Navy and Marine Corps Public Health Center

Appendix H
NMCPHC Preliminary Public Health Screening Risk Assessment Report for Camp Justice

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Executive Summary

On 23 July 2015, in response to a hotline complaint received by the Department of Defense (DoD) Inspector General (IG), the Navy and Marine Corps Public Health Center (NMCPHC) was asked by Commander Navy Region Southeast (CNRSE) to conduct a Public Health Review (PHR) of the DoD Office of Military Commissions (OMC) buildings located on Camp Justice at Naval Station (NS) Guantanamo Bay (GTMO). The hotline complaint alleged that since 2004, military and civilian members working for OMC have been exposed to carcinogens in an area surrounding the Commissions' trailers, tents, offices and courtrooms.

On August 4-8 2015, NMPCHC sent a team of public health experts to NS GTMO to conduct a preliminary investigation, which included an industrial hygiene and habitability survey of the OMC buildings, tents, and trailers at Camp Justice. Based on a review of available documents and the walk-through survey, it was determined in the NMCPHC preliminary report that the buildings, tents, and trailers where people live and work were habitable for occupancy. Although the buildings of concern were deemed habitable, environmental records for Camp Justice were limited. For example, an environmental site assessment which might have included environmental sampling (e.g., air, soil, drinking water, groundwater, etc.) had not been conducted, as would have been required under existing DoD policies.

Additionally, there was limited historical information regarding former operations that occurred onsite (e.g., hangar, maintenance, flight line activities, etc.) and/or potential spills or releases to the environment (e.g., locations of fuel tanks, use, storage, and disposal of solvents from work processes, etc.). Consequently, there was insufficient evidence available to address the potential environmental exposures to carcinogens that were alleged in the complaint.

NMCPHC identified environmental data gaps and recommended additional environmental sampling be performed at Camp Justice to assess health risks. Once complete, this will allow completion of the epidemiological investigation. Both steps are necessary to appropriately address the DoD IG complaint.

Following completion of the NMCPHC preliminary report, CNRSE (with Resolution Consultants) and NMCPHC (with Pioneer Technologies) conducted a site visit 25-29 September 2015 to GTMO to develop an environmental investigation plan. Subsequent to this site visit, CNRSE (with Resolution Consultants) conducted a Phase 1 environmental assessment 11-14 October 2015 which included the collection and analysis of indoor air, water and soil samples, and the development of several other environmental reports that are addressed in this document.

The purpose of this preliminary screening risk assessment is to determine any risk management actions that may need to be taken, at this time, to protect human health. This report compares sampling data from the CNRSE Phase 1 environmental assessment, for individual chemicals of concern (COCs) in environmental soil and indoor air, to their respective health protective U.S. Environmental Protection Agency (EPA) screening levels (SLs), adjusted to reflect site-specific exposures at Camp Justice. Screening levels were developed for four different site-specific exposure durations (e.g., a 9-month active-duty military worker who lives and/or works at Camp Justice). Drinking water results were compared to EPA Maximum Contaminant Levels (MCLs) used to regulate drinking water, as required in the U.S. by the Safe Drinking Water Act. Indoor air results were also compared to Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) which are regulatory standards for employee occupational exposures in the workplace.

The vast majority of COC concentrations detected at Camp Justice were less than their respective SLs. Mercury and formaldehyde in indoor air, and arsenic and benzo(a)pyrene in soil are of potential concern based on their concentrations and/or frequency of detection. Air concentrations of formaldehyde and mercury, in air, are below their respective OSHA PELs for employee occupational exposure in the workplace. However, this one on one comparison of COCs, with OSHA PELs, does not take into consideration risks related to multiple constituents and pathways of exposure. The future health risk assessment, to be conducted upon receipt of all data, will consider exposure to the multiple COCs and pathways.

This preliminary screening risk assessment report identifies the following recommendations and/or risk management actions:

1. Formaldehyde in Indoor Air (modular structures) - A heating, ventilation, and air conditioning (HVAC) consultant should evaluate the capacity of the existing air handling equipment to provide additional ambient air flow while maintaining acceptable temperature and humidity levels under maximal expected loads. In the future, recommend replacement or purchase of new modular buildings constructed with no, or low emission formaldehyde containing materials.
2. Mercury in Indoor Air (Building AV29) - Screening data indicate that mercury concentrations for indoor air exceeded SLs. However, these data are not representative of, and are anticipated to be, much greater than actual occupational exposure concentrations in the breathing zone. Recommend indoor sampling for mercury using National Institute of Occupational Safety and Health (NIOSH) Method 6009 (Modified per SOP 1827), to determine if mercury in the breathing zone is of concern. This will also inform the need for any further risk management actions.

3. Arsenic in Soil - Soil data indicate that there are locations throughout Camp Justice with arsenic concentrations that exceed SLs. However, arsenic concentrations in soil can be naturally occurring and/or can be enriched by human activities (e.g., applying arsenic-based herbicides/pesticides). Recommend analyzing background samples for arsenic to determine what the naturally occurring concentrations of arsenic in soil are proximate to Camp Justice. This will also inform the need for any further risk management actions.
4. Benzo(a)pyrene in Soil - The highest concentrations of benzo(a)pyrene were detected in soil adjacent to Building AV34, suggesting that there may have been a release (e.g., petroleum products) proximate to this building. Recommend performing additional site reconnaissance, at this building, to determine if additional soil samples should be collected, which will inform the need for any further risk management actions.

CNRSE and NMCPHC will continue to develop the work plan for conducting sampling and analysis of the air curtain incinerator emissions that will subsequently be used in the performance of the final health risk assessment. The overall aim of the work plan is to characterize potential exposures from these incinerators which are proximate to, but not on, Camp Justice. A site visit to conduct this sampling phase is scheduled for mid-April.

In summary, at this time the potential cancer risk and non-cancer health effects associated with Camp Justice and any final conclusions (and resulting risk management actions) cannot be determined. The final cumulative cancer risks and/or non-cancer hazard indices for all COCs, taking into consideration the applicable exposure scenarios at Camp Justice, will be calculated upon receipt of all data, including the air emissions data from sampling the air curtain incinerators. Completion of the final epidemiological review will occur once the final health risk assessment is developed to determine if completed exposure pathways exist, and if exposure levels and temporality are consistent with specific cancer latency periods and outcomes.

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Section 1 – Background/Purpose

NOTE: This is a preliminary health assessment and does not include all data and exposure pathways. Therefore, the risks presented in this document are preliminary only and will be updated/revised upon the collection, analysis and evaluation of additional data, including the air curtain incinerator data.

In response to a hotline complaint received by the Department of Defense (DoD) Inspector General (IG), the Navy and Marine Corps Public Health Center (NMCPHC) was asked by Commander Navy Region Southeast (CNRSE) to conduct a Public Health Review (PHR) of the DoD Office of Military Commissions' (OMC) buildings located on Camp Justice at Naval Station (NS) Guantanamo Bay (GTMO). The hotline complaint alleged that since 2004, military and civilian members working for OMC have been exposed to carcinogens in an area surrounding the Commissions' trailers, tents, offices and courtrooms.

This preliminary assessment is limited to the comparison of individual screening concentrations of chemicals of concern (COCs) for the various media sampled (soil, water, indoor air) from the site, with their respective United States Environmental Protection Agency (EPA) screening levels. A final health risk assessment will be conducted to calculate cumulative cancer risks and/or non-cancer hazard indices for all COCs and all exposure pathways upon receipt and evaluation of additional data to be collected, including the air curtain incinerator data. The purpose of this preliminary assessment is to determine any risk management actions that may need to be taken, at this time, to protect human health.

Section 2 – Actions to Date

4-8 August 2015: Initial NMCPHC Site Visit

NMCPHC public health experts conducted an onsite preliminary investigation to include an industrial hygiene and habitability walk-through survey of the OMC buildings, tents, and trailers at Camp Justice[1]. Based on a review of available documents and the walk-through, the report concluded that the buildings, tents, and trailers where people live and work are habitable for occupancy. Most of the worksites were administrative in nature and were low hazard with little potential for overexposures to current occupational health standards. Therefore, based on these industrial hygiene findings, none of the OMC personnel working in these buildings of concern are required to be enrolled in occupational medical surveillance or require occupational certification examinations.

The report also noted that environmental records and historical information for on-site operations are limited. For example, an environmental site assessment and monitoring which might have included testing of the air, soil, drinking water, groundwater, etc. has not been conducted as would have been required under existing policy[2,3,4]. Consequently, the report identified environmental data gaps and additional sampling to appropriately address potential environmental exposures to carcinogens, alleged in the DoD IG complaint, which then also allows the epidemiological investigation to be completed.

25-29 September 2015: CNRSE & NMCPHC Site Scoping Visit

CNRSE (with Resolution Consultants) and NMCPHC (with Pioneer Technologies) conducted limited indoor air quality sampling and developed a sampling/work plan for the follow-on environmental sampling phases of the investigation.[5] These visit reports recommended (1) sampling for asbestos and review of the Camp Justice Asbestos Operations and Maintenance Plan and (2) six different actions to address heating, ventilation and air conditioning (HVAC), and moisture issues in AV29 and AV34[5,6].

11-14 October CNRSE: Environmental Sampling Site Visit

CNRSE (with Resolution Consultants) conducted Phase 1 environmental sampling[5]. This sampling report provides the sampling approach and results of sampling conducted at Camp Justice for air, drinking water, paint chips, ionizing radiation and soil. This visit also produced another report that presents an environmental condition of property and environmental baseline survey to assist in determining if there are completed onsite or offsite pathways of exposure for chemicals of concern that could be related to past industrial chemical usage, storage, or disposal practices at Camp Justice[7]. While this report concluded, "Based on

historical and environmental information reviewed for this Overseas Baseline Environmental Assessment (OBEA), the environmental conditions identified appear acceptable under the current and reasonably anticipated future land uses at Camp Justice," it specifically pointed out the limitations of obtaining environmental data through site reconnaissance, records reviews and interviews.

Current Activities

CNRSE and NMCPHC continue to develop the work plan for conducting sampling and analysis of the air curtain incinerators that will subsequently be used in the performance of the final health risk assessment. The overall aim of the work plan is to characterize potential exposures from these incinerators which are proximate to, but not on, Camp Justice. A site visit to conduct this sampling phase is scheduled for mid-April 2016.

Section 3 – Preliminary Risk Assessment Screening Approach

The environmental sampling data collected was used to perform the preliminary risk screening assessment[5]. This assessment compares sampling data for individual COCs in environmental media (soil, water, air) to their respective EPA screening level (SL), adjusted to reflect site-specific exposures. These generic SLs are generally considered by the EPA to be protective of human health. Concentrations of chemicals in soil, tap water and indoor air that exceed these levels require additional evaluation. In all cases, inputs and assumptions for the risk calculations were selected to ensure a health-protective assessment that does not underestimate the risks. This screening approach and standards used is further discussed in Appendix A.

The average and maximum detected concentrations for each COC, in a given media (soil, water, air), was compared to its respective SL. In addition, the frequency at which the detected chemical concentrations exceeded their respective SLs (i.e., frequency of exceedance) was calculated to indicate how common/widespread exceedances of the SLs are for each type of sample (soil, water, air). The purpose of this preliminary screening risk assessment is to determine any risk management actions that may need to be taken as a result of individually screening site concentrations of COCs for the various media sampled (soil, water, air) with their respective SLs. Upon receipt and evaluation of all data, to include the air curtain incinerator data, a final health risk assessment will be conducted to calculate cumulative cancer risks and/or non-cancer hazard indices for all COCs and all exposure pathways.

Preliminary Conceptual Site Exposures Model

A preliminary conceptual site exposure model (CSEM) identifies the different types of populations (e.g., residents, workers, etc.) who might come into contact with contaminated media and the different exposure scenarios for them. It also identifies potential exposure pathways (e.g., ingestion of contaminated water, inhalation of chemicals in air, dermal contact with contaminated soil) that may occur for each population. Within risk assessment methodology, exposure is characterized by exposure duration (years), exposure frequency (days per year), and exposure time (hours each day).

There are different exposure scenarios for different types of workers (e.g., Joint Task Force (JTF) vs OMC) at Camp Justice. Some individuals may be assigned to JTF GTMO or Camp Justice for a 9-month time period (e.g., JTF GTMO reservists, OMC personnel). Some are permanent (typically for 1 year or more) while some individuals are transient and only periodically work at Camp Justice over a certain period of time such as when trials are in session. The CSEM is used to plan the risk assessment and associated data collection activities and is periodically revised

as data become available at a site. Additional data to complete the CSEM is currently being developed. That additional information will be used in the conduct of the final health risk assessment.

Camp Justice was established between 2007 and 2008; consequently, the maximum exposure duration for OMC staff members would not be more than 9 years to date[1]. From 2008 to the present, the number of personnel supporting the OMC has varied from 4 to 20 staff members who are considered permanent party working in AV29 or AV34. Specific exposure information for the various populations at Camp Justice will be addressed in the final health risk assessment to be conducted following the collection, analysis and evaluation of all sampling data. To simplify this preliminary screening risk assessment, four exposure scenarios were evaluated:

- 9-month active-duty military worker (who lives and/or works at Camp Justice) – A 9-month exposure duration, at a frequency of 270 days per year, was assumed because it represents the JTF and OMC typical tour length at GTMO.
- 3-year active-duty military worker (who only works at Camp Justice) – A 3-year exposure duration, at a frequency of 250 days per year, was assumed because it represents the Navy's typical (escorted) tour length at a duty station.
- 6-year active-duty military worker (who only works at Camp Justice) – A 6-year exposure duration, at a frequency of 250 days per year, was assumed because it represents the Navy's maximum escorted tour length at a duty station.
- 25-year commercial worker (who only works at Camp Justice) – A 25-year exposure duration, at a frequency of 250 days per year, for a commercial worker was assumed using EPA default exposure parameters.

Indoor air, soil, and drinking water risk-based SLs were developed, for these four exposure scenarios, as discussed below.

Indoor Air

Indoor air SLs were calculated for exposure via inhalation in Hangar AV32, Bunker AV31, Buildings AV29 and AV34, select tents, and various modular structures inside the expeditionary legal complex (ELC; see Figure 1). EPA's methodology (default exposure parameters and toxicological hierarchy) were used for all exposure scenarios. A target cancer risk of 1E-06 and hazard index of 1 was used to develop individual COC specific SLs. Indoor Air SLs are presented in Table 1.

Soil

Soil SLs were calculated for surficial soil exposure via incidental ingestion, inhalation, and dermal contact throughout the Camp. The EPA's default exposure parameters and EPA's

toxicological hierarchy were used for all exposure scenarios. A target cancer risk of 1E-06 and hazard index of 1 was used to develop individual COC specific SLs. Soil SLs are presented in Table 2.

Drinking Water

NS GTMO is divided into two distinct areas by Guantanamo Bay; the airfield on the Leeward side and the main base on the Windward side. Both areas are served by a single water treatment and distribution system receiving finished water from the Windward Desalination Water Treatment Plant (WTP). The drinking water delivered to NS GTMO from this WTP is considered fit for human consumption (FFHC)[8]. A Navy overseas drinking water system is approved as FFHC if it meets the required primary drinking water standards which are the health based EPA Maximum Contaminant Levels (MCLs) as defined in host nation Final Governing Standards (FGS), and CNICINST 5090.1 (U.S. Drinking Water Quality Standards for U.S. Navy Installations – 4 Feb 2013).

The water supplied to Camp Justice, ELC and OMC buildings is received from the WTP that supplies the rest of NS GTMO. Water is delivered to and distributed throughout Camp Justice using the following methods (based on end use):

- Hard plumbing connections directly from water mains (e.g., at Building AV29, Building AV34, and Hangar AV32).
- Hard plumbing connections connected to drinking water risers/hydrants.
- Flexible hoses connected directly to drinking water risers/hydrants.

All drinking water risers are installed and maintained by NS GTMO Public Works Department (PWD) personnel and Base Operations and Support (BOS) contractors. Bladders for the tent latrine units are filled with water from the distribution system then isolated using backflow prevention. Once a bladder (typically 500-gallon capacity) is filled, the water is used in the tent latrine units only to flush the commodes and supply the hand wash stations. Their function is to ensure the two containment boxes, which hold 360 gallons each, do not overfill and create a raw sewage overflow or spillage situation. Camp Justice is supplied with three backflow devices that are part of BOS contractor assets and there are no test records or data to support testing, repair, or operation[1].

The water system post water risers/hydrants, at the Camp, is maintained by the United States Air Force (USAF) Base Engineer Emergency Force (BEEF). The water at Camp Justice and ECL has been characterized as not fit for human consumption (NFFHC) due to routinely low disinfectant (chlorine) residuals at the taps. Because of this, the Camp is on bottled water for ingestion/cooking purposes. Note, this NFFHC water continues to be used for showering and laundry. Drinking water SLs are presented in Table 3.

Section 4 – Screening and Results

Indoor Air

Indoor air exceedances are presented in Table 1. The results are summarized below:

Mercury

Indoor air at Building AV29 was sampled for mercury because this building was historically identified to contain a dental clinic. As a result, the potential exists for mercury (which was historically used in amalgam fillings) to have been released at this location. Mercury exceeded the SL for a 25-year commercial worker in 29 of 108 samples; it exceeded the SL for a 6-year active duty military worker in 19 of 108 samples; it exceeded the SL for a 3-year active duty military worker in 19 of 108 samples; and it exceeded the SL for a 9-month active duty military worker in 29 of 108 samples. Mercury detection levels ranged from below detection level of the instrument to 6 ug/m^3. The majority of the exceedances were located on the first floor of the building. However, all mercury concentrations were less than the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL)* of 100 ug/m^3.

Formaldehyde

Indoor air was sampled since it has been an issue in modular homes, as it is frequently found in plywood, fiberboard, insulation, resins, glues and other building materials. Formaldehyde exceeded the SL for a 25-year commercial worker in 28 of 28 samples; it exceeded the SL for a 6-year active duty military worker in 28 of 28 samples; it exceeded the SL for a 3-year active duty military worker in 19 of 28 samples; and it exceeded the SL for a 9-month active duty military worker in 20 of 28 samples. All formaldehyde concentrations were less than the OSHA PEL of 925 ug/m^3. The average and maximum detected concentrations of formaldehyde in indoor air was 19 ug/m^3 (15.4 ppb) and 75 ug/m^3 (61 ppb), respectively. These formaldehyde concentrations exceed EPA SLs; however, they are within the range of concentrations considered "Low" to "Mid" as defined by the Center for Disease Control and Prevention [CDC]) for typical concentrations observed in manufactured homes[9].

In one study conducted by the EPA, the National Human Exposure Assessment Survey (NHEXAS) found 189 Arizona homes had a median formaldehyde level of 17 ppb with a high of 332 ppb[10].

*The PEL is a legal limit in the United States for exposure of an employee to a chemical substance or physical agent such as loud noise. A PEL is a time weighted average (TWA), although some are short term exposure limits (STEL) or ceiling limits. A TWA is the average exposure over a specified period of time, usually a nominal 8 hours. This means that, for limited periods, a worker may be exposed to concentration excursions higher than the PEL, so long as the TWA is not exceeded and any applicable excursion limit is not exceeded.

A more recent study of 184 single family homes in several different cities found a mean concentration of formaldehyde in outdoor ambient air of 3 ppb and in housing of 17 ppb[11]. That same study found a mean level of formaldehyde for mobile homes or trailers ranging from 15.5 to 24.7 ppb.

These studies show a trend in that while all homes have some level of formaldehyde, formaldehyde levels in general seem to be decreasing since the early 1980's. Another trend is that traditional stand-alone homes tend to have lower levels than do manufactured homes. Lower ventilation rates in manufactured homes, due to construction differences, may play a role in this trend[11].

Bromodichloromethane

Bromodichloromethane (BDCM) and chloroform exceeded their respective SLs for only the 25-year commercial worker (in two of 32 samples). These exceedances were from samples collected in two showers (S1 and S3). The average and maximum concentrations of BDCM were 0.24 and 0.64 ug/m^3, respectively. The average and maximum concentrations of chloroform were 0.16 and 1.5 ug/m^3, respectively. There are no OSHA PELs for BDCM or chloroform. There is an OSHA 15 minute ceiling limit of 240,000 ug/m^3 for chloroform. Chloroform and BDCM are two compounds that are formed when water is disinfected with chlorine.

Benzene

Benzene exceeded the SL for only the 6-year commercial worker (in one of 32 samples). The average and maximum concentrations of benzene were 0.48 ug/m^3 (0.015 ppb) and 3.6 ug/m^3 (1.125 ppb), respectively. The benzene concentration was less than the OSHA PEL of 3200 ug/m^3. According to the Agency for Toxic Substances and Disease Registry (ATSDR), benzene has been identified in outdoor air samples of both rural and urban environments and (1) was found to range from 0.8 to 6 ppb in the ambient air of 44 sites in 39 cities during a 3 month time period in 1984, 1985 and 1986 and (2) was found to range from >1 to <5 ppb for 13 sites tested in a 1996 study[12]. The maximum concentration of benzene in air is consistent with urban ambient air background concentrations.

Soil

Exceedances for COCs in soil are presented in Table 2. The results are summarized below:

- Arsenic, benzo(a)pyrene, and chlordecone, exceeded their SLs, as follows: Arsenic exceeded the SL for a 25-year commercial worker in 21 of the 60 samples, and it exceeded the SL for a 6-year active duty military worker in one of 60 samples (See note below).

- Benzo(a)pyrene exceeded the SL for a 25-year commercial worker in 11 of 60 samples, and it exceeded the SL for a 6-year active duty military worker in two of 60 samples.
- Chlordecone exceeded the SLs for a 25-year commercial worker, a 6-year active duty military worker, and a 3-year active duty military worker in one of 60 samples.
- Dibenz(a,h)anthracene exceeded the SL for a 25-year commercial worker in two of 60 samples.
- Benz(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, 2,6-Dinitrotoluene, DDE, and dieldrin exceeded the SL for a 25-year commercial worker in one of 60 samples.
- 2,6-Dinitrotoluene, DDE, and dieldrin exceeded the SL for a 25-year commercial worker in one of 60 samples.

Note: Arsenic is a naturally occurring element that is often present in soil. Background soil samples were collected and their analysis is pending. These samples will assist in determining arsenic risks associated with naturally occurring arsenic versus those that may be associated with arsenic related to anthropogenic (man-made) activities. This analysis will assist risk managers in determining whether concentrations of arsenic in soil are site related and warrant risk management actions.

Polychlorinated Biphenyls

Polychlorinated Biphenyls (PCBs) transformers were identified in a vault inside Hangar AV32 and outside AV32[7]. The report addresses historical drawings that show transformer vault rooms near the center of the first floor, adjoining stairwells, on the east and west sides of Hangar AV32[7]. A 1942 plan, labeled soil and water supply lines, shows a 4-inch soil line in one (north, outside) corner of each vault that presumably contained electrical lines that extended outside. Later plans (circa 1962) show a detached transformer vault outside the west exterior wall, and one interior vault (on the west side) labeled a transformer room. Vault transformers 40-809, 40-812, and 40-813 were non-PCB containing, vault transformers 40-811 and 40-814 were PCB-containing, and outside transformers 40-810 and NP214222 were PCB containing[13]. The vault/transformer room was not accessed during the site reconnaissance[5].

This information was not available when the site visit was conducted in September 2015; therefore, PCB sampling was not included in the Phase I sampling conducted in October 2015. The lack of PCB data is a potential data gap for assessing health risks proximate to AV32. Specifically, PCB wipe or soil samples are not available from inside the transformer vault and soil samples are not available proximate to outside transformers 40-810 and NP214222 (which were PCB containing).

Drinking Water

Drinking water exceedances are presented in Table 3. Only one constituent, Total Trihalomethanes (TTHM), collected from the ELC portable male latrine, exceeded its MCL in one of 18 samples (the maximum detected concentration of THHM was 81 ug/L and the MCL is 80 ug/L)[5]. This is a disinfection by-product and may be a result of the way water is managed in the distribution system. For example, the increased water retention times due to pipe and bladder storage and increased temperature due to the surface construction of the distribution system are known factors in disinfection by-product generation. This water is only being used for hand washing and flushing commodes.

Asbestos

The DoD IG complaint alleges that the old commissions' buildings potentially contain asbestos and possibly other carcinogens and the new commissions' building was built on the old runway and could be contaminated. This allegation has been repeated in the news media (e.g., Miami Herald).

Asbestos surveys conducted by NS GTMO PWD Environmental in 2003 and 2004 identified asbestos containing material (ACM) in buildings AV29, AV32 and AV34 at Camp Justice.

Visual inspections of all spaces were conducted by the NMCPHC and CNRSE teams within Camp Justice, and it was determined, in concurrence with NS GTMO PWD Environmental, that the ACM identified is non-friable, and is generally non-hazardous if it is undisturbed[5]. "Management in place" is a permissible response action under current Navy regulations. There was no documentation that identified whether ACM at Camp Justice is assessed annually to ensure it remains in safe condition.

Surveys conducted:

- January 2003 Asbestos and Lead Survey, Bldg. AV29.
- June 2003 Asbestos and Lead Survey, Bldg. AV34.
- September 2004 Asbestos and Lead Survey, Bldg. AV32.

NMCPHC previously identified the following Data Gaps[1]:

- No updated asbestos inspections for Camp Justice.
- No documentation of an Asbestos Operations and Maintenance Plan (O&M) for all existing ACM.

NMCPHC previously recommended:

- NS GTMO to update the current asbestos (and lead) survey and coordinate with the NS GTMO Asbestos Program Manager to either develop or include Camp Justice in the current O&M ACM plan.

Asbestos O&M plans are critical for tracking the status of existing locations of ACM, and for having a work order system in place to prevent contract or maintenance activities from disturbing ACM and subsequently exposing workers and building employees to airborne asbestos. NMCPHC has requested the status of those recommendations from OMC and NS GTMO with no resolution to date. Naval installations are required to have the following:

- An Asbestos O&M plan for all existing ACM[14,15].
- A work order system for maintenance activities in areas with ACM or presumed ACM (PACM).
- Records of asbestos training, maintenance activities, asbestos abatement, and ACM/PACM inspections and periodic assessments.

Typically, the owner of the maintenance Unit Identification Code (UIC) will have the responsibilities as described above. NMCPHC has been told by the NS GTMO Public Works Officer that OMC owns the maintenance UIC for Camp Justice.

Section 5 – Summary

This preliminary screening health risk assessment was prepared for Camp Justice based on indoor air, soil, and drinking water samples collected in October 2015 by Resolution Consultants[5]. Individual chemical average and maximum soil sample results were compared to SLs that were developed for a 9-month active-duty military worker (the typical exposure duration); 3-year active-duty military worker; 6-year active-duty military worker; and a 25-year commercial worker exposure scenario using EPA methodologies and adjusted default exposure parameters. All drinking water results were compared to EPA MCLs. The vast majority of COC concentrations detected at Camp Justice were less than their respective SLs.

Based on the concentrations and the frequency of detection of mercury and formaldehyde in indoor air, and arsenic and benzo(a)pyrene in soil, additional discussion is presented below for these four COCs. The cancer risks for formaldehyde in indoor air, arsenic in soil, and benzo(a)pyrene in soil are within the EPA Risk Management Criteria (i.e., a cancer risk between 1E-06 and 1E-04 [1 in a million and 1 in ten thousand]). Mercury concentrations in indoor air exceed the EPA Risk Management Criteria for non-cancer health effects (i.e., a hazard quotient of one). However, as will be discussed below, these mercury sampling results are not representative of occupational exposure.

Mercury

As was agreed to by the team (CNRSE and NMCPHC), mercury indoor air samples were collected using a portable field screening tool called the Jerome J405 Mercury Vapor Analyzer. Because of AV29's documented history as a dental clinic, floor tile seams and other potential discharge features (e.g. wall pipes) were screened for the presence of residual mercury from mercury amalgam[7]. While screening for the presence of mercury, at floor tile seams and discharge points, provides valuable screening information, it does not provide sufficient information to assess potential exposure (e.g., what is in the ambient air/breathing zone representative of typical occupational exposure). The Jerome J405 instrument's measurement range is 1 to 999 ug/m^3; therefore, the lower end of the instrument range is just below the SL of 1.3 ug/m^3. Consequently, there is some uncertainty associated with non-detected results reported as zero (0). In summary, while useful, the screening data on mercury is insufficient for assessing health risk. To more accurately characterize mercury air concentrations in AV29, for health risk assessment purposes, additional mercury sampling should be conducted.

Formaldehyde

Formaldehyde indoor air samples were collected per EPA protocols using a sampling cartridge and were analyzed at a fixed-laboratory using EPA Method TO-11A.

All 28 samples collected exceeded the formaldehyde SL for both the 25-year commercial worker and the SL for the 6-year military worker. Nineteen (19) of 28 samples exceeded the SL for the 3-year military worker and 20 of 28 samples exceeded the SL for the 9-month military worker. These exceedances were observed in modular buildings which historically can be expected to exhibit elevated concentrations of formaldehyde in indoor air due to the materials (e.g., urea formaldehyde (UF) insulation) used during construction of the buildings. The concentrations observed in indoor air ranged from 19 to 75 ug/m^3 and, as noted in Section 4, are considered within the CDC's range of "Low" to "Mid" concentrations for formaldehyde in typical manufactured buildings[9].

Based on the results of the screening assessment and the CDC guidance, NMCPHC recommends that:

- An HVAC consultant evaluate the capacity of the existing air handling equipment in the modular units to provide additional ambient air flow while maintaining acceptable temperature and humidity levels under maximal expected loads.
- The ventilation rate complies with the Department of Housing and Urban Development (HUD) requirement of 35 percent air changes per hour (0.35 air changes per hour) for manufactured housing[16].
- Humidity not exceed EPA limits of 60%.
- Temperature not exceed 72 degrees Fahrenheit.
- In the future, recommend replacement or purchase of new modular buildings constructed with no, or low emission formaldehyde containing materials:
    - Furniture, wood cabinetry, or flooring made without UF glues.
    - Pressed-wood products that meet ultra-low emitting formaldehyde (ULEF) or no added formaldehyde (NAF) requirements.
    - Products labeled "No VOC/Low VOC" (volatile organic compound).
    - Insulation that does not have UF foam.

In the event that existing air conditioning equipment is found to be insufficient, the HVAC consultant should identify corrective options. In addition, the rate at which formaldehyde is released is accelerated by heat and may also depend somewhat on the humidity level.

Therefore, the use of a dehumidifier and air conditioning to control or reduce humidity and to maintain a moderate temperature can help reduce formaldehyde emissions (drain and clean dehumidifier collection trays frequently so that they do not become a breeding ground for microorganisms).

The EPA allows no more than 0.016 ppm formaldehyde in the air in new buildings constructed for that agency[17]. An EPA study found a new home measured 0.076 ppm when brand new and 0.045 ppm after 30 days[18]. The Federal Emergency Management Agency (FEMA) has also announced limits on the formaldehyde levels in trailers purchased by that agency[19]. The EPA recommends the use of "exterior-grade" pressed-wood products with phenol instead of urea resin to limit formaldehyde exposure, since pressed-wood products containing formaldehyde resins are often a significant source of formaldehyde in homes[20]. HUD limits the emissions of formaldehyde from plywood and particle board used in the construction of manufactured housing to 0.2 and 0.3 ppm, respectively[21].

Arsenic

Arsenic soil samples were collected per EPA protocols and were analyzed at a fixed-laboratory using EPA Method 6020A. Twenty one (21) of 60 samples exceeded the SL for a 25-year commercial worker, two of 60 samples exceeded the SL for a 6-year active duty military worker, one of 60 samples exceeded the SL for a 3-year active duty military worker, and one of 60 samples exceeded the SL for a 9-month active duty military worker. These exceedances are spatially distributed throughout Camp Justice. Cancer risks for arsenic in soil are within the EPA's Risk Management Criteria. As noted in Section 4, arsenic is a naturally occurring element that is often present in soil. The analysis of background soil samples is pending. Sampling results will assist with assessing the level of arsenic that may be associated with anthropogenic (man-made [e.g., application of arsenic-based herbicides/pesticides]) activities compared to that which is naturally occurring and enable risk managers to determine the need for risk management actions.

Benzo(a)pyrene

Benzo(a)pyrene is one member of a group of chemicals called polycyclic aromatic hydrocarbons (PAHs) that are formed during the incomplete burning of coal, oil, gas, wood, garbage, and other organic substances (e.g., tobacco and charbroiled meat) and a product of biological systems (decaying of plant materials). Since an airfield was previously located at Camp Justice, PAHs were sampled in soil per EPA protocols and were analyzed at a fixed-laboratory using EPA Method 8270D. Eleven (11) of 60 samples exceeded the SL for a 25-year commercial worker, two of 60 samples the SL for a 6-year active duty military worker, one of 60 samples exceeded the SL for a 3-year active duty military worker, and one of 60 samples exceeded the SL for a 9-

month active duty military worker. While these exceedances are primarily located in the vicinity of the runways/taxiways associated with the former air field, two exceedances were proximate to building AV34. Air field benzo(a)pyrene concentrations ranged from 0.36 to 0.92 mg/kg and the two samples proximate to AV34 were 1.8 and 8.6 mg/kg. The cancer risks for benzo(a)pyrene in soil, at all locations, are within the EPA's Risk Management Criteria. Although there is no documentation available for spill events, the exceedances observed at AV34 may be associated with minor release(s) of petroleum products (e.g., minor spills) to soil. Additional site reconnaissance at AV34 should be conducted to determine the need for additional soil sampling, which will inform the need for any further risk management activities.

Implementation of Environmental and Public Health Programs

Similar to other occupational health and environmental programs (e.g., industrial hygiene, preventive medicine, asbestos, drinking water program, etc.) at Camp Justice, there appears to be uncertainty regarding what exact occupational and environmental standards (and monitoring) apply, "Expeditionary" or "Fixed Naval Installation". Admittedly this is confusing as Camp Justice is Expeditionary; however, it is located on, and surrounded by, a Fixed Naval Installation that already provides some host-tenant services to the Camp. Moving forward, for simplicity, continuity of services and recordkeeping, we recommend NS GTMO provide those occupational health and environmental services as they would for any other tenant command.

Lastly, at this time, the potential cancer risk and non-cancer health effects associated with Camp Justice and any final conclusions (and risk management actions) cannot be determined. The final cumulative cancer risks and/or non-cancer hazard indices for all COCs, taking into consideration the applicable exposure scenarios at Camp Justice, will be calculated upon receipt of all data, including the air emissions data from sampling air curtain incinerators.

Section 6 – Data Gaps

Upon review and evaluation of data collected at Camp Justice and the recent environmental reports, several data gaps were identified[1,5,7]. These data gaps are discussed above and are summarized below.

- Background soil analysis for arsenic.
- Obtaining mercury air sampling in AV29 that is representative of potential occupational exposures to building occupants.
- Sampling for PCBs (wipe or soil) from inside the transformer vault and PCB soil samples proximate to outside transformers 40-810 and NP214222 (which were PCB containing).
- Documented Asbestos O&M Plan for all existing ACM.
- Extent of benzo(a)pyrene in soil adjacent to AV34.

Section 7 – Epidemiological Evaluation

NMCPHC Epidemiological Data Center conducted an initial epidemiological review of each military member working and/or living at Camp Justice from a roster provided by the Commander, Navy Installations Command (CNIC) IG[1]. This review included analyzing all available Military Health System medical encounter records, performing a literature review to determine potential environmental and occupational risk factors for each cancer and identifying critical data gaps (i.e., arrival/departure rosters to assess temporality, an environmental site assessment and occupational health evaluation). Completion of the final epidemiological review will occur once the final health risk assessment is developed to determine if completed exposure pathways exist and if exposure levels and temporality are consistent with specific cancer latency periods and outcomes.

Section 8 – Recommendations

This preliminary screening risk assessment compared individual chemical results to their respective screening values. Recommendations are:

1. OMC and JTF United States Southern Command (SOUTHCOM) provide more granularity on exposure durations for their personnel who work and/or live on Camp Justice for use in the final report so that the report can capture the full range (maximum to minimum of exposure durations).
2. Mercury samples, representative of employee exposure and suitable for human health risk assessment, should be performed in AV29 using appropriate sampling methodologies.
3. In the future, recommend replacement or purchase of new modular buildings constructed with no, or low emission formaldehyde containing materials. An HVAC consultant should evaluate the capacity of the existing air handling equipment in the modular units to provide additional ambient air flow while maintaining acceptable temperature and humidity levels under maximal expected loads.
4. Background analysis should be conducted for soil to determine concentrations of arsenic and other metals that are site-related vice those that are not.
5. Site reconnaissance should be conducted for soil adjacent to AV34 to determine the need to further characterize the extent of benzo(a)pyrene in the soil.
6. PCB wipe and/or soil samples should be collected inside the transformer vault and soil samples should be collected proximate to outside transformers 40-810 and NP 214222.
7. Moving forward, for simplicity, implementation and continuity of services and recordkeeping, recommend NS GTMO, JTF GTMO and OMC discuss having NS GTMO provide those occupational and environmental services as they would for any other tenant command.

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Acronym List

Acronym	Definition
ACM	Asbestos Containing Material
ATSDR	Agency for Toxic Substances & Disease Registry
BEEF	Base Engineer Emergency Force
BDCM	Bromodichloromethane
BOS	Base Operations and Support
CDC	Centers for Disease Control and Prevention
CNIC	Commander, Navy Installations Command
CNRSE	Commander Navy Region Southeast
COC	Chemicals of Concern
CSEM	Conceptual Site Exposure Model
DoD	Department of Defense
ELC	Expeditionary Legal Complex
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FGS	Final Governing Standards
FFHC	Fit for Human Consumption
GTMO	Guantanamo Bay
HI	Hazard Index
HQ	Hazard Quotient
HUD	Department of Housing & Urban Development
HVAC	Heating, Ventilation, & Air Conditioning
IG	Inspector General
JTF	Joint Task Force
MCL	Maximum Contamination Level
NAF	No Added Formaldehyde

NFFHC	Not Fit for Human Consumption
NHEXAS	National Human Exposure Assessment Survey
NIOSH	National Institute of Occupational Health and Safety
NMCPHC	Navy and Marine Corps Public Health Center
NS	Naval Station
O & M	Operations and Maintenance Plan
OBEA	Overseas Baseline Environmental Assessment
OMC	Office of Military Commissions
OSHA	Occupational Safety and Health Administration
PACM	Presumed Asbestos Containing Materials
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PEL	Permissible Exposure Limit
PHR	Public Health Review
PWD	Public Works Department
RIOPA	Relationships of Indoor, Outdoor, & Personal Air
SL	Screening Level
SOUTCOM	United States Southern Command
STEL	Short Term Exposure Limit
TTHM	Total Trihalomethanes
TWA	Time Weighted Average
UF	Urea Formaldehyde
UIC	Unit Identification Code
ULEF	Ultra-Low Emitting Formaldehyde
USAF	United States Air Force
VOC	Volatile Organic Compound
WTP	Water Treatment Plant

Appendix A – Overview of the Phase II Risk Screening Evaluation Approach

Comparison of Environmental Sampling Results to Risk-Based Screening Concentrations

To determine whether or not the sampling results for indoor air, soil, and drinking water are potentially of concern to human health, the sampling results were compared to EPA risk-based SLs adjusted to reflect site-specific exposure scenarios. In addition, drinking water results were compared to EPA MCLs which are regulatory standards. For further context, indoor air results were compared to OSHA PELs which are also regulatory standards.

Comparison of Environmental Sampling Results to EPA Screening Levels

SLs incorporate many conservative assumptions about exposure to be protective of human health, such as being based on a 25-year residential exposure. SLs are calculated based on carcinogenic (i.e., cancer) risks and noncarcinogenic (i.e., non-cancer) health effects. Cancer risk is an estimate of how exposure to a chemical may increase the normal or expected rate of developing cancer in a population of people. The EPA generally evaluates cancer risk as follows:

- **Acceptable Risk –** A cancer risk of 1 x 10–6 (i.e., one person out of 1,000,000 will develop cancer) or less is considered safe (i.e., acceptable).

  Note: The EPA generally also considers the range between one in 10,000 (1 x 10–4) and one in 1,000,000 (1 x 10–6) people as a safe (i.e., acceptable) range, and actions to reduce the risk may or may not be required based on various site-specific factors. The EPA typically considers additional actions to reduce cancer risks that are close to or greater than one in 10,000 (1 x 10–4) people.

- **Unacceptable Risk** – EPA considers an increase of "more than" one additional case of cancer (or greater) in 10,000 (1 x 10–4) people to be of concern (i.e., unacceptable).

Non-cancer health effects are expressed by a number known as the hazard quotient (HQ). The HQ compares the amount of a chemical that people may have been exposed to over a specified time period with the amount that is considered to have no effect (i.e., safe). If people are exposed to an amount greater than that considered safe for a particular chemical, then the ratio will be greater than one. Because people can be exposed to more than one chemical at a time, the HQs for different chemicals are added together to give an overall hazard index (HI), unless data is available to indicate that they should not be added together (e.g., they do not affect the same target organ). EPA policy considers chemical concentrations resulting in an HI above one to be of concern for developing potential non-cancer health effects. Professional

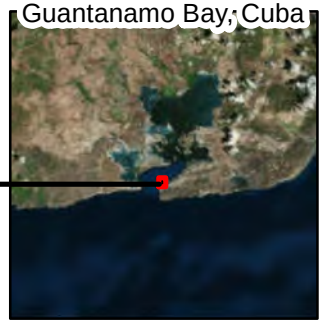
judgment must be used to evaluate the potential non-cancer health effects related to the concentration of these chemicals to determine if risk management actions are required.

Comparison of Environmental Sampling Results to EPA MCLs

MCLs are established by the EPA to set maximum permissible levels of a contaminant in public water supplies under the Safe Drinking Water Act. For private water supplies, MCLs are useful for determining potability (fit for human consumption). MCLs are protective of public health during a lifetime (70 years) for an individual who drinks two liters of water per day.

Comparison of Environmental Sampling Results to OSHA PELs

The PEL is a legal limit in the United States for exposure of an employee to a chemical substance or physical agent such as loud noise. A PEL is a time-weighted average (TWA), although some are short term exposure limits (STEL) or ceiling limits. A TWA is the average exposure over a specified period of time, usually a nominal 8 hours. This means that, for limited periods, a worker may be exposed to concentration excursions higher than the PEL, so long as the TWA is not exceeded and any applicable excursion limit is not exceeded.



Legend

Camp Justice

Notes:
-Boundaries are approximate.

0 100 200 300
Feet

PIONEER TECHNOLOGIES CORPORATION

Site Overview
Preliminary Screening Risk Assessment
Naval Station Guantanamo Bay, Cuba

Figure 1

Table 1: Detected Indoor Air Results Compared to Screening Levels

Analyte	Number of Samples	Frequency of Detection (%)	Average Concentration (ug/m^3)	Maximum Detected Concentration (ug/m^3)	25-Year Commercial Worker				6-Year Active-Duty Military Worker				3-Year Active Duty Military Worker				9-Month Military Worker (Resident)			
					Screening Level (ug/m^3)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)	Screening Level (ug/m^3)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)	Screening Level (ug/m^3)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)	Screening Level (ug/m^3)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)
Inorganics																				
Mercury	108	27	2.8	6.0	**1.31**	**Yes**	**29**	**27**	**1.3**	**Yes**	**19**	**18**	**1.3**	**Yes**	**19**	**18**	**0.30**	**Yes**	**29**	**27**
Semi-Volatile Organic Compounds																				
1,1,2-Trichloro-1,2,2-trifluoroethane	32	100	0.56	0.64	131,400	No	--	--	131,400	No	--	--	131,400	No	--	--	30,000	No	--	--
1,2,4-Trimethylbenzene	32	100	0.22	0.52	30.7	No	--	--	31	No	--	--	31	No	--	--	7.0	No	--	--
1,3,5-Trimethylbenzene	32	6.3	0.16	0.16	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
1,3-Butadiene	32	19	0.076	0.14	0.41	No	--	--	1.7	No	--	--	3.4	No	--	--	2.0	No	--	--
1,4-Dioxane	32	6.3	0.14	0.56	2.5	No	--	--	10	No	--	--	20	No	--	--	19	No	--	--
2,2,4-Trimethylpentane	32	38	0.34	0.44	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Cumene	32	6.3	0.16	0.19	1,752	No	--	--	1,752	No	--	--	1,752	No	--	--	400	No	--	--
Cyclohexane	32	44	0.35	2.5	26,280	No	--	--	26,280	No	--	--	26,280	No	--	--	6,000	No	--	--
Dichlorodifluoromethane	32	100	2.6	3.0	438	No	--	--	438	No	--	--	438	No	--	--	100	No	--	--
Formaldehyde	28	100	19	75	**0.94**	**Yes**	**28**	**100**	**3.9**	**Yes**	**28**	**100**	**7.9**	**Yes**	**19**	**68**	**7.3**	**Yes**	**20**	**71**
Heptane	32	66	0.28	1.2	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Isopropanol	32	75	3.5	26	876	No	--	--	876	No	--	--	876	No	--	--	200	No	--	--
Methyl Isobutyl Ketone	32	50	0.37	3.1	13,140	No	--	--	13,140	No	--	--	13,140	No	--	--	3,000	No	--	--
Methyl tert-Butyl Ether (MTBE)	32	16	0.012	0.023	47	No	--	--	197	No	--	--	393	No	--	--	364	No	--	--
N-Hexane	32	91	0.17	0.41	3,066	No	-	--	3,066	No	--	--	3,066	No	--	--	700	No	--	--
Propyl benzene	32	6.3	0.16	0.13	4,380	No	--	--	4,380	No	--	--	4,380	No	--	--	1,000	No	--	--
Trichlorofluoromethane	32	100	1.4	1.9	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Volatile Organic Compounds																				
1,1,1-Trichloroethane	32	97	0.022	0.14	21,900	No	--	--	21,900	No	--	--	21,900	No	--	--	5,000	No	--	--
1,1-Dichloroethane	32	6.3	0.013	0.019	8	No	--	--	32	No	--	--	64	No	--	--	59	No	--	--
1,1-Dichloroethylene	32	3.1	0.015	0.085	876	No	--	--	876	No	--	--	876	No	--	--	200	No	--	--
1,2-Dichloroethane	32	53	0.035	0.15	0.47	No	--	--	2.0	No	--	--	3.9	No	--	--	3.6	No	--	--
1,2-trans-Dichloroethylene	32	9.4	0.014	0.030	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
2-Hexanone	32	16	0.36	0.78	131	No	--	--	131	No	--	--	131	No	--	--	30	No	--	--
4-Ethyltoluene	32	44	0.20	0.46	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Acetone	32	94	20	92	135,780	No	--	--	135,780	No	--	--	135,780	No	--	--	31,000	No	--	--
Benzene	32	100	0.48	3.6	**1.6**	**Yes**	**1.0**	**3.1**	6.6	No	--	--	13	No	--	--	12	No	--	--
Bromodichloromethane	32	6.3	0.24	0.64	**0.33**	**Yes**	**2.0**	**6.3**	1.4	No	--	--	2.8	No	--	--	2.6	No	--	--
Bromoform	32	6.3	0.48	2.9	11	No	--	--	46	No	--	--	93	No	--	--	86	No	--	--
Carbon Disulfide	32	25	0.27	0.55	3,066	No	--	--	3,066	No	--	--	3,066	No	--	--	700	No	--	--
Carbon Tetrachloride	32	100	0.59	0.74	2.0	No	--	--	8.5	No	--	--	17	No	--	--	16	No	--	--
Chlorobenzene	32	3.1	0.15	0.34	219	No	--	--	219	No	--	--	219	No	--	--	50	No	--	--
Chloroform	32	100	0.16	1.5	**0.53**	**Yes**	**2.0**	**6.3**	2.2	No	--	--	4.4	No	--	--	4.1	No	--	--
Chloromethane	32	100	1.6	2.4	394	No	--	--	394	No	--	--	394	No	--	--	90	No	--	--
Dibromochloromethane	32	6.3	0.31	1.0	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Ethanol	32	81	27	370	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Ethyl Chloride	32	88	0.054	0.12	43,800	No	--	--	43,800	No	--	--	43,800	No	--	--	10,000	No	--	--
Ethylbenzene	32	100	0.19	0.94	4.9	No	--	--	20	No	--	--	41	No	--	--	38	No	--	--
Freon 114	32	100	0.12	0.14	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
m&p-Xylene[1]	32	100	0.49	2.3	438	No	--	--	438	No	--	--	438	No	--	--	100	No	--	--
Methyl Ethyl Ketone (2-Butanone)	32	100	1.6	4.4	21,900	No	--	--	21,900	No	--	--	21,900	No	--	--	5,000	No	--	--
Methylene Chloride	32	28	0.84	6.5	1,226	No	--	--	2,628	No	--	--	2,628	No	--	--	600	No	--	--
o-Xylene	32	100	0.21	0.75	438	No	--	--	438	No	--	--	438	No	--	--	100	No	--	--
Styrene	32	75	0.64	7.2	4,380	No	--	--	4,380	No	--	--	4,380	No	--	--	1,000	No	--	--
Tetrachloroethylene	32	66	0.049	0.22	47	No	--	--	175	No	--	--	175	No	--	--	40	No	--	--
Tetrahydrofuran	32	3.1	0.39	1.6	8,760	No	--	--	8,760	No	--	--	8,760	No	--	--	2,000	No	--	--
Toluene	32	100	2.5	13	21,900	No	--	--	21,900	No	--	--	21,900	No	--	--	5,000	No	--	--
Trichloroethylene	32	44	0.063	0.85	3.0	No	--	--	8.8	No	--	--	8.8	No	--	--	2.0	No	--	--
Vinyl Chloride	32	6.3	0.010	0.061	2.8	No	--	--	12	No	--	--	23	No	--	--	22	No	--	--

Notes

USEPA default exposure parameters, except exposure duration, for composite workers and the USEPA default toxicological hierarchy were used to calculate SLs.

[1] Total xylenes was used as a surrogate for m&p-Xylene.

Table 2: Detected Soil Results Compared to Screening Levels

Analyte	Number of Samples	Frequency of Detection (%)	Average Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	25-Year Commercial Worker				6-Year Active-Duty Military Worker				3-Year Active-Duty Military Worker				9-Month Military Worker (Resident)			
					Screening Level (mg/kg)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)	Screening Level (mg/kg)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)	Screening Level (ug/m^3)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)	Screening Level (ug/m^3)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)
Petroleum Compounds																				
Diesel Range Organics [C10-C28]	60	15	92	360	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Gasoline Range Organics [C6-C10]	60	6.7	0.61	0.58	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Inorganics																				
Aluminum	60	100	15,515	29,000	1,168,000	No	--	--	1,168,000	No	--	--	1,168,000	No	--	--	800,000	No	--	--
Antimony (metallic)	60	70	0.61	8.8	467	No	--	--	467	No	--	--	467	No	--	--	320	No	--	--
Arsenic, Inorganic	60	47	2.0	25	**3.0**	**Yes**	21	**35**	**12.5**	**Yes**	**1.0**	**1.7**	**16**	**Yes**	**1.0**	**1.7**	45	No	--	--
Barium	60	100	86	1,200	233,600	No	--	--	233,600	No	--	--	233,600	No	--	--	160,000	No	--	--
Beryllium and compounds	60	70	0.29	1.0	2,336	No	--	--	2,336	No	--	--	2,336	No	--	--	1,600	No	--	--
Cadmium	60	50	0.63	9.5	999	No	--	--	999	No	--	--	999	No	--	--	684	No	--	--
Chromium (3+)	60	100	288	850	1,752,000	No	--	--	1,752,000	No	--	--	1,752,000	No	--	--	1,200,000	No	--	--
Cobalt	60	100	33	97	350	No	--	--	350	No	--	--	350	No	--	--	240	No	--	--
Copper	60	100	41	95	46,720	No	--	--	46,720	No	--	--	46,720	No	--	--	32,000	No	--	--
Iron	60	100	33,017	74,000	817,600	No	--	--	817,600	No	--	--	817,600	No	--	--	560,000	No	--	--
Lead and Compounds	60	100	85	260	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Magnesium	60	100	46,567	130,000	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Manganese	60	100	587	1,300	163,520	No	--	--	163,520	No	--	--	163,520	No	--	--	112,000	No	--	--
Mercury (elemental)	60	80	0.16	4.0	46	No	--	--	46	No	--	--	46	No	--	--	10	No	--	--
Nickel Soluble Salts	60	100	617	1,500	23,360	No	--	--	23,360	No	--	--	23,360	No	--	--	16,000	No	--	--
Selenium	60	70	0.46	1.6	5,840	No	--	--	5,840	No	--	--	5,840	No	--	--	4,000	No	--	--
Silver	60	70	0.17	2.6	5,840	No	--	--	5,840	No	--	--	5,840	No	--	--	4,000	No	--	--
Thallium (Soluble Salts)	60	10.0	0.39	0.91	11.68	No	--	--	12	No	--	--	12	No	--	--	8.0	No	--	--
Vanadium	60	100	71	130	5,840	No	--	--	5,840	No	--	--	5,840	No	--	--	4,000	No	--	--
Zinc and Compounds	60	100	139	440	350,400	No	--	--	350,400	No	--	--	350,400	No	--	--	240,000	No	--	--
Semi-Volatile Organic Compounds																				
4-Bromophenylphenylether	60	1.7	0.21	0.40	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Bis(2-ethylhexyl)phthalate	60	23	0.26	1.7	164	No	--	--	684	No	--	--	1,368	No	--	--	3,799	No	--	--
Butyl Benzyl Phthalate	60	1.7	0.20	0.15	1,209	No	--	--	5,039	No	--	--	10,078	No	--	--	27,995	No	--	--
Carbazole	60	6.7	0.26	2.6	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Dibutyl-n-butyl Phthalate	60	1.7	0.20	0.22	82,066	No	--	--	82,066	No	--	--	82,066	No	--	--	56,210	No	--	--
p-Chloroaniline	60	1.7	0.52	1.1	11.5	No	--	--	48	No	--	--	96	No	--	--	266	No	--	--
Polycyclic Aromatic Hydrocarbons																				
1-Methylnaphthalene	60	3.3	0.056	0.14	73	No	--	--	303	No	--	--	606	No	--	--	1,684	No	--	--
2-Methylnaphthalene	60	3.3	0.11	0.12	3,014	No	--	--	3,014	No	--	--	3,014	No	--	--	2,064	No	--	--
Acenaphthene	60	5.0	0.13	1.2	45,207	No	--	--	45,207	No	--	--	45,207	No	--	--	30,964	No	--	--
Anthracene	60	12	0.15	2.0	226,034	No	--	--	226,034	No	--	--	226,034	No	--	--	154,818	No	--	--
Benz[a]anthracene	60	48	0.37	9.7	**2.9**	**Yes**	**1.0**	**1.7**	12.0	No	--	**--**	24	No	--	--	66	No	--	--
Benzo(g,h,i)perylene	60	45	0.22	3.4	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Benzo[a]pyrene	60	78	0.33	8.6	**0.29**	**Yes**	**11**	**18**	**1.20**	**Yes**	**2.0**	**3.3**	**2.4**	**Yes**	**1.0**	**1.7**	**6.7**	**Yes**	**1.0**	**1.7**
Benzo[b]fluoranthene	60	72	0.52	12	**2.9**	**Yes**	**1.0**	**1.7**	12.0	No	--	--	24	No	--	--	67	No	--	--
Benzo[k]fluoranthene	60	45	0.20	5.0	29	No	--	--	120	No	--	--	241	No	--	--	669	No	--	--
Chrysene	60	55	0.41	10.0	289	No	--	--	1,204	No	--	--	2,408	No	--	--	6,690	No	--	--
Dibenz[a,h]anthracene	60	13	0.14	1.2	**0.29**	**Yes**	**2.0**	**3.3**	1.20	No	--	**--**	2.4	No	--	--	6.7	No	--	--
Fluoranthene	60	70	0.77	23	30,138	No	--	--	30,138	No	--	--	30,138	No	--	--	20,642	No	--	--
Fluorene	60	5.0	0.12	0.83	30,138	No	--	--	30,138	No	--	--	30,138	No	--	--	20,642	No	--	--
Indeno[1,2,3-cd]pyrene	60	37	0.22	3.3	**2.9**	**Yes**	**1.0**	**1.7**	12.0	No	--	**--**	24	No	--	--	67	No	--	--
Naphthalene	60	1.7	0.11	0.16	17	No	--	--	70	No	--	--	139	No	--	--	129	No	--	--
Phenanthrene	60	53	0.41	13	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
Pyrene	60	62	0.54	15	22,603	No	--	--	22,603	No	--	--	22,603	No	--	--	15,482	No	--	--
Furans																				
Dibenzofuran	60	3.3	0.22	1.1	1,036	No	--	--	1,036	No	--	--	1,036	No	--	--	710	No	--	--
Dinitrotoluenes																				
2,4-Dinitrotoluene	60	1.7	0.53	1.8	7.4	No	--	--	30.7	No	--	--	61	No	--	--	171	No	--	--
2,6-Dinitrotoluene	60	1.7	0.24	2.4	**1.54**	**Yes**	**1.0**	**1.7**	6.4	No	--	**--**	13	No	--	--	36	No	--	--
Pesticides																				
alpha-Chlordane[1]	60	10.0	0.014	0.16	7.5	No	--	--	31.1	No	--	--	62	No	--	--	152	No	--	--
Chlordane[1]	60	6.7	0.16	0.32	7.5	No	--	--	31.1	No	--	--	62	No	--	--	152	No	--	--
Chlordecone (Kepone)	60	1.7	0.86	3.5	**0.23**	**Yes**	**1.0**	**1.7**	**0.96**	**Yes**	**1.0**	**1.7**	**1.9**	**Yes**	**1.0**	**1.7**	5.3	No	--	--
DDD	60	3.3	0.0098	0.082	9.6	No	--	--	39.9	No	--	--	80	No	--	--	222	No	--	--
DDE	60	85	0.36	16	**9.3**	**Yes**	**1.0**	**1.7**	38.7	No	--	**--**	77	No	--	--	201	No	--	--
DDT	60	67	0.047	0.66	8.5	No	--	--	35.6	No	--	--	71	No	--	--	198	No	--	--
Dieldrin	60	12	0.013	0.17	**0.144**	**Yes**	**1.0**	**1.7**	0.60	No	--	**--**	1.2	No	--	--	3.3	No	--	--
Endosulfan II	60	1.7	0.0085	0.00065	7,008	No	--	--	7,008	No	--	--	7,008	No	--	--	4,800	No	--	--
Endrin ketone	60	5.0	0.012	0.017	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--	No Value	--	--	--
gamma-Chlordane[1]	60	12	0.010	0.043	7.5	No	--	--	31.1	No	--	--	62	No	--	--	152	No	--	--

Table 2: Detected Soil Results Compared to Screening Levels

Analyte	Number of Samples	Frequency of Detection (%)	Average Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	25-Year Commercial Worker				6-Year Active-Duty Military Worker				3-Year Active-Duty Military Worker				9-Month Military Worker (Resident)			
					Screening Level (mg/kg)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)	Screening Level (mg/kg)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)	Screening Level (ug/m^3)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)	Screening Level (ug/m^3)	Does the Maximum Detected Concentration Exceed SL?	Number of Exceedances	Frequency of Exceedance (%)

Notes

USEPA default exposure parameters, except exposure duration, for composite workers and the USEPA default toxicological hierarchy were used to calculate SLs.

[1] Technical chlordane was used as a surrogate for alpha-Chlordane, Chlordane, and gamma-Chlordane.

Table 3 Detected Drinking Water Results Compared to Federal MCLs

Analyte	Number of Samples	Frequency of Detection (%)	Average Concentration (ug/L)	Maximum Detected Concentration (ug/L)	Federal MCL (ug/L)	Does the Maximum Detected Concentration Exceed the SL?	Frequency of Exceedance (%)
Copper	18	100	18	49	1,300[1]	No	--
Lead and Compounds	18	78	4.1	11	15	No	--
Chloroacetic Acid	18	0.0	0.49	0.0	No Value[2,3]	No	--
Dichloroacetic Acid	18	28	0.77	2.8	No Value[2,3]	No	--
Trichloroacetic Acid	18	11	0.25	0.80	No Value[2,3]	No	--
Bromodichloromethane	18	100	2.6	5.6	No Value[2,4]	No	--
Bromoform	18	100	43	57	No Value[2,4]	No	--
Chloroform	18	78	0.78	2.8	No Value[2,4]	No	--
Dibromoacetic Acid	18	100	10	16	No Value[2,3]	No	--
Dibromochloromethane	18	100	9.6	17	No Value[2,4]	No	--
Monobromoacetic Acid	18	89	1.9	4.3	No Value[2,3]	No	--
Total Haloacetic acids	18	100	13	18	60	No	--
Total Trihalomethanes	**18**	**100**	**56**	**81**	**80**	**Yes**	**5.6**

Notes:

Shaded cells indicate that the maximum detected concentration exceeded the MCL.

MCL: Maximum Contaminant Level

MCLG: Maximum Contaminant Level Goal

[1] Lead and copper are regulated by a treatment technique that require systems to control the corrosiveness of water. If more than 10% of tap water samples exceed the action level, additional steps must be taken. The values for lead and copper are action levels.

[2] Constituent only has a MCLG - the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable.

[3] Constituent is considered under Total Haloacetic acids.

[4] Constituent is considered under Total Trihalomethanes.