampled and discovered in detectable traces at several locations.

There is currently no regulatory standard for PCBs, therefore, it will fall under the "General Duty Clause" umbrella. The memo attached is sufficient in fulfilling the intent of the General Duty Clause.



CUI

Installation: Minot AFB (AFGSC)

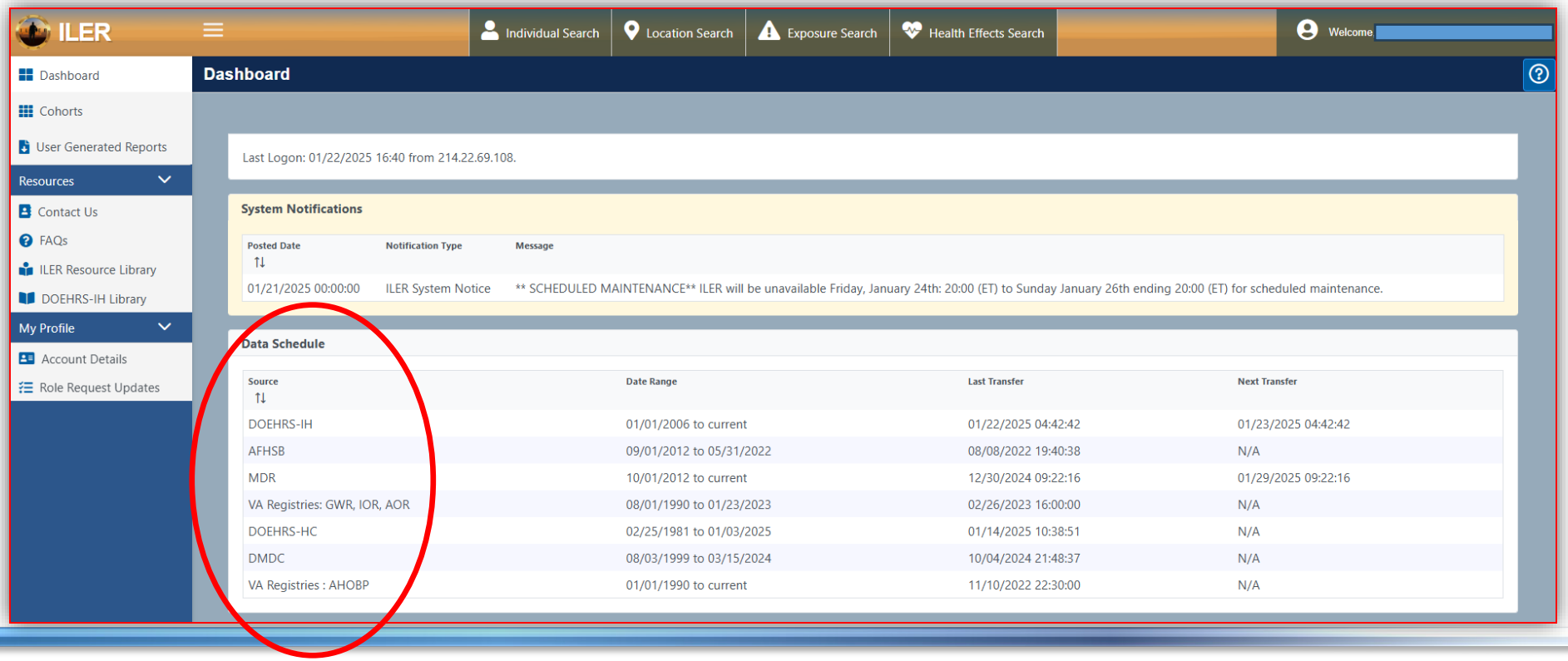
Workplace: 123A - Capsule Crew Members (91 MISSILE WG FFDW20, ND)

Risk Category: 2 - Medium Risk

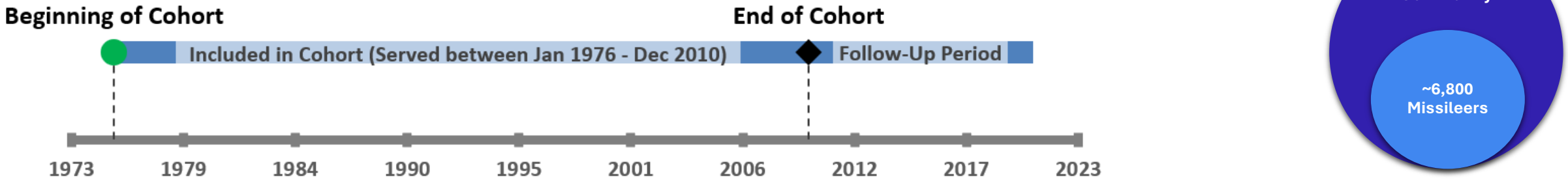
Workplace Description	# of Personnel
The Missile Alert Facilities (MAFs) provide housing for Facility Managers (FMs), Missileers, Chefs, Security Forces, and Maintenance personnel that may be required to rest overnight. MAFs also house Launch Control Centers (LCCs) manned by Missileers 24/7/365. Personnel are at a MAF approximately seven days at a time. This can change due to the following: 1) weather/road conditions that prevent oncoming Missileers from driving out to a MAF. 2) health issues affecting crew members. Two missileers split a 24-hour shift in the LCC. They monitor control of up to 55 Intercontinental Ballistic Missiles (ICBMs) and maintain nuclear surety. Missileers' constant vigilance and readiness allows them to launch ICBMs at the Presidents direction. Missileers coordinate with Maintainers to accomplish required troubleshooting and inspections, and they coordinate with Security Forces for potential security breaches. *Polychlorinated biphenyl (PCB) – Panels and electromagnetic boxes containing PCBs are properly labeled. If access to PCB contained materials is required, personnel should utilize nitrile, neoprene, teflon, vito, saranex, barricade or butyl rubber gloves. Personnel should doff and discard gloves immediately following task and wash hands prior to eating, drinking or smoking. From air sampling results, PCBs do not pose a significant inhalation health hazard under normal conditions.	242

ILER – Hazard Documentation

- **Individual Longitudinal Exposure Record (ILER)**
  - Individual data - will reflect hazards/exposures associated with your current / previous work centers
  - Location-based data - hazards listed by base, not yet linked to individuals for CONUS
  - The ILER Technical Working Group is working with SMEs to connect individuals to locations
  - Expanding access for Service members & Veterans with CAC access in 2025



Epidemiology Review



2001-2020 — **DoD Electronic Medical Record** — **Phase 1A**
Includes persons diagnosed with cancer utilizing the military healthcare system/Tricare

1991-2020 — **VA Electronic Medical Record** — **Phase 1B**
Includes persons diagnosed with cancer in the VA healthcare system

1986-2020 — **DoD Cancer Registry** — **Phase 1B**
Includes persons diagnosed with cancer in the military healthcare system and reported to cancer registry

1976-2020 — **VA Cancer Registry** — **Phase 1B**
Includes persons diagnosed with cancer in the VA healthcare system and reported to cancer registry

1979-2020 — **National Death Index** — **Phase 1C**
Includes persons who have died and had death reported on death certificate

Various Dates — **Virtual Pooled Registry** — **Phase 2**
Includes persons diagnosed with cancer in a state or U.S. territory with a participating cancer registry

Basics of Epi Statistics

- **Internal Comparison (MC vs non-MC):** Used Mortality Rate Ratios (MRR).
  - We *can* directly compare cancer mortality rates in the MC to the non-MC.
    - Counted the number of cancer deaths for each type of cancer in MC and non-MC.
    - Calculated the amount of person-time contributed.
- **External Comparison (MC vs U.S. population)**: Used Standardized Mortality Ratios (SMR).
  - We *cannot* directly calculate mortality rates for the U.S. population, so MRR is not an appropriate statistic to use.
    - Counted the number of cancer deaths in MC.
    - Used deidentified U.S. data from the National Cancer Institute's Surveillance, Epidemiology, and End Results Program (SEER).
    - SEER gives age, race, and sex specific cancer mortality rates for each year.
      - E.g., white females aged 20-24 years in 2001.
      - Multiply U.S. SEER rate for each age, race, and sex demographic by the amount of person-time contributed by that demographic in the MC to get expected MC cancer deaths for that demographic for that year.
      - Repeat for each demographic slice of the MC for each year and add all slices (90 demographic combination slices per year) together to get total expected # of cancer deaths for each cancer type in the MC.

Missile Community (MC)

Non-Missile Community (non-MC)

Person-time is a measurement that estimates the total time that participants are at risk of developing a disease or dying.

$$\textbf{Mortality Rate Ratio (MRR)} = \frac{Mortality\ Rate\ of\ Cancer\ in\ MC}{Mortality\ Rate\ of\ Cancer\ in\ non-MC}$$

$$= \frac{\frac{Number\ of\ Cancer\ Deaths\ in\ MC}{Person-Years}}{\frac{Number\ of\ Cancer\ Deaths\ in\ non-MC}{Person-Years}}$$

$$\textbf{Standardized Mortality Ratio (SMR)} = \frac{Observed\ \#\ of\ Cancer\ Deaths\ in\ MC}{Expected\ \#\ of\ Cancer\ Deaths}$$

Basics of Epi Statistics (cont.)

MRR: Mortality Rate Ratio

SMR: Standardized Mortality Ratio

- Both MRR and SMR comparisons are interpreted similarly.
  - MRR or SMR < 1 means that the mortality rate is lower in the MC compared to the non-MC (or U.S. population).
  - MRR or SMR = 1 means that mortality rate is the same in the MC and non-MC (or U.S. population).
  - MRR or SMR > 1 means that mortality rate is higher in the MC compared to the non-MC (or U.S. population).
- 95% confidence intervals and p-values are used to determine statistical significance.
- Statistical significance tells us if our findings are likely to be true and not just a coincidence.

If the lower and upper confidence intervals…	And the p-value is:	Then this means…
are < 1	<0.05	the mortality rate is **lower** in the MC compared to the non-MC (or U.S. population), and the result is *statistically significant.*
are >1	<0.05	the mortality rate is **higher** in the MC compared to the non-MC (or U.S. population), and the result is *statistically significant.*
include 1	>0.05	the result is not statistically significant; the mortality rates are *statistically similar* in both groups.

Phase 1C Results

National Death Index (from the Defense Suicide Prevention Office)

- There were a total of 37,100 cancer deaths in the DAF cohort overall from 1979-2020.
  - 1,145 cancer deaths in the MC.
  - 35,955 cancer deaths in the non-MC.
- Lung and bronchus cancer deaths were the most common cause of cancer deaths among both the MC and non-MC.
- Colon and rectum cancer deaths were the second most common cause of cancer deaths in both cohorts.
- Pancreatic cancer deaths were the third most common cause of cancer deaths in both cohorts.

Table 3. Cancer deaths [count (column %)] by cancer type and exposure status (missile community versus non-missile community) from 1 January 1979 – 31 December 2020

	Missile Community (N=64,930)	Non-missile Community (N=1,757,254)	Total
Total Cancer Deaths	1,145 (1.76%)	35,955 (2.05%)	37,100
Breast (Male and Female)	17 (1.48%)	1,110 (3.09%)	1,127 (3.04%)
Colon and Rectum	165 (14.41%)	4,680 (13.02%)	4,845 (13.06%)
Hodgkin Lymphoma	9 (0.79%)	222 (0.62%)	231 (0.62%)
Kidney and Renal Pelvis	61 (5.33%)	1707 (4.75%)	1768 (4.77%)
Leukemia	85 (7.42%)	2,294 (6.38%)	2,379 (6.41%)
Lung and Bronchus	413 (36.07%)	14,161 (39.39%)	14,574 (39.28%)
Melanoma of the Skin	69 (6.03%)	1,446 (4.02%)	1,515 (4.08%)
Non-Hodgkin Lymphoma	66 (5.76%)	2,096 (5.83%)	2,162 (5.83%)
Ovarian	5 (0.44%)	236 (0.66%)	241 (0.65%)
Pancreatic	137 (11.97%)	3,824 (10.64%)	3,961 (10.68%)
Prostate	63 (5.5%)	2,671 (7.43%)	2,734 (7.37%)
Testicular	4 (0.35%)	138 (0.38%)	142 (0.38%)
Thyroid	7 (0.61%)	133 (0.37%)	140 (0.38%)
Urinary Bladder	44 (3.84%)	1,237 (3.44%)	1,281 (3.45%)

Internal Comparison: MC to non-MC

- Deaths from cancer in the MC were compared to the rest of the AD DAF (non-MC).
- Comparisons were adjusted for sex, age, race, and rank.
- Cancer mortality rates were not significantly increased for total cancer or any of the 14 individual cancers in the MC.
  - Compared to the non-MC, the MC had significantly lower cancer mortality rates for lung and bronchus cancer, prostate cancer, and for all cancer types overall.
    - There was no difference in cancer mortality for the other study cancers, i.e., the mortality was statistically similar.
  - Data showed no increased cancer mortality for non-Hodgkin lymphoma in the MC.

Table 6. Cancer deaths, by type, of missile career field compared to non-missile career field* from 1 January 1979 - 31 December 2020 (MRR = Mortality Rate Ratio) (SE = Standard Error)

Cancer Type	MRR	SE	95% CI, lower	95% CI, upper	p-value
All 14 types (Male and Female)	**0.83**	**1.03**	**0.78**	**0.88**	**< 0.001**
All 12 types (Female)	**0.65**	**1.20**	**0.46**	**0.93**	**0.02**
All 13 types (Male)	**0.83**	**1.03**	**0.78**	**0.88**	**< 0.001**
Breast (Male and Female)	0.86	1.28	0.54	1.39	0.55
Breast (Female)	0.66	1.35	0.36	1.19	0.17
Colon and Rectum	0.90	1.08	0.77	1.05	0.18
Hodgkin Lymphoma	1.15	1.41	0.59	2.24	0.68
Kidney and Renal Pelvis	0.89	1.14	0.69	1.15	0.37
Leukemia	0.94	1.12	0.76	1.17	0.57
Lung and Bronchus	**0.74**	**1.05**	**0.67**	**0.82**	**< 0.001**
Melanoma of the Skin	1.20	1.13	0.94	1.53	0.13
Non-Hodgkin Lymphoma	0.80	1.13	0.63	1.02	0.07
Ovarian (Female)	1.37	1.57	0.56	3.33	0.49
Pancreatic	0.93	1.09	0.79	1.11	0.43
Prostate (Male)	**0.67**	**1.14**	**0.52**	**0.86**	**< 0.001**
Testicular (Male)	1.69	1.47	0.79	3.61	0.18
Thyroid	0.75	1.66	0.28	2.03	0.57
Urinary Bladder	0.93	1.17	0.69	1.26	0.64

* Multiple Poisson regression adjusted for age, race, sex, and rank.
** Bolded text indicates significant at alpha level 0.05.

External Comparison: MC to U.S. population

- Cancer mortality in MC was compared to the general U.S. population using SMRs.
- Cancer mortality rates were not significantly increased for cancer overall or any of the 14 individual cancers in the MC.
  - Compared to the general U.S. population, the MC had significantly lower cancer mortality for colon and rectum cancer, lung and bronchus cancer, non-Hodgkin lymphoma, prostate cancer, and for all cancer types overall.
  - There was no difference in cancer mortality for the other study cancers, i.e., the mortality was statistically similar.

Table 5. Standardized Mortality Ratios (SMRs) by cancer type among the missile community, compared to U.S. civilians using SEER Research database from 1 January 1979 – 31 December 2020

Cancer Type	Observed Deaths	Expected Deaths	SMR	95% CI Lower	95% CI Upper	p-value
All 14 types	**1145**	**1460**	**0.78**	**0.74**	**0.83**	**<0.001**
Male and Female Breast	17	17	1.01	0.59	1.62	1.02
Colon and Rectum	**165**	**209**	**0.79**	**0.67**	**0.92**	**<0.001**
Hodgkin Lymphoma	9	12	0.77	0.35	1.47	0.55
Kidney and Renal Pelvis	61	70	0.87	0.67	1.12	0.31
Leukemia	85	88	0.96	0.77	1.19	0.78
Lung and Bronchus	**413**	**611**	**0.68**	**0.61**	**0.74**	**<0.001**
Melanoma of the Skin	69	55	1.25	0.97	1.58	0.08
Non-Hodgkin Lymphoma	**66**	**86**	**0.77**	**0.59**	**0.98**	**0.03**
Ovarian	5	3	1.48	0.48	3.46	0.50
Pancreatic	137	151	0.91	0.76	1.07	0.28
Prostate	**63**	**96**	**0.65**	**0.50**	**0.84**	**<0.001**
Testicular	7	8	0.86	0.35	1.77	0.86
Thyroid	4	6	0.68	0.19	1.75	0.61
Urinary Bladder	44	48	0.92	0.67	1.24	0.66

* Bolded text indicates significant at alpha level 0.05.

Way Forward

- **Environmental Sampling Complete**
  - Collaborating with National Institute for Occupational Safety and Health on the comprehensive health risk assessment; projected completion Spring 2025
- **Continue Epidemiology Review**
  - For Phase 1C, the MCCS Team collaborated with experts from University of Cincinnati and Wright State University
  - Phase 2 – continuing to receive data from civilian cancer registries through the Virtual Pooled Registry; projected completion Dec 2025
- **Stakeholder Engagement**
  - Continuing to pass along study updates to Veterans Affairs (VA)
  - VA Coordination - Military Environmental Exposure Sub-Council
  - Congressional updates
  - For more information on expanded VA coverage

The PACT Act And Your VA Benefits | Veterans Affairs

- **Website for public information/questions: Missile Community Cancer Study (af.mil)**