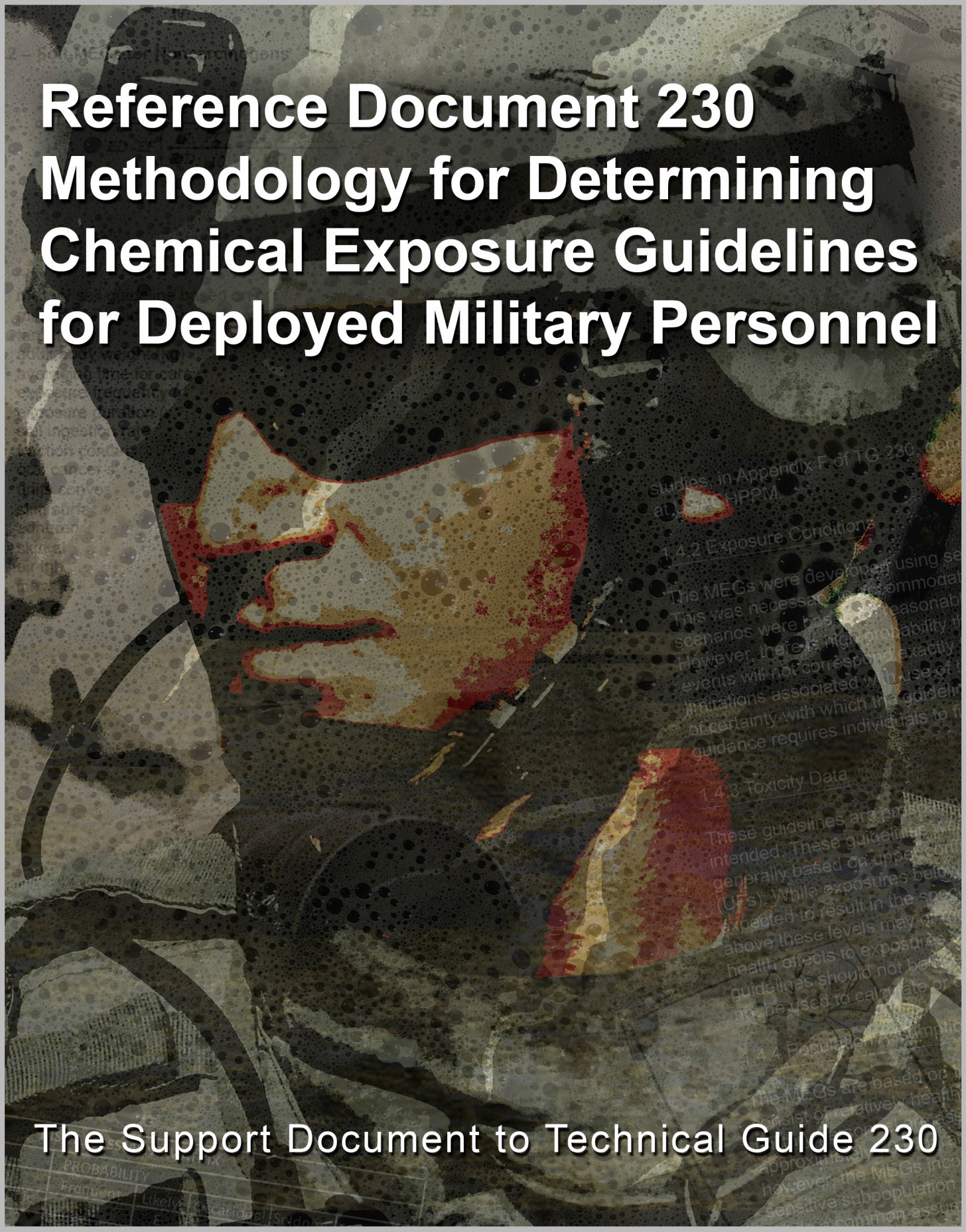

Reference Document 230 Methodology for Determining Chemical Exposure Guidelines for Deployed Military Personnel

The Support Document to Technical Guide 230

2013 REVISION

Approved for Public Release; Distribution Unlimited

Methodology for Developing Chemical Exposure Guidelines for Deployed Military Personnel

Reference Document 230
2013 Addendum

This is the support document for Technical Guide 230

U.S. Army Public Health Command

Approved for Public Release; Distribution Unlimited

RD 230 2013 addendum

As of the publication of the TG 230 2013 Revision, the content in RD 230 remains largely unchanged. This addendum serves as the 2013 update to RD 230 and identifies the places in RD 230 that are added, updated or changed. It also includes a summary of the changes to MEG values in the 2013 revision.

1. MEG CHANGES

The following MEGs were updated or corrected for the 2013 revision.

1.1 Eliminated the 1-Year Negligible Water MEGs for the 15 L/day consumption rate

The 15-L/day 1-year Negligible Water MEGs were eliminated from the revision of TG 230 and RD 230. The consumption of 15 L/day of drinking water is possible under harsh conditions for short periods of time; however, consumption of 15 L/day of drinking water for an entire year is not a realistic exposure scenario. With the retraction of the 15-L/day 1-year values, several methods in TG 230 were modified to allow a risk assessment of drinking water utilizing the remaining water MEGs. Many of the sections in RD 230 that discuss the derivation of drinking water MEGs for 1-year values now only apply to 5 L/day consumption rate MEGs. These modifications are minor (simply removing the reference to 15 L/day consumption rates for 1-year values) and are too numerous to list in this addendum. These changes to the RD 230 text will be incorporated into the next complete published edition of RD 230.

1.2 Lead 1-Year Water and Soil MEGs

The lead water and soil MEGs were included in the 2010 edition of RD 230 in section 5.5.1 for the water MEGs and in section 6.3.1 for the soil MEG but missing from MEG summary tables. These MEGs are now included in the new TG 230 MEG lookup tables published with the 2013 revision of TG 230.

1.3 Aluminum 1-year water MEG

The MRL value for aluminum was absent from the data set used to generate the MEGs in 2010, and was therefore not included in the 2010 tables. There was an MRL available for aluminum, and so the RD 230 methodology was re-implemented for aluminum to generate these two MEGs. The value for the 1-year Negligible MEG of 14 mg/L (5L/day) and was included in the new TG 230 MEG lookup tables published with the 2013 revision of TG 230.

1.4 Cyclohexanol and Cyclohexene Basis

The source of the data used to generate the cyclohexanol and cyclohexene was incorrectly listed as “TLV_TWA_adj*” (the * indicating that it was derived outside the normal hierarchy). This has been updated to reflect that these MEGs are based on a “TEEL1*” source.

1.5 Mercury Soil MEGs

This revised MEG utilizes slightly different methodology than the standard soil MEGs, and the derivation is detailed below in section 2 of this addendum.

1.6 PAH Soil MEGs

The soil MEGs for select PAHs were re-evaluated utilizing data not available in the standard soil MEG hierarchy. The derivation of these MEGs is detailed below in section 2 of this addendum.

2. RD 230 DOCUMENT CHANGES

2.1 Mercury Soil MEGs

The following section documents the development of the generic Mercury soil MEG and should be included in RD 230 as section 6.3.2.

6.3.2 Mercury in Soil

A non-cancer based MEG was derived for Mercury in soil utilizing equations 6-1, 6-3, 6-5, and 6-7. Since the form of mercury in soil may not be known if a lab report simply indicates Mercury was found, a generic safe-sided screening value was derived. This was done by utilizing data from different Mercury compounds and selecting the most conservative for each pathway. An oral RfD of 0.0003 mg/kg-day based on an IRIS RfD for mercuric chloride was utilized to calculate the oral screening level for the ingestion pathway. An inhalation RfC of 0.0002 mg/m^3 based on a chronic MRL for elemental Mercury was utilized to calculate the inhalation screening level for the inhalation pathway. There was no RfD available for dermal exposure, so the oral RfD was used in combination with the GI absorption factor of 0.07 for Mercury as a surrogate value per EPA's 1993 dermal risk assessment guidance. These calculations resulted in a 1-year Negligible Soil MEG of 56 mg/kg. This MEG may be used to screen soil samples if the exact form of Mercury is not known. If the sample does not pass this screen, a more precise lab analysis may be required in order to identify the form of Mercury so that the concentration may be compared to the MEG for that form of Mercury (mercuric chloride, or elemental mercury, etc.).

2.2 PAH Soil MEGs

The following section documents the development of a set of PAH soil MEGs and should be included in RD 230 as section 6.3.3.

6.3.3 Polycyclic Aromatic Hydrocarbons (PAHs) in Soil

A selected set of PAH soil MEGs were re-evaluated utilizing data from outside the standard MEG hierarchy of sources to fill in data gaps for these chemicals. Data from the Total Petroleum Hydrocarbon Working Group (TPHWG, 1997) and the California Environmental Protection Agency (CalEPA, 2009) were utilized to fill in any data gaps. In addition, EPA has published relative potency factors for PAHs (USEPA, 1993) that can be used to derive cancer slope factors (CSFs)for six chemicals from the CSF for Benz(a)pyrene. The 14 PAH chemicals that were re-evaluated are detailed below with information on where each of the values used in the derivation of the MEG came from.

6.3.3.1 Benzo[a]pyrene

Benzo[a]pyrene (BaP) is used as an index chemical by EPA when utilizing the relative potency factors for other chemicals. The new MEG of 1.2E+01 mg/kg was derived based on a risk of 1 in 10,000 of cancer utilizing equations 6-2, 6-4, 6-6, and 6-8. The CSF for the inhalation pathway was obtained from EPA's IRIS database. The CSF for the oral pathway was obtained from the California EPA (CalEPA, 2009) and was also used to extrapolate a dermal exposure CSF utilizing a GI absorption coefficient of 0.13. The cancer endpoint was selected because it provided a more conservative concentration estimate than the non-cancer endpoint calculation.

6.3.3.2 Benzo[a]anthracene, Benzo[b]fluoranthene, Dibenz[a,h]anthracene, Indeno[1,2,3-cd]pyrene

The MEGs for these four chemicals were calculated from the same data that the MEG for Benzo[a]pyrene was with the exception that EPA's relative potency factors (RPFs) were used to derive CSFs for these chemicals. Benzo[a]anthracene, Benzo[b]fluoranthene, and Indeno[1,2,3-cd]pyrene all have an RPF of 0.1 which led to their re-evaluated MEG values being set at 1.2E+02 mg/kg. Dibenz[a,h]anthracene has an RPF of 1 which leads to a re-evaluated MEG identical to that of Benzo[a]pyrene (1.2E+01 mg/kg).

6.3.3.3 Benzo[k]fluoranthene, Chrysene

The MEGs for Benzo[k]fluoranthene and Chrysene were derived using the same data sources and endpoints. The cancer and non-cancer based MEGs were calculated and for these two chemicals the non-cancer endpoint resulted in a lower, more conservative MEG which was selected. Equations 6-1, 6-5, and 6-7 were used in the derivation process. The RfD was obtained from the TPHWG dataset (TPHWG, 1997), and was also used with an ABS factor of 0.13 to extrapolate a dermal RfD. There was no inhalation RfC available for these chemicals, so the inhalation pathway was not included in the calculations. Using this data, both chemicals were assigned a 1-year Negligible Soil MEG of 3.9E+02 mg/kg.

6.3.3.4 Acenaphthene, Anthracene, Fluorene

The MEGs for Acenaphthene, Anthracene, and Fluorene were derived using the same data sources and endpoints. The cancer and non-cancer based MEGs were calculated and for these two chemicals the non-cancer endpoint resulted in a lower, more conservative MEG which was selected. Equations 6-1, 6-3, 6-5, and 6-7 were used in the derivation process. The subchronic RfDs were obtained from EPA's IRIS dataset, and were also used with an ABS factor of 0.13 to extrapolate a dermal RfD. The inhalation RfCs were obtained from the TPHWG dataset (TPHWG, 1997). Using these data, the 1-year Negligible Soil MEGs were assigned as follows: Acenaphthene 7.8E+03 mg/kg, Anthracene 3.9E+04 mg/kg, and Fluorene 5.2E+03 mg/kg.

6.3.3.5 Naphthalene

The new MEG of 2.6E+03 mg/kg for Naphthalene was derived based on non-cancer effects utilizing equations 6-1, 6-3, 6-5, and 6-7. The chronic RfC for the inhalation pathway was obtained from EPA's IRIS database. The subchronic RfD for the oral pathway was also obtained from the EPA's IRIS database and was also used to extrapolate a dermal exposure RfD utilizing an ABS factor of 0.13. The non-cancer endpoint was selected because it provided a more conservative concentration estimate than the cancer endpoint calculation.

6.3.3.6 Phenanthrene

The new MEG of 2.8E+03 mg/kg for Phenanthrene was derived based on non-cancer effects utilizing equations 6-1, 6-3, 6-5, and 6-7. The RfC and RfD for the inhalation and oral pathways were obtained from the TPHWG dataset (TPHWG, 1997). The RfD was also used to extrapolate a dermal exposure RfD utilizing EPS's default ABS factor of 1. The non-cancer endpoint was selected because it provided a more conservative concentration estimate than the cancer endpoint calculation.

6.3.3.7 1-Methylnaphthalene

The new MEG of 9.1E+02 mg/kg for 1-Methylnaphthalene was derived based on non-cancer effects utilizing equations 6-1, 6-3, 6-5, and 6-7. The RfC for the inhalation pathway was obtained from the TPHWG dataset (TPHWG, 1997). The RfD for the oral pathway was obtained from ATSDR's MRL dataset and was also used to extrapolate a dermal exposure RfD utilizing an ABS factor of 0.13. The non-cancer endpoint was selected because it provided a more conservative concentration estimate than the cancer endpoint calculation.

6.3.3.8 2-Methylnaphthalene

The new MEG of 5.2E+01 mg/kg for 2-Methylnaphthalene was derived based on non-cancer effects utilizing equations 6-1, 6-3, 6-5, and 6-7. The RfC for the inhalation pathway was obtained from the TPHWG dataset (TPHWG, 1997). The chronic RfD for the oral pathway was obtained from the EPA's IRIS database and was also used to extrapolate a dermal exposure RfD utilizing an ABS factor of 0.13. The non-cancer endpoint was selected because it provided a more conservative concentration estimate than the cancer endpoint calculation.

2.3 Soil MEGs Greater Than 1E+06

The following section documents the change to the soil MEG calculation method to include a cap of the soil MEG at 1E+06 mg/kg when needed.

6.2.3.1 Soil MEG Upper Limit

Soil MEGs are reported in units of milligrams of chemical per kilogram of the sample matrix (soil in this case). There are 1,000,000 milligrams in a kilogram, and therefore any soil MEG cannot exceed this limit (1E+06 denotes a pure substance). Due to the rates of exposure assumed for each pathway and the aerosolization and volatilization factors of the chemicals from the soil, the method for calculating soil MEGs may result in a MEG of greater than 1E+06 mg/kg. As these

levels are impossible, in reality, any calculated soil MEGs that exceeded 1E+06 were capped at a value of 1E+06 mg/kg and reported as such. This change was applied to the soil MEGs in the 2013 tables in TG 230 and affected the following chemicals soil MEGs:

- Boron trifluoride
- Epoxybutane, 1,2-
- Propylene glycol monoethyl ether
- Methyl mercaptan
- Ethyl acetate
- Propylene glycol monomethyl ether
- Difluoroethane, 1,1-
- HFC-134A
- Titanium tetrachloride
- Nitromethane
- JP-4 jet fuel
- Cyclohexanone
- Diisopropyl ether
- Coke oven emissions
- Hydrogen chloride
- Cyclopentadiene
- Phosphoric acid
- Ammonia
- Ethoxyethyl acetate, 2-
- Adiponitrile
- Diethyl phthalate
- Kerosene
- Nickel subsulfide
- Propylene glycol
- Methyl acetate
- Methanol
- Refractory ceramic fibers
- Nickel refinery dust
- Diesel engine exhaust
- Methylphosphonic acid
- Aluminum, elemental
- Nitropropane, 2-

2.4 Additional References

The following references should be added to Appendix A in RD 230.

CalEPA. 2009. Air Toxics Hot Spots Risk Assessment Guidelines Part II: Technical Support Document for Cancer Potency Factors. Appendix A: Hot Spots Unit Risk and Cancer Potency Values. Sacramento (CA): California Environmental Protection Agency, Office of Environmental Health Hazard Assessment; May 2009.

EPA. 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons.

TPHWG. 1997. Total Petroleum Hydrocarbon Criteria Working Group. Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH), Volume 4. Amherst (MA): Amherst Scientific Publishers.