



## The Periodic Occupational and Environmental Monitoring Summary (POEMS)—History, Intent, and Relationship to Individual Exposures and Health Outcomes

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### Technical Information Paper No. 64-002-1110

**PURPOSE.** To explain the intent of the POEMS, the long history that led to its need and development, and to discuss the relationship between environmental sample date, individual exposures, and relating potential adverse health outcomes to environmental exposures.

**REFERENCES.** See Appendix A for a list of reference information.

### POINTS OF MAJOR INTEREST AND FACTS.

#### Background.

The history of compensating veterans for adverse health effects resulting from Service-connected exposures is long and complex and includes: radiation from nuclear testing, Agent Orange during the Vietnam War, depleted uranium, chemical and biological warfare agents, pesticides, oil well fires, smoke, petroleum, vaccinations (including anthrax and botulinum toxoid) and pyridostigmine bromide (PB—anti-nerve agent) during Operation Desert Storm/Shield (ODS/S), and toxic embedded fragments for Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF) veterans. The key issues are that the health condition resulted because of your Service in the military (Service-connection), that the exposure caused the health condition, and that you were exposed to the precipitating agent. These last two issues are at the heart of this discussion and often the most difficult to prove with certainty. A classic example is the compensation of Vietnam veterans who were exposed to the herbicide/defoliant Agent Orange, which will be discussed below to elucidate the process.

**a. Exposure.** The difficult process of determining your “exposure to the precipitating agent” is made simple for Agent Orange and Vietnam Veterans. The U.S. Department of Veterans Affairs (VA) simply says, “*Veterans who served in-country Vietnam between 1962 and 1975 (including those who visited Vietnam even briefly) and who have a disease that VA recognizes as being associated with exposure to Agent Orange are presumed to have been exposed to Agent Orange.*” Vietnam Veterans with these specific diseases do not have to show that their diseases are related to their military Service to get disability compensation. In this case, being “in country” presumes exposure no matter how small or if in fact exposure occurred at all. This simplistic approach is not

the case for most other situations where Department of Defense (DOD) or the VA are trying to determine if an exposure occurred and that it could have been sufficient to cause a health problem.

**b. Causality.** As to the issue “that the exposure caused the health condition” VA has a “Categories of Association” based on National Academies of Science (NAS), Institute of Medicine (IOM) guidelines. The IOM committees classified the evidence of association between exposure to a specific agent and a specific health outcome into five categories outlined below. The committee’s conclusions are based on the strength and coherence of the findings in the available studies. The categories are—

**1. Sufficient Evidence of a Causal Relationship.** Evidence from available studies is sufficient to conclude that a causal relationship exists between exposure to a specific agent and a specific health outcome in humans, and the evidence is supported by experimental data. The evidence fulfills the guidelines for sufficient evidence of an association (below) and satisfies several of the guidelines used to assess causality: strength of association, dose-response relationship, consistency of association, and a temporal relationship (**added for Gulf War exposures, not applicable for Agent Orange exposure in Vietnam**).

**2. Sufficient Evidence of an Association.** Evidence from available studies is sufficient to conclude that there is a positive association. A consistent, positive association has been observed between exposure to a specific agent and a specific health outcome in which chance and bias, including confounding, could be ruled out with reasonable confidence. For example, several high-quality studies report consistent positive associations, and the studies are sufficiently free of bias, including adequate control for confounding.

**3. Limited/Suggestive Evidence of an Association.** Evidence from available studies suggests an association between exposure to a specific agent and a specific health outcome, but the body of evidence is limited by the inability to rule out chance and bias, including confounding, with confidence. For example, at least one high-quality study reports a positive association that is sufficiently free of bias, including adequate control for confounding. Other corroborating studies provide support for the association, but they were not sufficiently free of bias, including confounding. Alternatively, several studies of less quality show consistent positive associations, and the results are probably not due to bias, including confounding.

**4. Inadequate/Insufficient Evidence to Determine Whether an Association Exists.** Evidence from available studies is of insufficient quantity, quality, or consistency to permit a conclusion regarding the existence of an association between exposure to a specific agent and a specific health outcome in humans.

**5. Limited/Suggestive Evidence of No Association.** Evidence from available studies is consistent in not showing a positive association between exposure to a specific agent and a specific health outcome after exposure of any magnitude. A conclusion of no association is inevitably limited to the conditions, magnitudes of exposure, and length of observation in the available studies. The possibility of a very small increase in risk after exposure studied cannot be excluded.

**6. Consensus Not Reached on Category of Association.** If the entire committee did not agree on a conclusion, then the association was not assigned a category.

**c. Diseases.** The diseases considered to have **Sufficient Evidence of an Association** with Agent Orange exposure and compensated by the VA are (references: 1–6) are: Chronic lymphocytic Leukemia, soft-Tissue sarcoma, Non-Hodgkin’s lymphoma, Hodgkin’s disease, and Chloracne.

Those with **Limited or Suggestive Evidence of an Association** are: Respiratory cancer (of lung or bronchus, larynx, and trachea), Prostatic cancer, Multiple myeloma, Acute and sub-acute transient peripheral neuropathy, Porphyria cutanea tarda, Type 2 diabetes, Spina bifida in the children of Veterans.

Most often the decisions to compensate Veterans are based on statistical associations and not causal relationships. In fact, for Vietnam exposures, there is no “gold standard” category of **Sufficient Evidence of a Causal Relationship**. This category was added for Gulf War exposures. It is one of the most difficult processes in science to determine that a disease is caused by a particular environmental exposure to a chemical and to determine if the individual had the exposure, both qualitatively and quantitatively, required to cause the disease. The additional category makes causation explicit and includes evidence beyond that found just in epidemiologic studies. Although association and causation are often used interchangeably, they have different meanings scientifically. To demonstrate an association, the evidence simply must indicate that as exposure to an agent increases, the occurrence of an adverse outcome also increases. For causation, the evidence must demonstrate that the exposure leads to the health outcome. For example, the influenza virus causes a person to get influenza. Therefore, the categories of evidence used by the Gulf War committees explicitly distinguish between causation and association. One other change the Gulf War committees made was to clarify the definitions of **Limited/Suggestive Evidence of an Association and Sufficient Evidence of an Association**. The committee added the phrase “in human studies” to those definitions where they discuss “chance and bias, including confounding”. Chance, bias, and confounding are much more significant problems in human epidemiology studies than in animal studies (which are more controlled). The addition of the statement about human studies simply clarifies that point. At the same time, the IOM has put more weight on the human studies than on the animal studies.

## **Introduction.**

Even considering the costs and problems that were associated with Agent Orange exposure in Vietnam, it was not until after ODS that the DOD became concerned about potential environmental exposures to Service members and the adverse health outcomes they may cause. Previously, DOD was primarily concerned with food, water, and arthropod borne and infectious diseases that could affect troops real-time and impact the mission (i.e., disease and non-battle injury (DNBI)). However, after ODS with its many potential environmental exposures (i.e., oil well fire smoke, pesticides, chemical warfare agents, particulate matter, and so forth) and Veterans experiencing various health issues, the DOD became more focused on capturing environmental exposure data for Service members that may impact their health both during and after deployments. In fact, Public Law 102-190 Section 734, which required a means to calculate exposure to the Kuwait oil well fires for DOD personnel deployed in ODS (references 7 and 8) was enacted to this end and was the first of many Congressional forays into the area of assessing Service member exposures while deployed and the potential health consequences. In response to the Public Law, the U.S. Army Public Health Command (Provisional) (USAPHC (Prov)) developed a database and public website where ODS Veteran's could request or look up their individual exposure to and risk from oil well fires emissions (Appendix B). This was the first time a Service member could determine their individual exposure based on environmental sample data and modeled exposure data. In addition, since that time there have been numerous peer-reviewed, scientific journal articles published on the subject of environmental exposures and subsequent health outcomes from Service during ODS. Some examples are included to illustrate the diversity of exposures and outcomes studied and for how many years they have been continuing (references 9–22).

Unfortunately for the ODS exposures mentioned above the information, not only on how much of a chemical a person was exposed to, but even the specific chemicals a person might have been exposed to is lacking. This situation holds not only for chemicals but information on which vaccines or medications, or the amount of a medication, that a specific person took during deployment. Often a Veteran will talk about being given a vaccination, for example en route to a combat area, but they did not know what vaccination they were receiving. In addition, the DOD has very sparse records of who received what vaccinations. In other cases, when asked, Veterans reported being exposed to a multitude of agents such as pesticides, PB kerosene heaters, and oil well fire smoke during their deployment; however the levels of exposure to specific agents have not been determined and probably never will be. This lack of information on exposure makes it very difficult to link a given health effect in Veterans to a specific exposure. To try and remedy this situation, the DOD has spent tens of millions of dollars doing "investigations," many conducted by the Office of the Special Assistant for Gulf War Illnesses (OSAGWI), often in conjunction with the Research and Development

(RAND) Corporation, to try and elucidate as much information as possible about the Gulf War exposures that Service members may have received. An example of one of these exposure studies for pesticides is discussed in the attached (Appendix C). In addition, the IOM has conducted a series of investigations on behalf of the VA and DOD on various Gulf War exposures and their health implications (references 23– 8).

**a. VA Response.** Within several months of the ground war and while nearly half of the deployed troops were still in the combat theater, VA began work on a health-tracking program aimed at environmental issues, focusing initially on the effects of oil well fires. As Veterans' concerns broadened, in 1992 the program became the Gulf War Registry physical examination program in place today, where every VA medical center has a specific registry physician familiar with Gulf environmental issues performing the protocol exam. As the examination program evolved, the testing protocol was expanded, improved, and adopted as a model for a similar DOD examination program. The VA has a special compensation authority available only to Gulf War Veterans which provides criteria for monthly monetary benefits to Gulf Veterans who have significant symptoms that defy conventional medical diagnoses. Signs or symptoms of an undiagnosed illness may include: joint and muscle pain, headache, abnormal weight loss, fatigue, sleep disturbance, skin problems, and neurologic and neuropsychological signs and symptoms. Illnesses include: medically unexplained clusters of symptoms such as Chronic fatigue syndrome, Fibromyalgia, and Irritable bowel syndrome. For VA, an ongoing challenge is assessing the likelihood that any environmental exposures may have contributed to latent diseases, meaning diseases that would first appear after a Veteran's discharge and, thus, would not have been evident in Service records under conventional "incurred or aggravated in service" criteria. Again as with Agent Orange, VA has contracted with IOM to report on whether a higher risk of illnesses can be associated with potential Gulf exposures. In its study of possible associations of disease and Gulf environment risk factors, IOM is examining PB, vaccines and their components, uranium and depleted uranium, and the nerve agents sarin and cyclosarin. In addition, to improve understanding of Gulf War Veterans' health issues, the Federal Government, to include DOD and VA, has spent hundreds of millions of dollars on research projects investigating various theories and exposure issues as to the causes and treatments of "Gulf War Illnesses."

**b. DOD Response.** After the first Gulf War with the lack of good exposure data for all the chemical, agents, vaccines, and so forth (except for oil well fires as noted above) suspected of causing Veterans' health problems, DOD became serious in its efforts to collect environmental samples and other exposure data, archive the data, document troop exposures, track troop locations on a daily basis, and assess service member's health outcomes. This first occurred during Operation Joint Endeavor/Forge in Bosnia in 1996. Since that time, the efforts have only increased and become more sophisticated as policy and doctrine (references 29–31), sampling equipment, training, and computer equipment,

networks, and database advances have occurred (reference 32–33). Advances have occurred more rapidly in some areas than others, with the greatest advances coming in environmental sample collection, data archiving, policy, doctrine, and training, and electronic data systems. The most difficult task that remains is still determining individual Service member’s exposures and the resultant health consequences. That will be the focus of the rest of this paper concentrating on efforts underway for OEF/OIF.

**Facts.**

**a. Sampling.** Currently, sample data are typically collected where there are large concentrations of troops such as base camps, airports/airbases, seaports, forward operating locations, forward operating bases, and so forth where Service members may be exposed and there are preventive medicine assets and infrastructure to collect data. A number of problematic issues become apparent with the collection and interpretation of environmental data as it relates to Service member exposures and related adverse health outcomes. These include, but are not limited to—

1. Spatial and temporal relationship of the samples to the Service member.
2. Relationship of the environmental sample to the actual individual exposure dose.
3. Time the Service member spends away from the sample location (base camp).
4. Contaminants not sampled.
5. Additive, synergistic, and antagonistic effects of multiple contaminants.
6. Multiple exposure pathways of the same contaminant.

**b. Sample Documentation.** For several years now, occupational and environmental health (OEH) exposure information and data for deployment sites have been collected and archived by the DOD. However, the existing information and data are in a multitude of documents and databases, much of which are limited in content or has restricted access. Over the past couple of years, various documents that were essentially ‘predecessors’ of the current POEMS have been created for certain deployment sites to summarize data and address the specific medical record (Standard Form (SF) 600, *Chronological Record of Medical Care*, Rev. 6-97)) requirement to place exposure data in Service members medical record. The Air Force has been very proactive in creating summary documents they call Environmental and Occupational Health Workplace Exposure Data (EOHWED) on an SF 600 and including them in medical records, as well as posting them to a protected (accessible to U.S. Government personnel only) website. The Army also produced documents very similar to the Air

Force EOHWED on an SF 600 for their deployment locations in the U.S. Central Command (CENTCOM) area of responsibility (AOR). While these and other documents were conceptually similar to the POEMS, there were key problems related to inconsistencies in format/detail/content. In addition, the Army and Navy considered the information to be inappropriate for inclusion in individual medical records, since the available information only provides estimated 'population-based' health risks and is not to be considered definitive individual exposure documentation. Over the last several years, the DOD Senior Leadership has generally agreed with this position. The concept of developing multi-Service POEMS, to be available on a public website, was considered a reasonable alternative to the current policy requirement. The Deputy Assistant Secretary of Defense (Force Health Protection and Readiness) (DASD FHP& R), the proponent for DOD Instruction 6490.03, (*Deployment Health*, 2006), agrees with this policy interpretation.

The POEMS are to be the official multi-Service-approved documents (4–10 pages in length) that summarize the DOD medical interpretation of OEH exposure information/data for deployment sites in support of combat operations, peacekeeping, deterrence operations, disaster relief, and so forth. Locations may include base camps, airports/airbases, seaports, forward operating locations, forward operating bases, and so forth, where Service members may be exposed. Specifically, POEMS describe the types of exposure hazards (e.g., airborne pollutants, water pollutants, infectious disease, noise, heat/cold), summarize data/information collected, and then provide an assessment of the significance of any known or potential acute (short-term) and long-term (post-deployment) health effects to the population deployed to the site.

The POEMS are being developed to address the requirements DOD Instruction 6490.03 and DOD Instruction 6055.05, *Occupational and Environmental Health*, 2008, and Memorandum, Joint Chiefs of Staff, MCM 0028-07, 2007, subject: *Procedures for Deployment Health Surveillance*, 2007. Specifically, DOD Instruction 6490.03 requires that the Services "document periodic occupational and environmental monitoring summaries on an SF 600 for each permanent or semi-permanent basing location and update at least annually." The requirements indicate that the information should include monitoring results, assessment of whether exposures are acceptable or not, and identification of standards used to assess the hazards. A standardized template for the POEMS for deployment sites has been created, reviewed and concurred by the DOD Senior Leadership represented on the Joint Environmental Surveillance Work Group (JESWG), a joint working group that reports directly to the DASD FHP& R. The key members creating the POEMS were from: Office of the Deputy under Secretary of Defense, Installations and Environment OSD (I&E), DASD (FHP&R), the Joint Staff, CENTCOM, and the Service Surgeons' offices.

**c. Creating the POEMS.** While certain information will be provided by field personnel at the site being evaluated, the POEMS will generally be created by specialized technical support units (e.g., specialized deployable teams/units, USAPHC (Prov), Navy and Marine Corp Public Health Center (NMCPHC), U.S. Air Force School of Aerospace Medicine (USAFSAM))—especially for the description of long-term health risks and the assessment of laboratory data that requires a level of technical expertise and resources not always available in the field. The POEMS includes information based on a summary of field observations/reports/surveys assessments and/or sampling/monitoring analytical data from the site. Some of the underlying data/documents are classified or “For Official Use Only” (FOUO) due to operational security aspects of certain site/operational details, photographs, and so forth. However, due to the intent and requirement for the POEMS, the information is summarized and focused on the health implications for the Service members deployed to the site and does not reflect site or operational specific details and is therefore unclassified.

**d. Audience.** The primary audience of the POEMS is military public health personnel and healthcare providers (military, VA, as well as private sector). As indicated, the intent of POEMS was to address (replace) the need for such information to be included in individual medical records and to be available to providers should Service personnel have OEH exposure-related concerns. The same information is also desired by the Active and Reserve Component members who are or have been deployed to these sites. Since Service members are required to complete pre- and post-deployment questionnaires regarding their health status and any occupational or environmental exposures that they had while deployed, they should have access to the POEMS. As an additional audience consideration, POEMS may be used to address various Congressional inquiries.

The POEMS will be posted on the front end of the designated DOD environmental exposure data portal (Deployment Occupational and Environmental Health Surveillance (DOEHS) data portal (<https://doehsportal.apgea.army.mil/doehrs-oehs/>)) as a “publically accessible” (login/password required) domain. A login/password requirement for access is consistent with other existing data in the DOEHS portal (e.g., detailed site surveys, field data reports, and assessments) which requires a password/assigned permission for access. The site will be activated when several related background documents, factsheets/explanatory information, and a ‘critical mass’ of site POEMS are completed and placed on the site. This will ensure that the site is useful to those using it and also provide key information regarding the context and interpretation of the POEMS. The current goal is to go ‘active’ by Fiscal Year 2010. In the interim, POEMS that have been completed for sites will be provided to the Preventive Medicine assets at the deployed locations and the COCOM and can be obtained by request to USAPHC (Prov).



**e. POEMS Content and Format.** The POEMS was created to document the estimated short-term (during deployment) and long-term (post deployment) health risks and medical implications associated with identified OEH exposures at major deployment sites. To accomplish this, the POEMS must summarize all the pertinent information (sampling data and documents) available on the site being assessed. This includes 10 specific categories that are evaluated to include; air, soil, water, military unique (i.e., depleted uranium, chemical, biological, radiological nuclear, and so forth), endemic diseases, venomous animals/insects, heat/cold stress, noise, other unique occupational hazards (i.e., pesticides, asbestos, lead-based paint, hazardous waste, and so forth), and unique incidents/concerns at the site. After the information is gathered, each category is evaluated for potential acute and chronic health risks and medical implications of the risks. A template showing the POEMS format and instructions for completing the POEMS are attached (Appendix D and E). The header on each page is the date the POEMS was last updated (POEMS should be routinely updated yearly) and the footer should be the COCOM/Component approval, as designated by the COCOM, including the point of contact (POC) and date, which is required before the document goes final.

The quantity and quality of environmental sample data and the various documents pertaining to the POEMS site are variable for each site. Some sites (basecamps) have thousands of environmental samples (air, water, and soil) for numerous analytes (metals, volatile organic compounds (VOC), pesticides, particulate matter, semi-volatile organic compounds (SVOC), and so forth), and several hundred documents (reports, surveys, inspections, field test results, and so forth), while others have sparse data or none at all. This often depends on the size of the basecamp, the troop population, how long the site has been operational, and the preventive medicine assets available to conduct OEH surveillance activities. The larger, more populated, older camps with more preventive medicine staff tend to have the most data available. A more complete and accurate POEMS results from: (1) more quality environmental sample data available for a longer time period (for chronic risk assessments), (2) sample data from a larger area or more areas of the camp, (3) data for more analytes and environmental media, and (4) a wide variety of documents in sufficient numbers to draw conclusions.

**f. POEMS Relationship to Individual Exposures and Health Outcomes.** As stated above, the POEMS is a DOD requirement to document periodic occupational and environmental monitoring summaries for each permanent or semi-permanent basing location and update at least annually. The requirements indicate that the information should include monitoring results, assessment of whether exposures are acceptable or not, and identification of standards used to assess the hazards. The POEMS is a response to past problems with collecting Service members' potential exposure data and documenting it in some form of record. The POEMS is well intentioned and does serve a useful purpose, that of documenting the environmental conditions at a site,

assessing their potential for causing adverse health effects, and documenting this in a form and at a location where it can be retrieved for future use. It does, however, suffer from several shortcomings when trying to predict individual Service members' exposures and the potential for adverse health outcomes.

To understand what a POEMS can tell us about exposure in general on a site, and ultimately about exposure to an individual, we have to look at what data makes up a "typical" POEMS. Focusing on particulate matter and chemical pollutants, two of the most "concerning" contaminants monitored on a site as an example, we see a great range in the robustness of the data available with which to draw exposure and health outcome conclusions. Take two large sites in Iraq (real examples) both operational for 6 years between 2003 and 2008; for particulate matter one had 459 samples collected the other had 164 collected over the same time period; for chemical pollutants, the first had 249 samples collected from multiple (5) locations and the other had 20 samples collected from one location. Clearly there is a large disparity in data robustness from these two sites and therefore the confidence in the conclusions we can draw about exposures at the site and the potential for adverse health effects. However, even with good environmental sample data at a site we can only draw general conclusions about individual exposure. The data in the POEMS is more suited to looking at population exposure levels and health outcomes for the following reasons.

1. The spatial and temporal relationship of the individual to the sample and thus the contaminant being measured. Depending on the military occupational specialty (MOS) or job of the Service member he/she may be inside or outside, away from the site on patrol, or near a hazardous operation when the sample is collected. The location of a Service member is only tracked to basecamp level on a daily basis. This is a key issue, since determining exposure level is critical to determining potential health effects. This key issue was disregarded in Viet Nam for Agent Orange exposure due to a lack of data. Everyone in country was considered exposed no matter your location, time in country, or job (i.e., working with Agent Orange, being doused while on patrol, or working in an office).

2. Relationship of the environmental sample to the actual individual exposure dose. The sample measured in the environment does not always translate into the actual dose the individual receives. There are several examples from Iraq where high levels of heavy metals were measured in the air and/or soil; however, when bio-monitoring of blood samples was conducted on the potentially exposed Service members, "normal unexposed" or undetectable levels were found.

Then there are the general problems with environmental epidemiology trying to "prove" a health problem is caused by an exposure, a few of which will only be noted in this paper.

1. Is there causality and/or health effects data for the contaminant being assessed? For example the issue of chronic health effects with particulate matter (PM<sub>10</sub>).
2. Is there good health outcome surveillance data for the exposed population? This can often be an issue in deployment situations.
3. Is there a completed pathway for the contaminant? Just because something is measured in the environment does not mean an exposure has occurred.
4. Environmental exposures are often low level and chronic and lead to subtle and/or non-specific health effects or if they are specific like cancer may take decades to develop. Often the non-specific health effect can be caused by many other chemicals.
5. The elevation of the “level of risk” from exposure to environmental contaminants is often small and difficult to detect.
6. Controlling for all the potential confounding factors, such as, occupational exposures, smoking, is the population healthier, etc.

Clearly it is very difficult to relate general environmental sample data from a site to an individual that is stationed on the site for the reasons stated above, from how much time the individual actually spends on the site to how much data is available to characterize the site. However, the DOD has come a long way since the ODS in characterizing, in general terms, what and how much Service members are exposed to when deployed. The data, in most cases is not individual, so it does not belong in an individual medical record; however, it should be readily available to the Service member and the physicians who care for the Service member to ensure they have the most complete information available about potential environmental conditions where the service member was located during deployment. This will ensure they receive the most complete healthcare possible while in the Service and that it continues with their care by the VA, as this information will be available to their healthcare providers.

### **Conclusions.**

a. The DOD has made remarkable strides in determining the environmental conditions at deployment sites and assessing the potential exposures of Service members while deployed; however, the process of determining individual exposure still remains difficult.

b. The POEMS will be the official multi-Service approved documents for summarizing the DOD medical interpretation of the OEH exposure information for deployment sites where Service members may be exposed. Specifically, POEMS

describe the types of exposure hazards, summarize data/information collected, and then provide an assessment of the significance of any known or potential acute (short-term) and long-term (post-deployment) health effects to the population deployed to the site. The POEMS should be updated at least annually.

**c.** The POEMS are best created by specialized technical support units (e.g. specialized deployable teams/units, , NMCPHC, USAFSAM) especially for the description of long-term health risks and the assessment of laboratory data that requires a level of technical expertise and resources not always available in the field. However, the input of preventive medicine personnel at the site is crucial to “ground truth” the information and conclusions and assure that the information describing site conditions, such as water sources, DNBI rates, exposure incidents are accurate and complete.

**d.** The primary audience of the POEMS is military public health personnel and healthcare providers (military, VA, as well as private sector) since the intent of the POEMS is to address (replace) the need for such information to be included in individual medical records and to be available to providers should Service personnel have OEH exposure-related concerns. Since Service members are required to complete pre- and post-deployment questionnaires regarding their health status and any occupational or environmental exposures that they had while deployed, they should also have access to the POEMS.

**e.** The data in the POEMS is more suited to looking at population exposure levels and health outcomes than individuals. It is very difficult to relate general environmental sample data from a site to an individual that is stationed on the site based on the factors discussed above.

However, the DOD has come a long way since the ODS in characterizing, in general terms, what and how much Service members are exposed to when deployed and soon making it readily available to the Service member and the physicians who care for their health needs.

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**Dated;** 15/09/2009

## Appendix A

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## **Appendix B**

### **Method for the Exposure Assessment To the Fumes\* of Burning Oil Well Fires**

#### **B-1. Authority.**

- a. Public Law 102-190, Section 734, Registry of Members of the Armed Forces Exposed to Fumes of Burning Oil in Connection with Operation Desert Storm.
- b. Public Law 102-585, Section 704, Expansion of Coverage of Persian Gulf Registry, 1996.

#### **B-2. Background.**

a. Public Law 102-190 requires the Secretary of Defense to establish and maintain a record relating to members of the Armed Forces who were exposed to the fumes of burning oil wells. Section 734 of this law and Section 704 of PL 102-585, requires a means of calculating exposures to DOD military and civilian personnel deployed for ODS/S and who were exposed to oil well fires smoke. This includes the length of time of the exposure, the circumstances of each exposure to the fumes of burning oil, and the locations in the OSD Theater of Operations. The USAPHC (Prov) was assigned this mission of determining the exposure of Persian Gulf Veterans to the fumes from burning oil well fires as an adjunct to the troop registry requirement.

b. The U.S. Armed Services Center for Unit Records Research (USASCURR) was charged with determining the locations of all troop units on a daily basis for the period of time the oil well fires were burning (February through November 1991). The USASCURR Troop Movement Database was constructed by examining all existing Gulf War records, such as troop unit logbooks and situation reports that contained daily troop-unit location data by latitude and longitude. Over 5 million records were examined. The individual personnel in each troop unit were determined from the Defense Manpower Data Center's (DMDC) Persian Gulf Registry. In addition to containing a list of individuals in each troop unit, this registry contains the dates when an individual entered and left the theater of operation. This data was used to determine the length of time when an individual may have received oil well fire smoke exposure.

c. To determine the oil well fire smoke exposure an individual received, the USAPHC (Prov) enlisted the aid of the National Oceanic and Atmospheric Administration (NOAA), Air Resources Laboratory (ARL) to assist in the exposure modeling effort. The USAPHC (Prov) used the output from the NOAA Hybrid Single-

Particle Lagrangian Integrated Trajectories (or HY-SPLIT) model, in conjunction with their Advanced Very High Resolution Radiometer (or AVHRR) satellite images to determine where the oil well fire smoke plume impacted troops on a daily basis and at what concentration. The HY-SPLIT was able to estimate the concentrations of individual oil well fire smoke contaminants at the breathing zone level (2 meters) for 40,000 points (15 kilometer grid spacing) throughout the theater. To make the model more accurate the following information was used: (1) ground level air sampling results, (2) data from air sampling flights through the smoke cloud, (3) chemical composition of the oil, (4) number of oil wells burning, and (5) estimated amount of chemicals coming out of the burning wells. The USAPHC (Prov) Troop Exposure Assessment Model (TEAM) used model exposure data, standard U.S. Environmental Protection Agency (USEPA) toxicity factors (i.e., reference dose/concentration and cancer slope factor), and risk assessment methods and calculated individual troops' exposure and resultant health risk. Figures 1, 2, and 3 shows an example for May 20, 1991 of the modeled, satellite, and merged oil well fire smoke plumes used to determine daily troop exposure levels. Daily troop unit locations were then plotted on the map (Figures 4 and 5) and their relationship to the oil well fire smoke plume determined. Exposure levels and risk from the various compounds coming from the oil well fire smoke were then estimated. Finally, Service members in each unit were identified (Figure 6) so individual risk levels could be determined based on time in theater, and estimated exposure to the oil well fire smoke.

**Figure B-1. Modeled Plume Boundary for 20 May 1991**

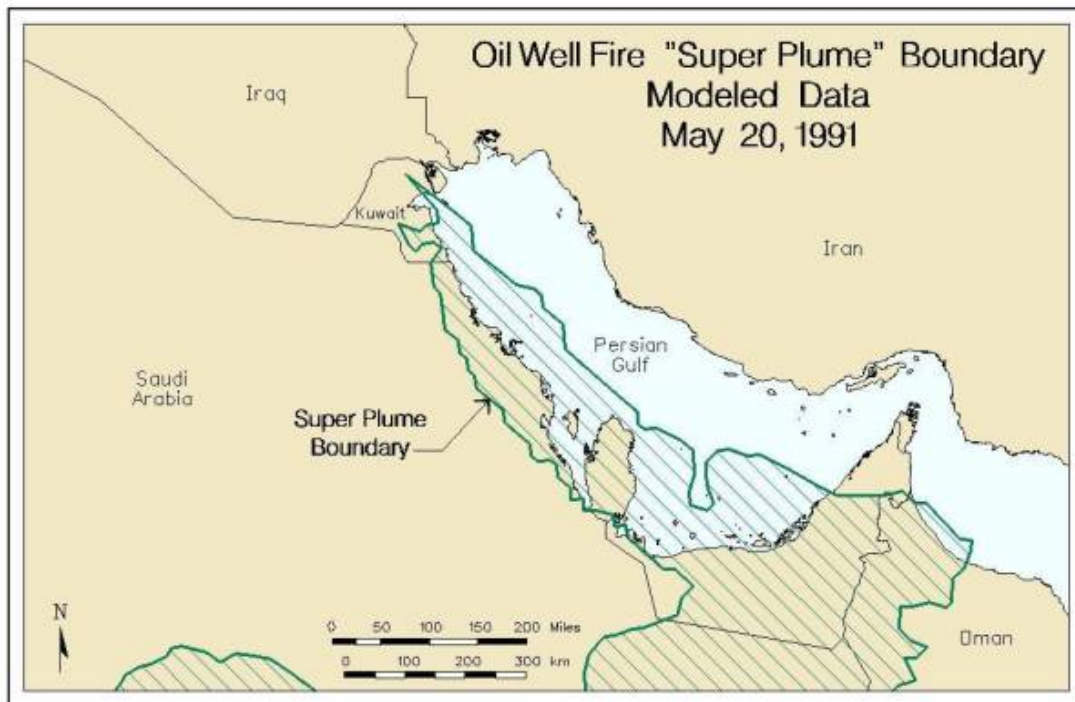
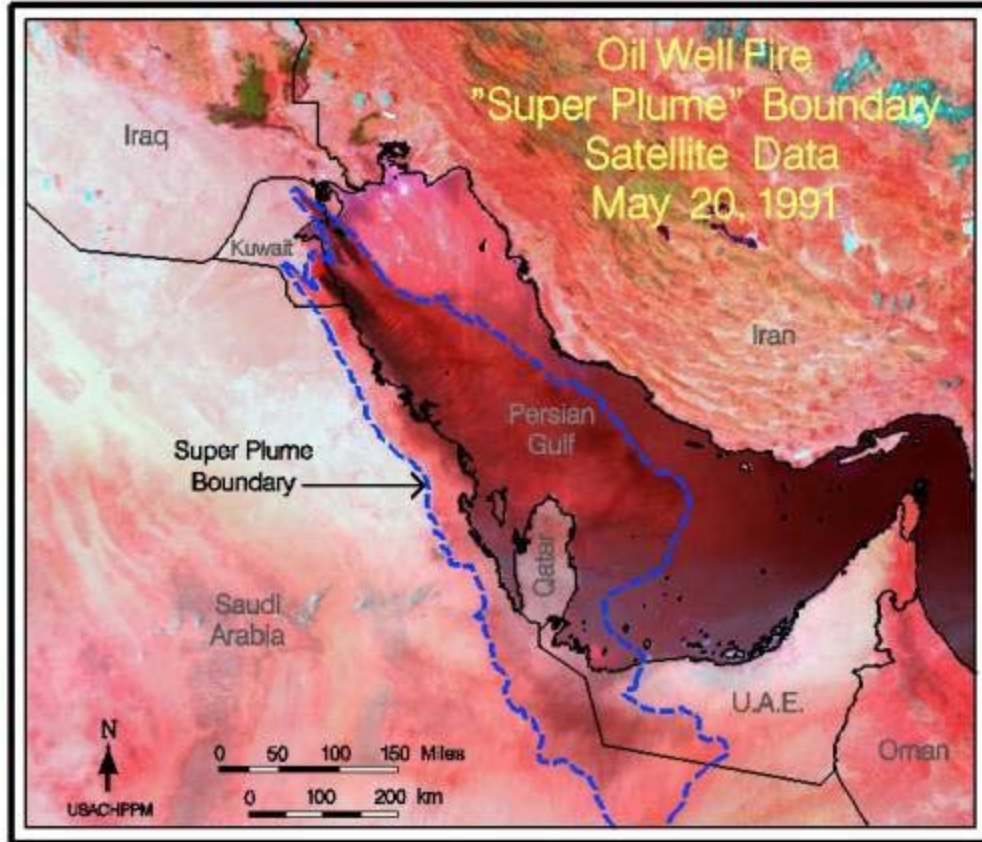
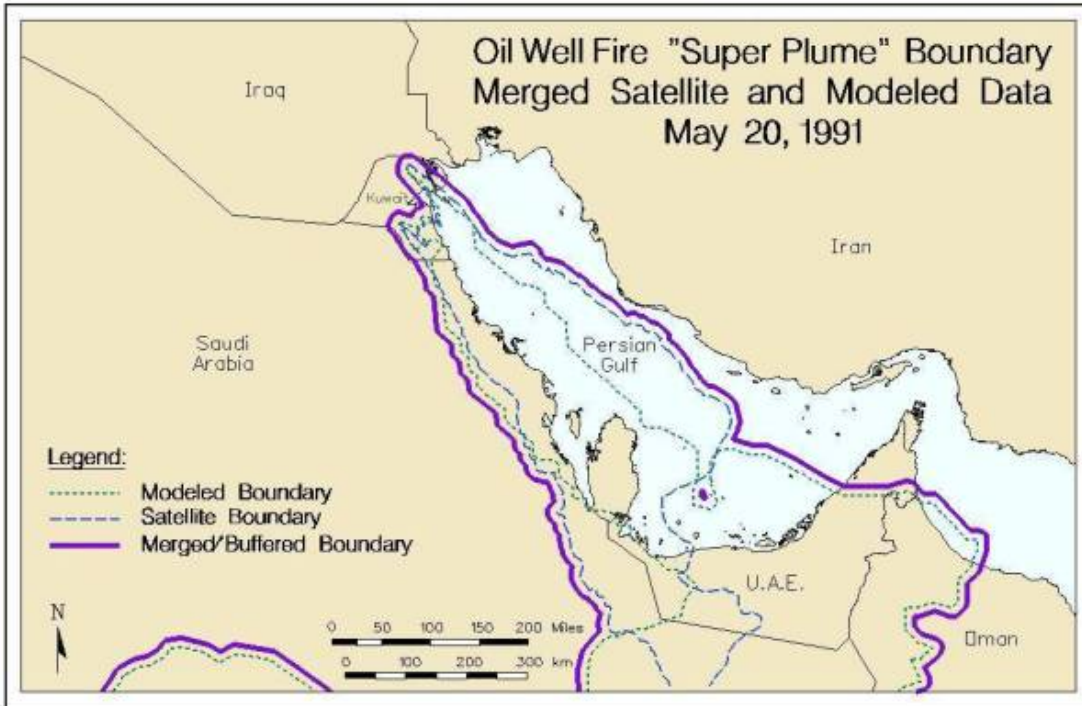


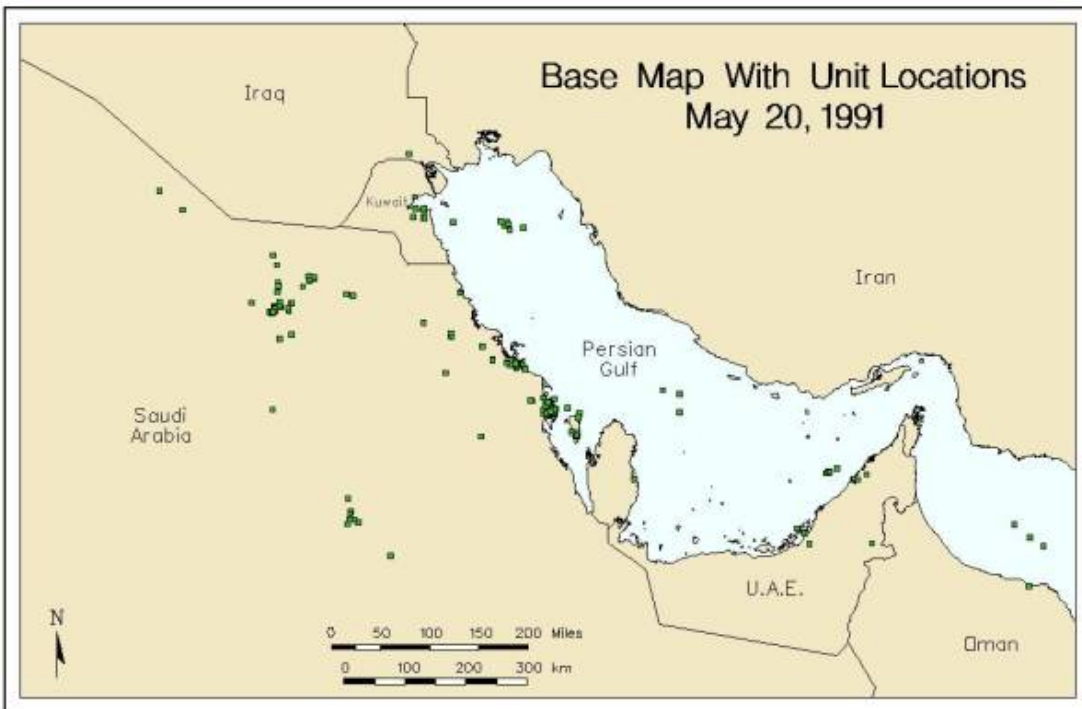
Figure B-2. Satellite Plume Boundary for 20 May 1991



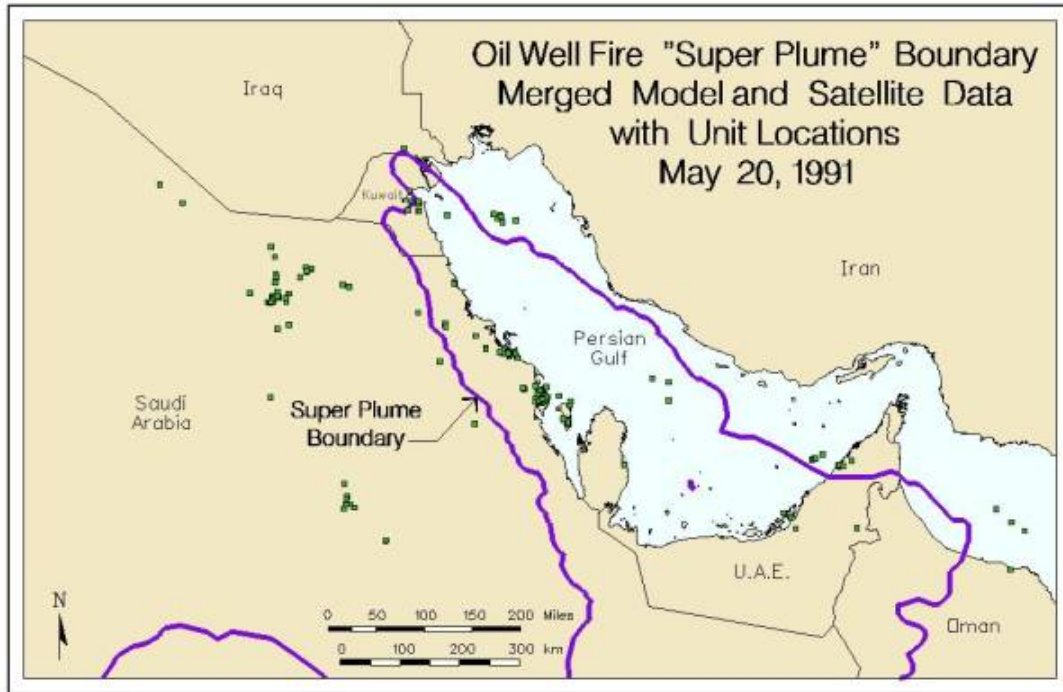
**Figure B-3. Plume Features for 20 May 1991**



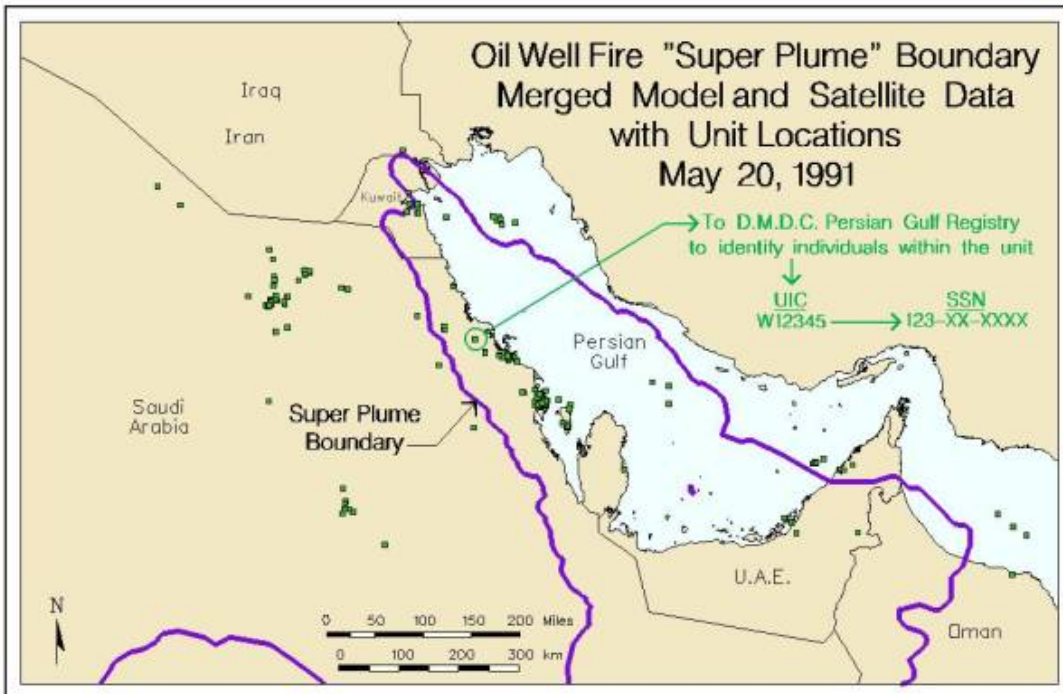
**Figure B-4. Base Map with Unit Locations**



**Figure B-5. Base Map with Unit Locations and Merged Plume Data**



**Figure B-6. Base Map with Unit Locations and Merged Plume Data Identifying Individuals**



### **B-3. Exposure Assessment.**

**a. Oil Well Fire Smoke Exposure.** The assessment of oil well fire smoke exposure was based on four factors: (1) exposure to known or suspected carcinogenic compounds in the oil well fire smoke and the risk from that exposure (excess cancer risk), (2) exposure to non-carcinogenic compounds in the oil well fire smoke and the risk from that exposure, (3) exposure to particles in the oil well fire smoke and the risk from that exposure, and (4) the number of days exposed to oil well fire smoke. These exposure levels were then compared to USEPA national standards to determine the extent of risk they pose to the individual.

**b. Excess Cancer Risk.** Excess cancer risk from a particular environmental exposure such as the oil well fire smoke, is defined as the extra risk of getting cancer from that exposure alone. This risk is in addition to the risk of cancer from other sources. This included such things as smoking, diet, excess sun, or other environmental exposures. The excess cancer risk caused by exposure to the oil well fire smoke was determined by evaluating the air concentration of the compounds that cause cancer against a USEPA toxicity factor (cancer slope factor). The risk from all the cancer causing compounds in the oil fire smoke, for all the days the person was exposed were added together to determine the total excess cancer risk. This risk is the additional chance of getting cancer from oil well fire smoke exposure, such as one in a million. This means if one million people received this exposure then, potentially one person may develop cancer. The chart showing the individual Service members cancer risk also shows the range of risks for all exposed troop units and compares them to the USEPA risk limits of one in ten thousand (1E-04) to one in a million (1E-06).

**c. Non-Cancer Risk.** Exposure to certain compounds causes health effects other than cancer. These compounds, called non-carcinogens, may affect the function of organs and systems in the body. One major difference between exposure to carcinogens and non-carcinogens is that the effects caused by non-carcinogens stop when the exposure stops. To determine the hazard from environmental exposure to non-carcinogenic compounds in oil well fire smoke, a method similar to that used for carcinogens was applied. The air concentration of the compound was evaluated by comparing it to a USEPA toxicity value called the reference concentration. The reference concentration is the amount of a chemical that a person can be exposed to in the air for their entire lifetime without a bad health effect. These reference concentrations are set to protect sensitive subpopulations (i.e., the elderly, children in schools, daycare centers, and so forth). Oil well fire smoke exposures in the Persian Gulf were for much shorter periods (days to weeks) and affected generally healthy Service members. To determine the impact of many non-carcinogenic chemicals in the oil well fire smoke, the value obtained when each non-carcinogen was evaluated were added together to obtain the hazard index for the total exposure. The USEPA limit for

exposure to non-carcinogenic compounds is a Hazard Index of 1. The chart showing the individual Service members non-cancer hazard index also shows the range of hazard indices for all exposed troop units and compares them to the USEPA limit of 1. A hazard index of 1 or less means there is no risk of health problems, while an index greater than 1 means there is the potential for health problems. However, a hazard index greater than 1 does not mean an individual will have a health problem because the system is meant to protect sensitive individuals, such as older people or children.

**d. Total Suspended Particulate (TSP) Exposure.** In addition to chemical compounds, the oil fire smoke contained small particles of carbon material (total soot) that could be inhaled. The total quantity of all the particles from the oil well fire smoke is known as TSP. The USEPA National Ambient Air Quality Standard for TSP is 75 micrograms per cubic meter of air (annual standard) and 260 micrograms per cubic meter of air (daily standard). These standards were withdrawn in 1986 in favor of a standard for small particles that get deeper into the lungs. However, we are still using the TSP standard because this is the only data the oil well fire smoke model produced. It is not applicable to use the annual standard in evaluating the veteran's TSP exposure because there was not a long enough exposure period. However, the daily standard is appropriate and was used to evaluate the veteran's TSP exposure because it is the only U.S. standard available to evaluate TSP exposures.

Note: Fumes are composed of particles formed during the combustion of a solid material. Smokes are composed of a mixture of fumes, vapors, and gases. In this appendix, the terms fumes and smokes are used interchangeably.

## **Appendix C**

### **Pesticide Exposure**

#### **C-1. Introduction.**

The requirement for pesticide use in the Kuwait Theater of Operation (KTO) arose due to the prevalence of pests such as filth flies, sand flies, mosquitoes, fleas, and lice indigenous to this part of the Middle East. These insects carry several infectious diseases; including leishmaniasis, sand fly fever, malaria, and typhus. Unabated, these diseases were believed to be capable of incapacitating a large number of the U.S. and Coalition fighting force. To combat this threat more than 60 different pesticide products and formulations were used during the Gulf War. This total includes a variety of products that include sprays, powders, baits, pest strips, and flypaper. Depending on its intended use and the pest it was formulated to target, most of the pesticide products consisted of at least one active ingredient and one or more inert ingredients.

Based on a thorough analysis of the available data, investigators focused on 15 pesticides of potential concern containing 12 active ingredients. The compounds consist of five organophosphate pesticides (azamethiphos, chlorpyrifos, diazinon, dichlorvos and malathion); three carbamate pesticides (bendiocarb, methomyl, and propoxur); two pyrethroid pesticides (permethrin and d-phenothrin); one organochlorine pesticide (lindane); and one repellent (DEET). Investigators believe these active ingredients posed the greatest potential hazard to U.S. Service members due to manner of use, prevalence of use, and toxicity. Some pesticide products containing these active ingredients were used only on a limited basis, and some were used by only a very small number of U.S. Service members. Others received widespread use and were largely available to the general military population. All were considered safe at the time for general use under normal application conditions and when applicators followed instructions for use on the packaging labels.

These or similar pesticide products were available for purchase by the general public at local garden and hardware supply stores and, when used during the Gulf War, were approved by the USEPA and/or the U.S. Food and Drug Administration for general use by the U.S. public. However, in recent years, the USEPA has moved to limit the uses of some of the active ingredients, due mainly to concerns about possible impacts on the health of children. Some pesticide products, such as the fly bait, were purchased in-theater by authorized personnel for unit use or by individuals for their personal use. Some of these locally purchased products were not registered with the USEPA. We know from information received during veteran interviews and from DoD guidance and policy documents that U.S. Forces used pesticides in areas where they worked,



slept, and ate throughout the KTO. The U.S. military personnel used pesticides for several reasons—

- Personal use on the skin and uniforms as an insect repellent;
- As area sprays, surface applications, and fogs to kill crawling and flying insects;
- In pest strips and fly baits to attract and kill flying insects; and
- Delousing agents applied to enemy prisoners of war.

## **C-2. Health Effects from Exposure To Pesticides.**

As part of a continuing effort to better understand the possible causes of undiagnosed illnesses reported by some Gulf War veterans, DOD commissioned RAND to conduct a review of the scientific literature on the potential health effects of pesticides. The RAND report reviews literature on 12 of the 37 pesticide active ingredients used during the war.

The RAND report summarizes the relevant scientific literature and focuses on reports of known pesticide exposures or doses and related health effects where available. According to the literature the range of short- and long-term health effects from exposure to pesticides varies by pesticide and is a function of the duration of exposure and route of exposure (i.e., dermal, inhalation, ingestion). In general, health findings and short-term symptoms from exposure to pesticides include: acetylcholinesterase inhibition, headache, nausea, vomiting, restlessness, ataxia (loss of muscular coordination), tremor, dizziness, anorexia (loss of appetite), shortness of breath, rashes, and itching. More severe short-term health effects include: blood disorders, convulsions, respiratory depression, and coma. Long-term or chronic effects from organophosphates and carbamates include: impaired cognition (memory loss, confusion), fatigue, joint and muscle symptoms, sleep effects, mood effects, and neurological effects. Long-term effects from exposure to pesticides other than organophosphates and carbamates have not been consistently observed.

Several individual differences also complicate analyzing the effect of pesticides on Gulf War veterans. First, genetic differences occur among individuals. For example, some pesticides may be potentially more toxic to people with genetic or acquired differences in susceptibility. Second, many factors may affect the rate and magnitude of pesticide absorption. Protective clothing and differences in skin properties and integrity influence dermal exposure, and inhalation exposure may vary with ventilation rate or as a result of other factors, including properties of airway membranes. Furthermore, the rates at which pesticides are cleared from the body vary by individual.

The RAND considers the organophosphates chlorpyrifos, diazinon, Malathion, dichlorvos; the carbamate, bendiocarb; and the organochlorine, lindane to represent the

greatest risk for adverse health effects. RAND suggests exposure to some pesticides, especially the acetylcholinesterase (AChE) inhibitors, organophosphates and carbamates, could be among potential contributing agents to some of the undiagnosed illnesses reported by Gulf War veterans.

### **C-3. Health Risk Assessment.**

The OSAGWI prepared a health risk assessment (HRA) as part of this investigation. Developed in conjunction with the USEPA and peer-reviewed by subject matter experts and members of the academic community, the HRA's purpose is twofold: to help identify those who may have been at higher risk of pesticide exposure and to estimate the likelihood of certain specific effects from those exposures. Such effects would have been limited to the time of deployment and may or may not have implications for long-term health effects.

Developing the HRA was hampered by the lack of quantitative data on the amount of pesticides used during the Gulf War and the levels of pesticides present in the air and on surfaces to which U.S. military personnel were exposed. For example, during the Gulf War, military personnel may have used 37 different types of pesticide active ingredients, but the amounts used are undocumented. Because the military kept no records on what pesticides it dispensed, it was impossible for investigators to determine the total quantity of pesticides used in the Gulf. The lack of information in several key areas regarding use and application has resulted in a fairly high degree of uncertainty about the results of the HRA. Despite these limitations, the HRA provides the best estimate available to attempt to determine potential exposures.

The HRA relies on exposure scenarios to estimate the likelihood and magnitude of health effects. Exposure scenarios are based on commonly known application procedures and deployment-specific data (e.g., area spraying by certified applicators and enemy prisoner of war delousing by military police) determined through interviews and the RAND survey; however, we do not know the application rates and doses received by the applicators. Therefore, we were obliged to estimate the range of exposure potential to complete the HRA. Since the HRA relies on many assumptions with varying degrees of uncertainty, the risk estimates may indicate areas of potential concern for large groups (e.g., area sprayers or field sanitation teams) but cannot with any certainty predict the hazards and risks to individuals.

The HRA suggests that several subgroups of the general population may have experienced exposures to pesticides that exceeded levels of concern. The OSAGWI investigators estimated that a large minority of the roughly 3,500 to 4,500 Veterans whose assignments included the handling and application of pesticides may have been at elevated risk for short-term health effects. The OSAGWI also estimates, based in

part on the RAND survey that a second group consisting of approximately 30,500 members of the general military population may also have been at elevated risk for short-term health effects because of their exposure to pest strips. A third group, numbering about 7,000 of the general military population may have been overexposed to pesticides applied during area spraying operations. Although there may be a little double counting, OSAGWI considers it likely that at least 42,000 Service members overall may have been overexposed to pesticides during the Gulf War.

In addition, according to the RAND survey, a group consisting of up to roughly 54,500 Service members used or witnessed the use of fly baits. Fly baits were applied not only by trained applicators but widely applied by untrained Service members as well. It is difficult to determine the subgroup of fly bait users who may have been overexposed as the data does not differentiate between indoor and outdoor use, nor does the data differentiate users from those who report they saw fly baits used. It is those who used the product indoors who are considered to have been at risk.

The following table summarizes the exposures for the general military population that exceeded the levels of concern.

**Table C–1. General Military Population Exposures which Exceeded the Levels of Concern**

<b>Pesticide Type</b>	<b>Affected Group</b>	<b>Active Ingredient/Class</b>	<b>Scenarios</b>
<b>Fly baits</b>	Only individuals who handled (applied) fly baits	Azamethiphos (OP)	Medium, High
		Methomyl (C)	High
<b>Pest strips</b>	General military population	Dichlorvos (OP)	Low, Medium, High
<b>Sprayed liquids</b>	General military population	Chlorpyrifos (OP)	High
		Diazinon (OP)	High
		Malathion (OP)	High
<b>Sprayed powders</b>	General military population	Bendiocarb (C)	Medium, High

Legend:

OP - organophosphate

C – carbamate

The results of the HRA alone do not prove either that overexposures occurred during deployment, or that any connection exists between pesticide exposures and chronic health effects months or years after exposure. However, the HRA contends that some groups had the potential to be exposed to concentrations of pesticides exceeding

conservatively derived, risk-based levels of concern. While not conclusive, these results provide justification to consider some pesticide exposures as possible contributing factors to the unexplained illnesses reported by some veterans. Moreover, as the result of the overall lack of data with which to conduct a rigorous analysis, there is insufficient evidence to completely rule out possible long-term effects resulting from exposures to pesticides during the Gulf War.

#### **C-4. Pesticide References.**

1. Pesticide Use During the Gulf War: A Survey of Gulf War Veterans. 2000. Donald D. Fricker, Jr., Elaine Reardon, Dalia M. Spektor, Sarah K. Cotton, Jennifer Hawes-Dawson, Jennifer E. Pace, Susan D. Hosek. January 9, 2001. MR-1018/12-OSD. RAND.
2. Environmental Exposure Report—Pesticides. March 1, 2001. Special Assistant for Gulf War Illnesses, Medical Readiness, and Military Deployment, Department of Defense.
3. A Review of the Scientific Literature as it Pertains to Gulf War Illnesses, Volume 8: Pesticides. 2000. Gary Cecchine, Beatrice A. Golomb, Lee H. Hilborne, Dalia M. Spektor, C. Ross Anthony. January 9, 2001. MR-1018/8-OSD. RAND.

## Appendix D

### Military Deployment Periodic Occupational and Environmental Monitoring Summary (POEMS): Name: [This is a blank template]

**AUTHORITY:** This periodic occupational and environmental monitoring summary (POEMS) has been developed in accordance with Department of Defense (DoD) Instructions 6490.03, *Deployment Health*, 2006, 6055.05, Occupational and Environmental Health, 2008, and JCSM (MCM) 0028-07, *Procedures for Deployment Health Surveillance*, 2007. **See POEMS Instruction Sheet for background and guidance completing/submitting.**

**PURPOSE:** This POEMS documents the DoD assessment of base camp level occupational and environmental health (OEH) exposure data for [site name]. It presents the identified health risks and associated medical implications. The findings are based on information collected from [MO/YEAR through MO/YEAR] to include OEH sampling and monitoring data (e.g. air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases. While this assessment may reflect similar exposures and risks pertaining to historic or future conditions at this site, the underlying data is limited to the time period(s) and area(s) sampled and thus may not reflect fluctuations or unique occurrences. It also may not be fully representative of all the fluctuations during the timeframe. To the extent data allow, this summary describes the general ambient conditions at the site and characterizes the risks at the *population-level*. While useful to inform providers and others of potential health effects and associated medical implications, it does not represent an individual exposure profile. Actual individual exposures and specific resulting health effects depend on many variables and, should be addressed in individual medical records by providers as appropriate at the time of an evaluation of a unique exposure.

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**SITE DESCRIPTION:** [brief summary of location/activities/population – See Instruction Sheet].

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**SUMMARY:** The Table on the following page provides a list of the overall identified health risks at [site name]. Summarized below are the key health risks estimated to present a Moderate or greater risk of medical concern along with recommended follow-on medical actions that providers should be aware. As indicated in the detailed Sections that follow the Table, controls that have been effectively established to reduce risk levels have been factored into this overall assessment. In some cases, e.g. ambient air, specific controls are noted but not routinely available/feasible.

**Short-term health risks & medical implications:** The following may have caused acute health effects in some personnel during deployment at [site name]:

[ ]

While for the most part any associated effects from the above should have resolved post-deployment, providers should be prepared to consider relationships to current complaints. Personnel who reported with symptoms or required treatment while at this site should have exposure/treatment noted in medical records/on SF600.

**Long-term health risks & medical implications:**

[ ]

Providers should still consider overall individual health status (e.g. any underlying conditions/susceptibilities) and potential unique individual exposures (such as occupational, or specific personal dosimeter data) when assessing individual concerns. Certain individuals may need to be followed/evaluated for specific occupational exposures/injuries (e.g. including annual audiograms for those enrolled in Noise Medical Surveillance of the Hearing Conservation

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Program; and personnel covered by Respiratory Protection program and/or Hazardous Waste/Emergency Responders Medical Surveillance).

<b>Where Do I Get More Information?</b>			
<p>If a provider feels that the Service member's or Veteran's current medical condition may be attributed to specific OEH exposures at this deployment location, he/she can contact the Service specific organization below. Organizations external to DoD should contact DoD Force Health Protection and Readiness (FHP &amp; R).</p>			
<p><b>U.S. Army Public Health Command (Provisional) (USAPHC (Prov))</b>                      Phone: (800) 222-9698  <a href="http://chppm-www.apgea.army.mil">http://chppm-www.apgea.army.mil</a></p>	<p><b>Navy and Marine Corps Public Health Center (NMCPHC)</b>                      (formerly NEHC)                      Phone: (757) 953-0700  <a href="http://www-nehc.med.navy.mil">http://www-nehc.med.navy.mil</a></p>	<p><b>US Air Force School of Aerospace Medicine (USAFSAM)</b> (formerly AFIOH)                      Phone: (888) 232-3764  <a href="http://www.brooks.af.mil/units/airforceinstituteofoperationalhealth/index.asp">http://www.brooks.af.mil/units/airforceinstituteofoperationalhealth/index.asp</a></p>	<p><b>DoD Force Health Protection and Readiness (FHP &amp; R)</b>                      Phone: (800) 497-6261  <a href="http://fhp.osd.mil">http://fhp.osd.mil</a></p>
<p>Occupational and environmental sampling data are available in Defense Occupational and Environmental Health Readiness System (DOEHRs) at <a href="https://doehrs-ih.csd.disa.mil/Doehrs/">https://doehrs-ih.csd.disa.mil/Doehrs/</a>. Additional environmental health reports/information are in the DoD OEHS Data Portal: <a href="https://doehsportal.apgea.army.mil/doehrs-oehs/">https://doehsportal.apgea.army.mil/doehrs-oehs/</a>. Regional/country info on endemic/infectious disease from National Center for Medical Intelligence (NCMI) is at <a href="https://www.intelink.gov/ncmi/index.php">https://www.intelink.gov/ncmi/index.php</a></p>			

**POEMS**

**Population-Based Health Risk Estimates – [Blank Template Example\*]<sup>1,2</sup>**

Sources of Identified Health* <sup>3</sup>	Health Risk Assessment Summary <sup>4</sup>	
	Short Term Health Risk	Long Term Health Risks
<b>AIR</b>	<b>Airborne Substances – Overall Short Term Risks:</b>	<b>Airborne Substances – Overall Long-Term Risks:</b>
Particulate matter (PM <sub>10</sub> )		
Particulate matter (PM <sub>2.5</sub> )		
Metals		
Chemical Pollutants		
<b>WATER</b>	<b>Waterborne Substances – Overall Short Term Risks:</b>	<b>Waterborne Substances – Overall Long Term Risks:</b>
Used for Drinking		
Used for Other Purposes		
<b>MILITARY UNIQUE</b>	<b>Military Unique – Overall Short Term Risks:</b>	<b>Military Unique – Overall Long Term Risks:</b>
(e.g. CBRN; Depleted Uranium; Ionizing/Non ionizing radiation)		
<b>ENDEMIC DISEASE</b>	<b>Endemic Disease – Overall Short Term Risks:</b>	<b>Endemic Disease – Overall Long Term Risks</b>
Food borne/Waterborne (e.g., diarrhea-bacteriological)		
<b>Arthropod Vector Borne</b>		
Respiratory		
Water-Contact (e.g. wading, swimming)		
Animal Contact		
<b>VENOMOUS ANIMAL/INSECTS</b>	<b>Venomous Animals/Insects – Overall Short Term Risks:</b>	<b>Venomous Animals/Insects – Overall Long Term Risks:</b>
Snakes, scorpions, and spiders		
<b>HEAT/COLD STRESS</b>	<b>Heat/Cold – Overall Short Term Risks:</b>	<b>Heat/Cold – Overall Long Term Risks:</b>
Heat		
<b>NOISE</b>	<b>Noise – Overall Short Term Risks:</b>	<b>Noise – Overall Long Term Risks:</b>
Continuous		
Impulse		
<b>OTHER</b>	<b>Other – Overall Short Term Risks:</b>	<b>Other – Overall Long Term Risks:</b>
Pesticides		
Asbestos/Lead Paint		
<b>UNIQUE INCIDENT/CONCERNS</b>		

Notes:

\* **[The specific sub Categories of Health Risks listed are general examples and may be somewhat different per site - See POEMS Instruction Sheet for background and guidance completing/submitting.]**

<sup>1</sup> This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the general ambient and occupational environment conditions at **[site name]**. It does not represent a unique individual exposure profile. Actual individual exposures and health effects depend on many variables. For example, while a chemical may be present in the environment, if a person does not inhale, ingest, or contact a specific dose of the chemical for adequate duration and frequency, then there may be no health risk. Alternatively, a person at a specific location may experience a unique exposure – such as **[description of unique event at site]** which has been reported at this site - which could result in a significant individual exposure. Any such person seeking medical care should have their specific exposure documented in an SF600.

<sup>2</sup> This assessment is based on specific data and reports obtained from the **[MO/YEAR through MO/YEAR]** timeframe. It is considered a current representation of general site conditions but may not reflect certain fluctuations or unique exposure incidents. Acute health risk estimates are generally consistent with field-observed health effects.

<sup>3</sup> This Summary Table is organized by major categories of identified sources of health risk. It only lists those sub-categories specifically identified and addressed at **[site name]**. The health risks are presented as Low, Moderate, High or Extremely High for both acute and chronic health effects. The risk level is based on an assessment of both the potential severity of the health effects that could be caused and probability of the exposure that would produce such health effects. Details can be obtained from USAPHC (Prov). Where applicable, “None Identified” is used when though an exposure was identified, no risk of either a specific acute or chronic health effects were determined. More detailed descriptions of OEH exposures that were evaluated but determined to pose no health risk are discussed in the following sections of this report.

<sup>4</sup> Risks in this Summary Table are based on quantitative surveillance thresholds (e.g., endemic disease rates; host/vector/pathogen surveillance) or screening levels (e.g., Military Exposure Guidelines (MEGs) for chemicals). Some previous assessment reports may provide slightly inconsistent risk estimates because quantitative criteria such as MEGs may have changed since the samples were originally evaluated and/or because this assessment makes use of all historic site data while previous reports may have only been based on a select few samples.



### Discussion of Health Risks at [Site Name] by Source

*The following is a blank template that shows the general format of the various sections to be completed for a POEMS. Sections can be expanded to the extent necessary to capture relevant information. See attached POEMS Instruction Sheet for background and additional guidance/consideration when completing the POEMS.*

The following Tables describe the major source categories of potential health risk that were evaluated at [site name]. For each category, the evaluation process includes identifying what, if any, specific sub-categories/health concerns are present. This initial step results in “screening out” certain sub-categories that pose no identifiable health risk (for example if all data is below screening levels). While these Tables identify sub-categories that have been determined to present no identifiable health risk, the Summary Table on the previous page only contains those sub-categories that were determined to pose some level of potential health risk.

<b>1. AIR</b>		
<b>Site-Specific SOURCES Identified (all those checked):</b>		
<input type="checkbox"/> Wind-blown Sand	<input type="checkbox"/> Commercial Industry _____	<input type="checkbox"/> Other : vehicles
<input type="checkbox"/> Burn pits	<input type="checkbox"/> Agricultural	<input type="checkbox"/> Not Determined
<b>[include information regarding sources and completed exposure pathways]</b>		
<b>Assessment of Data and Identified Risks</b>		
<i>Particulate matter, 10 microns (PM<sub>10</sub>)</i>  (see CHPPM 2008 PM factsheet; 64-009-0708 for more details)	<b>Sample data/Notes:</b> _____	
	<b>Acute health risk:</b> _____	
	<b>Chronic health risk:</b> _____	
<i>Particulate matter, 2.5 microns (PM<sub>2.5</sub>)</i>  (see CHPPM 2008 PM factsheet; 64-009-0708 for more details)	<b>Sample data/Notes:</b> _____	
	<b>Acute health risk:</b> _____	
	<b>Chronic health risk:</b> _____	
<i>Metals</i>	<b>Sample data/Notes:</b> _____	
	<b>Acute and chronic health risk:</b> _____	
<i>Chemical Pollutants (gases and vapors)</i>	<b>Sample data/Notes:</b> _____	
	<b>Acute and chronic health risk:</b> _____	

<b>2. SOIL</b>		
<b>Site-Specific SOURCES of Contaminants Identified (all those checked):</b>		
<input type="checkbox"/> Waste Site/Burn pits	<input type="checkbox"/> Commercial Industry _____	<input type="checkbox"/> None
<input type="checkbox"/> Agricultural	<input type="checkbox"/> Other : vehicles	<input type="checkbox"/> Not Determined
<i>[include information regarding sources and completed exposure pathways]</i>		
<b>Assessment of Data and Identified Risks</b>		
<i>Analyses includes metals/inorganics as well as organics</i>	<b>Sample data/Notes:</b> _____	
	<b>Acute and chronic health risk:</b> _____	

<b>3. WATER*: Used for Drinking and Other Purposes(Personal Hygiene, Cooking, Showering, etc.)</b>			
<b>Identified Water Supplies</b>			
<input type="checkbox"/> Bottled; Local procured	<input type="checkbox"/> Military Bottled/Packaged (unknown)	<input type="checkbox"/> ROWPU	<input type="checkbox"/> Municipal Sources
<p><b>*Perform separate risk assessments and include information on two tables (e.g. 3A and 3B) if there are distinct different water sources for “Drinking Water” and “Water for other Purposes (personal hygiene, cooking, etc)”</b></p> <p>Water must meet potable water standards per <i>TB Med 577</i>. Routine field tests conducted by _____ include bacteriological, CBRN, free available chlorine (FAC) and other sanitation surveillance parameters per <i>TB Med 577</i>.</p>			
<b>Assessment of Data and Identified Health Risks</b>			
<i>Analyses include metals/inorganics as well as organics</i>	<b>Sample data/Notes:</b> _____		
	<b>Acute or chronic health risk</b> _____		

<b>4. MILITARY UNIQUE</b>	
<b>Chemical Biological, Radiological Nuclear (CBRN) Weapons:</b>	
_____	
<b>Acute or chronic health risk:</b> _____	
<b>Depleted Uranium (DU):</b>	
_____	
<b>Acute or chronic health risk:</b> _____	
<b>Ionizing Radiation</b>	
<b>Acute or chronic health risk:</b> _____	
<b>Non-ionizing Radiation</b> (example – possible include summary info regarding EMF/laser injuries that are to be submitted through specified repositories - see Instruction Sheet)	
<b>Acute or chronic health risk:</b> _____	

<p><b>5. ENDEMIC DISEASE</b>                  (based on NCMI [date ] (<a href="https://www.intelink.gov/ncmi/index.php">https://www.intelink.gov/ncmi/index.php</a>)                  NOTE: "Risk" level refers to both severity of disease (without controls) and probability of disease based on local rates/endemic status. Diseases described are those presenting greater risk when compared with US conditions. Most identified disease risks can and are being mitigated with military preventive medicine measures/policies.</p>
<p><b><i>Food borne and Waterborne Diseases</i></b></p>
<p>Acute or chronic health risk: _____</p>
<p><b><i>Arthropod Vector-Borne Diseases</i></b></p>
<p>Acute or chronic health risk: _____</p>
<p><b><i>Water Contact Diseases</i></b></p>
<p>Acute or chronic health risk: _____</p>
<p><b><i>Respiratory Diseases</i></b></p>
<p>Acute or chronic health risk _____</p>
<p><b><i>Animal- Contact Diseases</i></b></p>
<p>Acute or chronic health risk: _____</p>

<p><b>6. VENEMOUS ANIMAL/INSECT</b></p>
<p><b><i>Snakes, scorpions, and spiders</i></b></p>
<p>Acute or chronic health risk. _____</p>
<p><b><i>Other</i></b></p>
<p>Acute or chronic health risk. _____</p>

<p><b>7. HEAT/COLD STRESS</b></p>
<p><b><i>Heat</i></b></p>
<p>Acute or chronic health risk. The risk of heat injury is _____ in unacclimatized personnel. Risk is reduced to _____ through preventive measures. Long term health implications from heat injury are rare but can occur – especially from more serious heat injuries such as heat stroke. It has also been considered possible that high heat in conjunction with various chemical exposures can increase long term health risks, though specific scientific evidence is not conclusive. The overall risk though _____ may be greater to certain susceptible persons – those older (&gt;45), in lesser physical shape, or with underlying medical/health conditions.</p>
<p><b><i>Cold</i></b></p>
<p>Acute or chronic health risk. _____</p>

<b>8. NOISE</b>
<b><i>Continuous:</i></b>
_____
Acute or chronic health risk: _____
<b><i>Impulse:</i></b>
_____
Acute or chronic health risk: _____
<b>OVERALL RISKS, CONFIDENCE, CONTROLS, ADDITIONAL NOTES</b>

<b>9. OTHER UNIQUE OCCUPATIONAL HAZARDS</b>
_____
Acute or chronic health risk _____
_____
Acute and chronic health risks: _____

<b>10. UNIQUE INCIDENTS/CONCERNS</b>
<b><i>[Event description - e.g., specific situation/condition resulting in specific real-time medical treatment/health assessment/risk communication actions]</i></b>
_____
Acute or Chronic health risk: _____

## APPENDIX E

August 28, 2009

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### GUIDANCE FOR COMPLETING POEMS

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This guidance document provides general guidance regarding various aspects of developing and completing Periodic Occupational and Environmental Monitoring Summary (POEMS). The initial pages describe overarching procedural aspects. The 'POEMS checklist' at the end provides some additional hazard-specific guidance.

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### POEMS BACKGROUND AND SCOPE

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**PURPOSE:** The POEMS standardizes the DOD's documentation of the estimated short-term (during deployment) and long-term (post deployment) health risks and medical implications associated with identified occupational and environmental health (OEH) exposures at major deployment sites (e.g., base-camps).

**AUTHORITY:** POEMS are developed as a means to address the documentation requirements established by Department of Defense (DOD) Instructions 6490.03, *Deployment Health*, 2006; 6055.05, *Occupational and Environmental Health*, 2008; and Memorandum, Joint Chiefs of Staff, MCM, 2007, subject: *Procedures for Deployment Health Surveillance*.

**TIMEFRAMES:** POEMS are to be created and validated/updated for every major deployment site as soon as sufficient data is available, but at least annually. In general, POEMS should be a summary of information reflecting a year or more of data to ensure adequate collection of exposure information.

**CLASSIFICATION/PUBLICATION/ACCESS:** POEMS will be unclassified but will be posted on the password-protected Deployment Occupational and Environmental Health Surveillance Data Portal (<https://doehsportal.apgea.army.mil/doehrs-oehs/>.) Because this is a DOD password-protected internet application, you will need to register for a user name and password if you do not already have one. All key related documents (such as raw data, calculations, assessments, reference reports used to derive risk estimates) should also be archived, though these underlying documents/files may have more restricted access/availability.

**RESPONSIBILITY:** The Combatant Command (COCOM) Surgeons are responsible for ensuring POEMS are completed for sites in their Area of Responsibility. They may delegate the responsibility of the specific site POEMS to Service Component and Joint

Task Force (JTF) Surgeons. They should develop site prioritization lists and enlist the support of Service public health organization (e.g., USAPHC (Prov), U.S. Air Force School of Aerospace Medicine, Navy and marine Corps Public Health Center) to draft the content of a site POEMS. The USAPHC (Prov) oversees the DOD data archival website for publication of final POEMS and associated documents; however, approval of 'final' POEMS must come from the COCOM Surgeon or designated Component/Joint Task Force Surgeon. In all cases, POEMS documents should be 'ground-truthed' by preventive medicine personnel who have physically been present at the location.

## POEMS METHODOLOGY

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**INFORMATION SOURCES:** The POEMS should be based on evaluation and assessment of all available OEH sampling and monitoring data (e.g. air, water, and soil), as well as all field investigation surveys and health related reports, and country/area-specific information on endemic diseases for a selected time-duration. This generally includes, at a minimum, the Occupational and Environmental Health Site Assessment (OEHSA) and/or related documents (Environmental Baseline Survey (EBS), Environmental Health Site Assessment (EHSA), and Industrial Hygiene Site Assessments) as well as all monitoring/sampling data contained in the Defense Occupational and Environmental Health Readiness System (DOEHRS) at <https://doehrs-ih.csd.disa.mil/Doehrs/>. Regional/country specific information on endemic/infectious disease from the National Center for Medical Intelligence (NCMI) is at <https://www.intelink.gov/ncmi/index.php>. POEMS developers also need to evaluate any additional environmental health reports/information in the DOEHS Data Portal: <https://doehsportal.apgea.army.mil/doehrs-oehs/>. In some cases, the DOEHRS and DOEHS Data Portal do not contain all relevant reports and field monitoring data and/or specific reports/documents describing field monitoring data/ unique investigations/ evaluations pertaining to potential OEH exposure hazards. Examples might include field water quality assurance surveys and monitoring data, pest surveillance surveys/reports, noise surveys, radiation surveys/monitoring data, entomological surveys, infectious/endemic disease reports and polymerase chain reaction (PCR) results. Because of this, it is necessary to coordinate with site preventive medicine units (e.g., Forward Deployment Preventive Medicine Units) to acquire any such additional information/data.

The POEMS describes the overall OEH risks associated with a site and is not itself an individual Service member exposure profile. Unique individual exposures that are identified/documented (such as from dosimeters or specific occupational activity monitoring, or as a result of a time-/location specific "exposure incident" that occurred at the site), could be *summarized* in the unique incident section (Section 10) of the POEMS. It is important that individual dosimeter data and/or medical treatment

information be documented in individual medical records using the SF Form 600 (*Medical Record – Chronological Records of Medical Care*, Rev. 6/97).

Certain additional hazard-specific information sources are also mentioned in the 'POEMS template checklist' further in this document.

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Any data/reports used in the development of a POEMS that is not in <https://doehrs-ih.csd.disa.mil/Doehrs/> or <https://doehsportal.apgea.army.mil/doehrs-oehs/> should be submitted to those sites for archiving as required by the DOD and Joint Staff policy.

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**APPLICATION OF THE MILITARY RISK MANAGEMENT (MRM) FRAMEWORK:** The goal of the POEMS is to provide a description of the types of identified OEH exposures associated with deployment to a specified site during a specified time in terms of the potential for associated acute (real-time/during deployment) and chronic (long-term/post-deployment) health risks. Because the types of health effects and impacts from OEH exposures can vary, and because they so often can occur simultaneously, as well as with other deployment related (non-OEH) hazards, it is necessary to characterize the significance of the impacts (risks) on a similar scale. This allows Commanders and other decision makers a means to better compare risks and mitigate the overall 'composite risk' to personnel and the mission that result from the military activities at a particular location. Military-related risks are characterized according to the long-established military risk matrix shown below cited in Field Manual (FM) 3-100.12/MCRP 5-12.1C/NTTP 5-03.5/AFTTP (I) 3-2.34, MTTP, *Risk Management*, February 2001 (See Figure 1). In addition, health risks associated with acute and chronic health effects caused by OEH exposures must be estimated and characterized with the matrix and the associated risk management process per DOD Instruction 6490.03 and Memorandum, JCS MCM 0028-07. This means that—

- For purposes of the POEMS, the severity of effects and probability of exposure to all identified OEH hazards (e.g., chemical, radiation, noise, endemic disease, heat, and so forth) should be evaluated and characterized in terms of medical implications/impacts (e.g., risks).
- Risk estimates do not represent unique individual exposure profiles but rather represent a general population risk level. While unique exposure incidents that have resulted in individuals with symptoms/requiring treatment can and should be summarized in the POEMS, the unique individuals' situation should be document in their individual medical record (SF 600). The POEMS itself is not designed to be an individual exposure profile.

- Risks associated with OEH exposures and their resulting health effects, must be characterized as Low, Moderate, High, or Extremely High per Figure 1. These qualitative levels are “risk estimates.”
- Risk estimates are derived by the risk management process that includes the follow steps:
  - Hazard identification.
  - Hazard assessment (See Figure 1).
    - Determine Hazard severity (see Figure A-1).
    - Determine Hazard probability (see Figure A-2).
    - Characterize Risk (see Figures A-3 and A-4).
    - Describe Confidence in risk estimate (See Figure A-5).
- Risk estimates associated with acute and chronic health effects from OEH exposures must be characterized and presented as two **separate** risk estimates. Separate risk level definitions for acute and chronic health effects are contained in the Appendix at the end of this document. These are derived from the specific acute and chronic health effects severity level definitions contained in Memorandum, JCS MCM 0028-07, also contained in the Appendix along with detailed description of the various Confidence levels.
- Acute health effects generally have direct ‘tactical’ mission consequences (e.g., short-term risk), while chronic health effects have post deployment impacts (long-term risk) to military resources and force readiness. (See Appendix for more details).

**Figure 1. Military Risk Management Matrix**

HAZARD SEVERITY	HAZARD PROBABILITY				
	Frequent (A)	Likely (B)	Occasional (C)	Seldom (D)	Unlikely (E)
Catastrophic (I)	Extremely High	Extremely High	High	High	Moderate
Critical (II)	Extremely High	High	High	Moderate	Low
Marginal (III)	High	Moderate	Moderate	Low	Low
Negligible (IV)	Moderate	Low	Low	Low	Low



## POEMS CHECKLIST

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### FRONT PAGE:

- Note that much of this information should be able to be obtained from the occupational and environmental health site assessment (OEHSA) and any available preventive medicine surveys and occupational and environmental sampling for the site.
- The PURPOSE paragraph contains general standardized information. Complete information from template.
- The SITE DESCRIPTION paragraph should briefly describe the general location and site physical features, activities, population/unit information, to the extent appropriate and remain unclassified.
- The SUMMARY paragraph identifies the key health risk assessment findings and the medical interpretation of the significance of those findings at the site. Typically, this means moderate or greater risks of acute and chronic health effects. The template includes suggested text such as the statement “Providers need to consider overall individual health status (e.g., any underlying conditions/susceptibilities) and potential unique individual exposures.”
  - The acute effects may have occurred to persons while at the site and may still be occurring. Include a statement that “personnel who report with symptoms or require treatment because of an exposure while at this site should have the exposure and treatment noted in medical records on an SF 600.”
  - The risk of chronic effects should identify the health risk level and include statements as to whether there is a need for providers to conduct any specific post deployment evaluations, testing, or continued medical surveillance (active or passive).

### SITE OEH HEALTH RISK ESTIMATES SUMMARY TABLE:

- The Summary Table simply summarizes the risk estimates for the site and is completed once you have assessed all identified hazards and completed the detailed OEH Hazard Source Assessment Tables in the Discussion of Health Risks section (see following guidance).
- The Table is organized by major categories of potential sources of health risk. The subcategories listed are examples only and may be different depending on the site being assessed. This means existing sub categories may be deleted or

additional subcategories may be added. It should be emphasized that the contaminants identified in the subcategories of the Summary Table are examples only and may be different depending on the site being assessed.

- List only those subcategories determined to pose a potential health risk (if no acute or chronic hazard is identified then do not include the sub-category). These can be discussed in the follow-on discussion source tables. In addition, negative exposure data should be documented in the discussion of health risk tables.
- Present the health risks as Low, Moderate, High or Extremely High.
- Insert “None Identified” when no specific acute or chronic health effects are identified (e.g., not associated with the type of source or results are below screening levels).
- Risks in this Summary Table are generally determined through use of quantitative surveillance thresholds (e.g., endemic disease rates; host/vector/pathogen surveillance) or screening levels (e.g., military exposure guidelines (MEGs) for chemicals and guidelines/standards for lasers radiofrequency, noise, and ionizing radiation). Note that some previous assessment reports may provide slightly inconsistent risk estimates because quantitative criteria such as MEGs or other guidelines may have changed since previous reports or assessments were completed. Also note that risk estimates may change as a more robust dataset is developed for a site (e.g., previous assessments of only a few samples may have resulted in different conclusions).

#### **DETAILED OEH HAZARD SOURCE ASSESSMENT TABLES:**

- The information in the introductory paragraph of this Discussion of Health Risks section of the POEMS contains standardized information.
- For each section Table, complete the various ‘boxes’ of information based on an evaluation of all pertinent data. In general—
  - Summarize the sources of the particular types of hazards at the site, dates of data collection/monitoring data collected for this hazard, a summary of the assessment process/basis for determination of the risk estimate (e.g., hazard severity, probability, and overall degree of confidence in the risk estimate).
  - Documentation of any potential associated health effects/symptoms (e.g., field anecdotal information) is also appropriate.

- Identify any hazard mitigation procedures /medical countermeasures or personal protective equipment (PPE) that is used to minimize or prevent exposure, especially where such procedures reduce the risk.

- **Table 1—Air.**

- Describe/assess the OEH airborne constituents identified through various monitoring and sampling efforts. Identify the theater or reach back laboratory that performed the analyses. Since laboratory analytical results do not include all chemical hazards, like certain toxic industrial chemicals (chlorine, hydrogen sulfide, and so forth). It is important to include data from field/hand held sources (this may not always be in DOEHRS—check with the field for such data).
- Describe seasonal variations if appropriate.
- Note that negative sample results are very important to include in the POEMS if available.
- Note any gaps/limitation in data (e.g., limited temporal data results in very low confidence in chronic risk estimates) and potential implications to overall risk estimate(s).
- Consider air data from other nearby sites when there are data gaps—where ambient conditions are expected to be similar to your location use data from sites with more robust data sets.
- Ensure documentation of any unique airborne exposure incidents (such as one-time release of an acutely toxic industrial chemical (TIC)) that resulted in treatment of personnel/complaints/special investigation. Additional details may be referred to/ include in Table 10 (Unique Exposures). Ensure that appropriate documents of the incident including a roster of affected personnel, have also been submitted to the DOEHS data portal. The roster should identify individuals and their units.
- Identify any areas/hazards that need follow up for surveillance. Note any subpopulations under specific medical surveillance programs/Respiratory Protection programs.

- **Table 2—Soil.**

- Describe any unique sources of ground contamination. Explain how an exposure to any contaminated soil is/was expected to have occurred.
- Describe measures to mitigate/eliminate contact/exposure to identified soil contamination.

- **Table 3—Water (Used for Drinking and for Other Purposes (Personal Hygiene, Cooking, and so forth)).**
  - Perform separate risk assessment and include information on two tables (e.g., 3A and 3B) if there are distinct different water sources for “Drinking Water” and “Water for other Purposes (personal hygiene, cooking, and so forth).”
  - Identify the supply (e.g., bottled water, packaged water, reverse osmosis water purification unit, host nation, or other sources and source(s) of raw water for drinking).
  - Identify who is treating and/or providing the drinking water, who is conducting field monitoring/quality assurance/quality control.
  - Describe any results regarding bacteriological or other field-testing (e.g., free available chlorine, etc.); identify hazards clearly.
  
- **Table 4—Military Unique.**
  - Note that the subcategories in the POEMS Template are examples and may be different at the assessed site. Hazards could include chemicals, chemical warfare agents, TICs/toxic industrial materials, depleted uranium, ionizing and non-ionizing radiation.
  - If an incident from a military-unique situation occurred, provide comprehensive details of the incident and include a roster of personnel involved/potentially exposed. Ensure a comprehensive description is entered into TABLE 10—UNIQUE INCIDENTS/CONCERNS. As previously stated, the roster should identify individuals and their units and be submitted to the DOEHS data portal. Note there are specific incident submission requirements for electromagnetic frequency field mishaps and overexposure and laser injuries per DOD Instruction 6055.11 (*Protecting Personnel from Electromagnetic Fields*, August 29, 2009) and DOD Instruction 6055.15 (*DOD Laser Protection Program*, May 4, 2007) respectively.
  
- **Table 5—Endemic Disease.**
  - The introductory portion provides standardized information. Data used will include Regional/Country specific information on endemic/infectious disease from the National Center for Medical Intelligence (NCMI) at <https://www.intelink.gov/ncmi/index.php> and field surveys/information for the POEMS timeframe.
  - Note that the subcategories in the POEMS Template are examples and may be different at the assessed site. Disease categories may include food borne

- and waterborne diseases, arthropod vector-borne diseases, water contact diseases, respiratory diseases, and animal-contact diseases.
- Specifically evaluate/document site-specific data related to DNBI rates for described diseases and any disease control/medical countermeasures employed to include vaccines, vector control, and so forth.
  - **Table 6—Venomous Animal/Insect.** Hazards are site/area specific could include: snakes, scorpions, spiders, ants, and so forth. Complete following similar procedures that were used for completing Table 5—Endemic Diseases.
  - **Table 7—Heat/Cold Stress.**
    - Typically, hazard is either heat or cold though both may be present at a site.
    - Identify specific hazard based on published indices and control measures used at site to reduce risk. Identify as appropriate numbers/rates of associated casualties.
  - **Table 8—Noise.**
    - Hazards could include blast overpressure from weapons (howitzers/recoilless rifle firing); steady state hazardous or nuisance noise from aircraft flight operations or other specific site operations (e.g., generators); and impulse noise primarily from weapons firing.
    - Identify if certain sub populations have unique risks and if they are in Noise Surveillance programs.
  - **Table 9—Other.** Unique Site hazards could include pesticides, hypo and hyper baric illness, vision related hazards, unique waste disposal practices/operations, asbestos or lead based paint in facilities, and specific operation occupational hazards such as welding/grinding/painting armored vehicles, or ergonomic related issues. In general, these hazards are documented when preventive medicine personnel have performed site-specific assessments/investigations.
  - **Table 10—Unique Incidents/Concerns.** These typically represent time or site-specific ‘incidents’ that address a unique exposure group or hazard type. The incidents/concerns may have occurred or may be non-existent at the assessed site. Hazards could include a one-time chemical release (e.g., chlorine), and/or specific investigation of a hazard (i.e., power plant emissions) or activity at a site, and so forth. The hazard may have been determined to pose little or no health risk or may have posed a risk to only a unique group of individuals. Typically, this ‘summary’ refers the reader to a more detailed documentation/report/factsheet of the incident/hazard source.

## Annex 1 to Appendix E

### Military Risk Management Applied to OEH Exposures:

#### Details and Definitions for Hazard Assessment and Risk Characterization

**E-1-1. Hazard Severity.** The hazard severity of any given deployment-related exposure refers to the extent and severity of potential injury, illness, disease, or other adverse health effects within the population under assumed exposure conditions, integrated with the significance of the health consequences to the tactical and strategic missions. The Joint Staff has provided definitions of health severity levels for use in the military risk management process; these are presented in Figure E-1-1. The difference between “acute” and “chronic” health effects as it pertains to the military risk assessment process is described below—

- **Acute Health Effects.** These are health effects that develop immediately or shortly after an exposure. Acute effects occur after single relatively brief or short-term exposures (minutes to days). Acute health effects can degrade the ability of personnel to conduct real-time deployment required mission tasks and thus have direct (tactical) consequences to military operations. The overall consequences (risks) resulting from acute health effects include direct impacts to success of the specific tactical mission resulting from both the soldier/unit capability degradation as well as any required medical or preventive medicine resources.
- **Chronic (Latent) Health Effects.** These are health effects that develop or continue post-deployment (e.g. months or years later). While it is possible for certain single, short-term exposures to result in a latent health effect (e.g., permanent damage to lung tissue leading to long-term respiratory disease), chronic, long-term, or latent health effects are generally associated with continuous or repeated chronic or long-term exposures (e.g., exposures that last at least many months or, more often, for many years). While chronic effects themselves do not pose significant tactical impact (risk), the impacts on morale (psychological and physiological considerations) and resulting resources required for risk communication can affect unit effectiveness. In addition, per current policy, field Commanders must consider the future consequences of chronic health effects on the full force readiness life cycle. The force readiness ‘life cycle’ includes personnel accession through retirement or separation and beyond. Military strategic consequences include the DOD resources that may be required for medical documentation, surveillance, and follow-up of personnel if chronic long-term effects are associated with exposures encountered during deployments.

**Figure E-1–1. Health Effects Descriptions for Each Hazard Severity Category (Memorandum, JCS MCM 0028-07)**

<b>Negligible Severity</b>	<b>Marginal Severity</b>	<b>Critical Severity</b>	<b>Catastrophic Severity</b>
<p><u>Acute Effects</u></p> <p>Few exposed personnel (if any) are expected to have noticeable health effects during mission. Exposed personnel are expected to be able to effectively perform all critical tasks during mission operations. Minimal to no degradation of abilities to conduct complex tasks are expected.</p>	<p><u>Acute Effects</u></p> <p>Many exposed persons are expected to have noticeable but not incapacitating health effects. Observable effects require minimal if any medical attention but may reduce some individual physical capabilities and/or may enhance stress-related casualties. Exposed personnel able to perform most critical tasks. Note: Ability to accomplish complex tasks may be degraded.</p>	<p><u>Acute Effects</u></p> <p>Personnel are expected to have incapacitating health effects that require immediate medical treatment or support (e.g., are considered 'casualties'.) There may be limited numbers of fatalities. Personnel not experiencing these more serious effects are expected to have at least noticeable, but not incapacitating health effects. Exposed personnel will have limited ability to perform most critical tasks. Note: Ability to accomplish complex tasks likely to be degraded.</p>	<p><u>Acute Effects</u></p> <p>Casualties with severe incapacitating effects requiring immediate and significant medical attention and/or additional support for survival. Increasing number of fatalities are expected. Exposed personnel unable to perform critical tasks.</p>
and/or	and/or	and/or	not a driver
<p><u>Chronic Effects</u></p> <p>Few exposed personnel (if any) are expected to develop delayed onset, irreversible effects</p>	<p><u>Chronic Effects</u></p> <p>Many exposed personnel are plausibly expected to develop delayed onset, irreversible effects. While this may not affect the immediate physiological capabilities of individuals, commanders must consider long-term implications and appropriately communicate the potential risks. Operational stress related implications may adversely impact operations particularly over extended operational periods.</p>	<p><u>Chronic Effects</u></p> <p>Majority to all exposed personnel are plausibly expected to develop delayed onset, irreversible effects due to the specified exposure. While this may not affect the immediate physiological capabilities of individuals, commanders must consider long-term implications and appropriately communicate the potential risks. Psychological implications may adversely impact operations particularly over extended operational periods.</p>	<p><u>Chronic Effects</u></p> <p>This level of hazard severity is reserved for the most serious of conditions where immediate survivability against acute effects is the priority. Those that survive may be at increased risk for certain chronic effects.</p>

**E–1–2. Hazard Probability.** For assessing OEH hazards, the hazard probability can be generally defined as the likelihood that the population exposure will result in the hazard severity outcome. The five probability levels in the operational risk matrix (Figure E–1–1) are defined in Figure F–2 below. In this case, the hazard severity is determined before the hazard probability.

**Figure E–1–2. Hazard Probability Level Interpretation**

Rank	Interpretation
<b>Frequent</b>	Personnel will continuously experience exposures that are greater than that required to produce the health effect outcomes associated with the hazard severity level.
<b>Likely</b>	Personnel will commonly experience exposures that are greater than that required to produce the health effect outcomes associated with the hazard severity level.
<b>Occasional</b>	Personnel will often experience exposures that are greater than that required to produce the health effect outcomes associated with the hazard severity level.
<b>Seldom</b>	Personnel will rarely experience exposures that are greater than that required to produce the health effect outcomes associated with the hazard severity level.
<b>Unlikely</b>	Personnel are unlikely to experience exposures that are greater than that required to produce the health effect outcomes associated with the hazard severity level.

**E–1–3. Risk Characterization.**

**a. Short-term (During Deployment) Health Risks.** Acute health effects from environmental exposures can pose **direct risks** to the mission. Current doctrinal operational (non medical) risk definitions are presented in Figure E–1–3, along with the addition (in italics) the possible medical and preventive medicine risk management responses that may be anticipated. In addition to the medical resources needed to treat and document acute effects, certain exposures that result in acute health effects may also be associated with circumstances that require post-deployment medical surveillance/follow-up. The potential for any post-deployment medical follow-up and surveillance should be addressed as part of the risk management response triggered by the “chronic” risk estimate as discussed in the following section and Figure E–1–3.



**Figure E–1–3. Risk Level Definitions for Acute Health Effects**

Risk Level	Consequences to Military Operations and Force Readiness
Extremely High	Loss of ability to accomplish the mission if hazards occur during mission. <i>Notable in-theater medical countermeasures and resources anticipated. For example, protection, treatment, and exposure documentation.</i>
High	Significant degradation of mission capabilities in terms of the required mission standard, inability to accomplish all parts of the mission, or inability to complete the mission to standard if hazards occur during the mission. <i>Some in-theater medical countermeasures and resources anticipated. For example, protection, treatment, and exposure documentation.</i>
Moderate	Expected degraded mission capabilities in terms of the required mission standard and will result in reduced mission capability if hazards occur during the mission. <i>Limited in-theater medical countermeasures and resources anticipated. For example, protection, treatment, and exposure documentation.</i>
Low	Expected losses have little or no impact on accomplishing the mission. <i>Little to no in-theater medical resources anticipated for protection and treatment. However, a summary of any negative or low level sampling results should be documented and archived particularly if some personnel express concerns.</i>

**b. Long-term (Post-deployment) Health Risks.** The risk from chronic/delayed health effects is described in terms of the degree of impact to the medical support system following deployment. The consequences associated with strategic risks are less oriented on “treatment” than those associated with the tactical risks. Instead, they reflect the anticipated broad, long-term resource responsibilities of the military medical system to ensure overall force readiness. Risk definitions are presented in Figure E–1–4, which also identifies (in italics) the possible medical and preventive medicine risk management responses that may be anticipated.

**Figure E–1–4. Risk Level Definitions for Chronic Health Effects**

Risk Level	Consequences to Military Operations and Force Readiness
Extremely High	Significant future medical surveillance activities and medical provider resources anticipated. <i>Documentation of exposure data in designated DOD archive and designate a registry to actively track the exposed personnel. Conduct specific active surveillance and/or medical follow-up procedures for life cycle of identified group.</i>
High	Notable future medical surveillance activities and related resources anticipated. <i>Documentation of exposure data in designated DOD archive. Specific identification and documentation of the exposed personnel/group. Possible passive medical surveillance related activities.</i>
Moderate	Limited future medical surveillance activities and related resources anticipated. <i>Documentation of exposure data in designated DoD archive. Consider documenting exposed groups or personnel of surveillance interest.</i>
Low	No specific medical action required. <i>Documentation of exposure in designated DOD archive.</i>

**E–1–4. Level of Confidence (or Uncertainty) in the Risk Estimate.**

Generally, risk estimates should be provided in conjunction with a statement concerning the ‘confidence’ the assessor places in the accuracy with which the estimate may represent the true risk. It is a subjective determination of one of the following three categories.

**Figure E–1–5. Confidence Example Criteria**

Confidence	Criteria
High	<ul style="list-style-type: none"> <li>- Field Sampling data quality is very good – substantial samples over time/space.</li> <li>- Field activity patterns are well known.</li> <li>- True exposures are reasonably approximated.</li> <li>- No important missing information.</li> <li>- The predicted health outcomes are highly plausible (strong toxicological weight of evidence/human data) or already demonstrated.</li> </ul>
Medium	<ul style="list-style-type: none"> <li>- Field data quality is relatively good.</li> <li>- Estimates of field exposure are likely to be greater than true exposures due to incomplete data coverage relative to actual exposure durations.</li> <li>- Detailed information is lacking regarding true personnel activity patterns in the field.</li> <li>- Predicted health outcomes are plausible but there is toxicological data but limited weight of evidence/human data is lacking.</li> </ul>
Low	<ul style="list-style-type: none"> <li>- Important data gaps and/or inconsistencies exist.</li> <li>- Exposure conditions are not well defined.</li> <li>- Field personnel activity patterns are basically unknown.</li> <li>- Predicted health outcomes are not plausible because it is not consistent with real-world events/experience.</li> </ul>