



ONE TEAM ONE MISSION
THESE THINGS WE DO THAT OTHERS MAY LIVE



Long-Term Health Effects of Post-9/11 Pesticide Exposures in Service Members





ONE TEAM ONE MISSION
THESE THINGS WE DO THAT OTHERS MAY LIVE



Long-Term Health Effects of Post-9/11 Pesticide Exposures in Service Members

During post-9/11 deployments, U.S. service members were commonly exposed to a variety of pesticides and insect repellents. These included personal-use repellents like **DEET** (N,N-diethyl-m-toluamide) applied to skin and **permethrin** applied to uniforms, as well as pesticides used in base-area vector control: **organophosphates** (e.g. malathion, chlorpyrifos), **carbamates** (e.g. carbaryl), and **pyrethroid insecticides** (e.g. resmethrin, lambda-cyhalothrin, cyfluthrin, bifenthrin, deltamethrin, cypermethrin) ncbi.nlm.nih.gov. Troops in Iraq and Afghanistan often wore permethrin-treated uniforms and used DEET for personal protection, and military pest control units sprayed areas with chemicals like malathion, resmethrin, and pyrethroids to reduce disease-carrying insects ncbi.nlm.nih.gov. These exposures raised concerns about **chronic health conditions** that might manifest years after service. Below is a structured overview of long-term health effects linked to such pesticide exposures, with emphasis on conditions recognized by the U.S. Department of Veterans Affairs (VA) and findings from scientific and veteran-focused research.

Neurological Disorders

- **Peripheral Neuropathy and Neurotoxicity:** Some organophosphate and carbamate pesticides can cause nerve damage. High-level exposure to certain organophosphates is known to trigger **organophosphate-induced delayed neuropathy**, a chronic peripheral neuropathy characterized by numbness, tingling, and weakness in limbs weeks after exposure. Even without acute poisoning, long-term low-dose exposure to cholinesterase-inhibiting pesticides has been linked to subtle neuropathic signs (e.g. impaired sensation or reflexes) and neurobehavioral changes va.gov. In Gulf War veterans, the Institute of Medicine (IOM) noted **suggestive evidence** of an association between insecticide exposure and chronic peripheral nerve disorders nap.nationalacademies.org. Veterans reporting high pesticide use have also described symptoms like **paresthesias** (tingling) and chronic headaches, consistent with neurotoxic effects.





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



- **Parkinson's Disease (PD):** A growing body of evidence links long-term pesticide exposure with elevated risk of Parkinson's disease, a degenerative brain disorder. Epidemiological studies indicate that individuals with occupational or environmental contact with pesticides (especially insecticides) have higher odds of developing PD years later apdaparkinson.org. In particular, research has implicated **organophosphates** and other insecticides as contributors: **organochlorine and organophosphate pesticides are associated with increased PD risk** in exposed populations apdaparkinson.org. Veterans are no exception – VA epidemiological data suggest Gulf War veterans may face increased PD incidence, possibly due to pesticide and other toxic exposures during deployment publichealth.va.gov/news.va.gov. Although the risk increase per individual is modest (on the order of 1.5–2.0-fold in many studies) apdaparkinson.org, Parkinson's disease is a VA-recognized condition (with a DBQ available for PD), and a service connection may be considered if pesticide exposure in service is documented as a contributing factor.
- **Amyotrophic Lateral Sclerosis (ALS) and Multiple Sclerosis (MS):** Neurological outcomes like ALS (Lou Gehrig's disease) have been observed at higher rates in certain veteran cohorts. An early VA study found that Gulf War deployed veterans had a higher incidence of ALS in the decade after the war, leading the VA to recognize ALS as a presumptive service-connected condition for all veterans. Pesticide exposure has been examined as one possible risk factor. The IOM (2003) review noted limited evidence of an association between Gulf War insecticide exposures and later development of ALS nap.nationalacademies.org. Similarly, research is ongoing into possible links between pesticides and **multiple sclerosis** or other neuroimmune disorders nap.nationalacademies.org, although clear causal relationships have not been confirmed. Both ALS and MS have VA Disability Benefits Questionnaires (DBQs), and if a veteran with service pesticide exposure develops these diseases, medical opinions often discuss the potential nexus.
- **Cognitive and Mood Disorders (Gulf War Illness):** Many Post-9/11 veterans report persistent cognitive difficulties, memory loss, depression, or anxiety years after deployment. Chronic exposure to DEET and permethrin (especially in combination with other chemicals) is one hypothesized contributor to the complex of symptoms known as **Gulf War Illness (GWI)** or chronic multisymptom illness. Animal studies have shown that combined, repeated exposure to





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



DEET and permethrin can cause lasting neurobehavioral deficits and brain chemistry alterations academic.oup.com/today.duke.edu. A VA Research Advisory Committee review found **evidence of an association** between Gulf War Illness and wartime exposure to pesticides (and the nerve-agent pre-treatment pill pyridostigmine bromide) publichealth.va.gov. Veterans with GWI commonly have neurological symptoms such as impaired concentration, headaches, and mood disturbances. While the VA currently considers GWI a **medically unexplained illness** (with presumptive service connection for Gulf War vets) and does not tie it to a specific single agent, scientific panels have long pointed to pesticides as a probable contributor publichealth.va.gov. In practice, clinicians writing nexus letters for Gulf War vets with chronic neurocognitive symptoms often cite the veteran's significant pesticide exposures and the known neurotoxic effects of those chemicals as supporting evidence.

- **Other Neurodegenerative Outcomes:** Some research has explored links between pesticide exposure and other neurodegenerative diseases like **Alzheimer's disease** or **dementia**. The evidence here is limited, but chronic oxidative stress from chemical exposures is theorized to accelerate brain aging news.va.gov/news.va.gov. Additionally, long-term follow-up of veterans exposed to pesticides is examining rates of **brain cancer**, though a 2017 VA update did not find a significant long-term increase in brain cancer mortality among Gulf War veterans relative to non-deployed peers publichealth.va.gov. Overall, **neurological disorders** (from peripheral neuropathies to Parkinson's and ALS) are among the most significant long-term health concerns for veterans with past pesticide exposure, and many of these conditions are formally recognized by VA for disability compensation (with dedicated evaluations via DBQs).

Cancers and Tumors

Chronic pesticide exposure has been scrutinized for potential **carcinogenic effects**. Some of the chemicals used in post-9/11 deployments are considered possible or probable carcinogens by expert agencies, and epidemiological studies of pesticide-exposed populations (like farmers and applicators) have observed increases in certain cancers:





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



- **Non-Hodgkin Lymphoma (NHL) and Hematologic Cancers:** Numerous studies have linked pesticide exposure to NHL, multiple myeloma, and leukemia. The International Agency for Research on Cancer (IARC) classified **malathion** (an organophosphate insecticide used for mosquito control in deployments ncbi.nlm.nih.gov) as “*probably carcinogenic to humans*” (Group 2A) after finding **limited evidence in humans for malathion’s carcinogenicity, with positive associations observed for non-Hodgkin lymphoma** as well as prostate cancer publications.iarc.fr. Veterans with significant malathion exposure may thus be at elevated risk for NHL later in life. Similarly, **carbaryl** (a carbamate insecticide) has been studied in farming populations: while overall cancer incidence was not increased, **high cumulative carbaryl use was associated with a higher risk of melanoma (a type of skin cancer)** in one large cohort (RR ~4 for the highest exposure group) pubmed.ncbi.nlm.nih.gov. These findings suggest that certain hematologic or immune-system cancers could manifest years after service for those heavily exposed to pesticides, even if not immediately apparent.
- **Prostate Cancer:** Prostate cancer is common in older veterans, and there is some evidence linking it to pesticide exposure. As noted, IARC’s review found a positive association between **malathion** exposure and **prostate cancer** in epidemiologic studies publications.iarc.fr. Organophosphate pesticides like malathion may disrupt endocrine pathways or cause DNA damage that contributes to prostate tumor development. While prostate cancer is not unique to pesticide-exposed veterans (and is influenced by age and genetics), a service member with unusually early or aggressive prostate cancer and a history of heavy pesticide contact might cite this research in a nexus letter. Prostate cancer is a condition for which VA provides disability compensation (and a DBQ exists), though it is not currently presumptively linked to post-9/11 service unless Agent Orange exposure in Vietnam/Korea is involved. Nonetheless, documentation of pesticide exposure could be used on a case-by-case basis to support service connection.
- **Lung Cancer: Chlorpyrifos**, another organophosphate insecticide used at some deployment sites ncbi.nlm.nih.gov, has been implicated in elevated lung cancer risk. A prominent study from the Agricultural Health Study (AHS) found that among pesticide applicators, those with the highest lifetime days of chlorpyrifos use had more than double the risk of developing lung cancer compared to those unexposed (RR \approx 2.18 for the top exposure quartile) pubmed.ncbi.nlm.nih.gov pubmed.ncbi.nlm.nih.gov. This association was statistically significant even after adjusting for





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



smoking and other factors. Although service members typically had intermittent exposure (e.g. from area spraying) rather than occupational daily use, this finding raises concern that repeated inhalation of chlorpyrifos mist or residue in deployments could increase long-term lung cancer risk. The VA does acknowledge lung cancer in veterans (with specific presumptions for Agent Orange or radiation exposures), and a veteran exposed to pesticides who later develops lung cancer could use such evidence in a nexus letter. It's worth noting that **smoking** and burn pit exposure are also common in deployed veterans, which confounds analysis; however, chlorpyrifos's known effects provide a biologically plausible link to lung tumors pubmed.ncbi.nlm.nih.gov.

- **Multiple Myeloma and Blood Disorders:** A striking finding in pesticide research is the possible link between permethrin (a pyrethroid) and **multiple myeloma**, a cancer of plasma cells. An analysis of cancer incidence in the AHS found no overall increase in most cancers among those using permethrin, **except for multiple myeloma** – applicators with the highest lifetime permethrin exposure had a roughly fivefold higher risk of myeloma compared to non-users (RR ~5.0, based on small numbers of cases) pubmed.ncbi.nlm.nih.gov pubmed.ncbi.nlm.nih.gov. While based on only 15 exposed cases and needing confirmation, this suggests permethrin could potentially contribute to plasma cell dyscrasias. Another study noted a connection between long-term permethrin/pyrethroid exposure and *monoclonal gammopathy of undetermined significance* (MGUS), a precursor to multiple myeloma beyondpesticides.org. For veterans, multiple myeloma is a presumptive condition only for Agent Orange exposure currently. But if a post-9/11 veteran with extensive permethrin contact (such as handling treated uniforms daily for months) develops MGUS or multiple myeloma, these research findings pubmed.ncbi.nlm.nih.gov could support an argument for service connection by showing a nexus between the exposure and the illness.
- **Other Solid Tumors:** Research on other cancers (like liver, kidney, brain, and testicular cancer) in relation to deployment pesticide exposure is limited. The IOM Gulf War and Health review (2003) did evaluate cancer outcomes; overall it found inadequate evidence to firmly link insecticides to most solid tumors in Gulf War vets [publichealth.va.gov](https://publichealth.va.gov/publichealth.va.gov) [publichealth.va.gov](https://publichealth.va.gov/publichealth.va.gov). However, some studies outside the veteran population provide clues. For example, case-control studies have reported associations between various agricultural pesticides and **leukemia** and **multiple myeloma** va.gov va.gov, and organophosphates like diazinon (chemically similar to chlorpyrifos and malathion) have been linked to **stomach and thyroid cancers** in certain cohorts





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



(though data are not consistent). In one analysis, **chlorpyrifos** exposure showed a possible relation to **colorectal cancer** incidence as well [sciencedirect.com](https://www.sciencedirect.com), and **pyrethroids** in high doses caused benign liver tumors in rodent studies (raising questions of human risk at chronic low doses). It's also notable that **deltamethrin** and some pyrethroids can cross the blood-brain barrier, but evidence of any link to human brain tumors is lacking. In summary, the strongest cancer associations for the pesticides of interest appear to be with hematologic cancers (lymphomas, myeloma, leukemia) and possibly prostate and lung cancer publications.iarc.fr pubmed.ncbi.nlm.nih.gov. Veterans developing these malignancies years after service may find epidemiologic support for a connection to past pesticide exposure, which can be crucial for DBQ documentation and nexus letters.





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



Respiratory Conditions

- **Asthma and Bronchitis:** There is emerging evidence that long-term pesticide exposure can contribute to chronic respiratory problems. Veterans who repeatedly inhaled pesticide sprays or dusts may experience persistent airway inflammation. Studies of occupational settings have found that people regularly exposed to pesticides report higher rates of **wheezing, chronic cough, and bronchitic symptoms** pmc.ncbi.nlm.nih.gov. For instance, farmworkers with years of pesticide use showed increased prevalence of **asthma** and allergic rhinitis, especially when exposed to pesticide mixtures over long periods sciencedirect.com. In one study of Colombian farmworkers, chronic exposure was significantly associated with asthma diagnosis sciencedirect.com. Pyrethroids like permethrin and cyfluthrin are respiratory irritants; acute exposure can cause throat irritation and shortness of breath, and repeated exposure might sensitize the airways. Organophosphates such as chlorpyrifos and malathion have also been linked to reactive airway dysfunction. While the VA has recently made **asthma** a presumptive condition for burn pit exposure in post-9/11 veterans, no such blanket presumption exists for pesticide exposure. However, a veteran who develops adult-onset asthma or chronic bronchitis after deployment could cite pesticide inhalation as a contributing factor. The **European Respiratory Society** has posed the question “Is pesticide exposure a cause of obstructive airways disease?” and highlighted that repeated exposures might indeed increase the risk of developing asthma or COPD in previously healthy individuals publications.ersnet.org. In VA disability evaluations, a clinician may note if a veteran’s asthma began after heavy exposure to insecticide sprays in service, strengthening the service connection rationale.
- **Chronic Obstructive Pulmonary Disease (COPD):** Chronic exposure to irritant chemicals can lead to conditions like COPD (encompassing chronic bronchitis and emphysema). While smoking is the dominant cause, toxic inhalants like pesticides contribute to the cumulative damage. Research suggests pesticide applicators have more chronic phlegm and reduced lung function over time pmc.ncbi.nlm.nih.gov. Some pesticides can induce an oxidative stress response in lung tissue; for example, organophosphates can generate reactive oxygen species that inflame airways. The IOM did not find conclusive evidence linking Gulf War insecticide exposure to COPD specifically,





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



but it did note that **new-onset chronic respiratory symptoms** were reported by many Gulf War veterans in surveys (often overlapping with burn pit smoke exposure) publichealth.va.gov. If a veteran has COPD (which has a VA DBQ) without a heavy smoking history but significant pesticide exposure, it would be reasonable for a medical opinion to discuss pesticides as one of the potential etiologies. Notably, **chlorpyrifos** exposure has been associated with lung injury in animal studies, and some Vietnam-era studies on herbicide/pesticide handlers pointed to higher rates of chronic respiratory disease. In summary, **asthma, chronic bronchitis, and related respiratory conditions** are possible long-term outcomes of deployment pesticide exposure, especially in those who had frequent inhalation of these chemicals. Veterans experiencing persistent respiratory issues should inform their VA providers about past pesticide contact, as it might warrant further evaluation or inclusion in their disability claim evidence [pmc.ncbi.nlm.nih.govpublications.ersnet.org](https://pubmed.ncbi.nlm.nih.gov/publications/ersnet.org).

Autoimmune and Immune-Related Disorders

- **Rheumatoid Arthritis (RA) and Systemic Lupus Erythematosus (SLE):** There is mounting evidence that pesticide exposure can dysregulate the immune system and trigger autoimmune disease years later. Both RA and SLE (autoimmune rheumatic diseases) have been linked to farming and pesticide use in epidemiological research [nature.com](https://www.nature.com). A notable study from the Women's Health Initiative found that women with a history of **insecticide use (mixing or applying)** had roughly double the risk of developing RA or lupus compared to those with no insecticide exposure, with a clear dose-response trend (hazard ratio ~2.0 for the highest frequency of use) [pubmed.ncbi.nlm.nih.govpubmed.ncbi.nlm.nih.gov](https://pubmed.ncbi.nlm.nih.gov/pubmed.ncbi.nlm.nih.gov). In older male farmers studied in the Agricultural Health Study, **nine specific pesticides** were identified as significantly increasing RA risk – this list included **malathion** and **carbaryl**, two chemicals also used by deployed troops [news-medical.netnews-medical.net](https://www.news-medical.net/news-medical.net). Malathion showed a dose-dependent relationship with RA incidence, and carbaryl (as well as the carbamate **carbofuran** and organophosphate **phorate**) also elevated RA risk [news-medical.net](https://www.news-medical.net). These findings suggest that long-term immune system changes from pesticide exposure might lead to loss of self-tolerance and joint inflammation years later. For veterans, RA and SLE are both disabling conditions with VA DBQs, and establishing service





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



connection typically requires showing an in-service precipitant. If a veteran with no family history of RA develops it at a relatively young age and had substantial pesticide contact in Southwest Asia, a nexus letter might cite these studies to argue the exposure “more likely than not” contributed to the autoimmune disease [news-medical.net](http://news-medical.net/news-medical.net).

- **Other Autoimmune Conditions:** Beyond RA and lupus, researchers have examined links between pesticides and conditions like **multiple sclerosis**, **autoimmune thyroid disease**, and even **immune-mediated gastrointestinal disorders**. Some studies indicate that high pesticide exposure can elevate levels of autoantibodies; for example, male farmers who used certain insecticides were more prone to developing **antinuclear antibodies (ANA)**, which are often a precursor in systemic autoimmune diseases sciencedirect.com. In the context of veterans, **Multiple Sclerosis (MS)** onset after service has been a topic of interest. While MS is presumptively service-connected if it manifests within 7 years of separation (under VA regulations), there is speculation that neurotoxic exposures like organophosphates could trigger immune-mediated demyelination. The IOM (2003) considered whether Gulf War insecticides might be linked to MS, but found the evidence inadequate nap.nationalacademies.org. Another area of concern is **autoimmune thyroiditis** (Hashimoto’s disease); some pesticides act as endocrine disruptors and could potentially provoke thyroid autoimmunity. There is also emerging research on **pesticides and autoimmune diabetes** (Type 1 diabetes), though nothing conclusive. For now, the strongest autoimmune connections in humans remain RA and lupus. The VA does not have presumptive rulings for those due to Gulf War service, but a veteran’s claim for lupus, for example, could be supported by showing heavy pesticide exposure in the Persian Gulf and citing the general scientific consensus that pesticide exposure correlates with increased risk of systemic autoimmune disorders [ncbi.nlm.nih.gov](http://ncbi.nlm.nih.gov/news-medical.net). Notably, even **Agent Orange** (a herbicide) has an established link with one autoimmune-like condition (chloracne, a skin condition) and suggested links to others like MGUS. By analogy, insecticides might be influencing autoimmunity in post-9/11 vets.
- **Immune System Dysfunction:** Some veterans with pesticide exposure report chronic immune issues such as frequent infections or **Gulf War immune dysfunction syndrome**. While pesticides are primarily neurotoxicants, they can also affect immune organs (e.g., the thymus) and immune cell function. High pesticide exposures have been associated with immunosuppression in animal studies, and a review noted that **immune depression was observed in cases of very high**





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



pesticide exposure or poisoning nap.nationalacademies.org. On the other hand, certain pesticide exposures might *stimulate* immune responses abnormally, contributing to allergy or autoimmunity. A balanced immune system can be disrupted by long-term low-level chemical exposure, though pinning specific clinical immune deficiencies on deployment pesticide use is difficult. Veterans concerned about immune health (e.g., unusual susceptibility to infections post-service) should discuss their exposure history with healthcare providers; such issues might be rolled into the broader context of Gulf War Illness or chronic fatigue immune dysfunction, which the VA acknowledges as possibly service-related in Gulf War vets publichealth.va.gov publichealth.va.gov.

Reproductive and Developmental Effects

- **Infertility (Male and Female):** Pesticide exposure has the potential to impact fertility by affecting sperm, ova, or hormonal regulation. The IOM Gulf War and Health Volume 2 (2003) specifically examined whether insecticides used in theater could cause **male or female infertility after exposure** – while no definitive causal link was proven, this was an area of concern nap.nationalacademies.org nap.nationalacademies.org. Some animal studies have shown that permethrin at high doses can impair male reproductive organs (e.g. **reduced testis weight and sperm abnormalities in mice** at very high exposure levels) ncbi.nlm.nih.gov ncbi.nlm.nih.gov. However, those doses far exceeded typical human exposure from uniforms. In humans, studies of couples with occupational pesticide contact have noted higher rates of infertility and miscarriage. For example, male pesticide applicators have been found to have altered sperm quality – one study observed that environmental pyrethroid metabolites in men’s urine correlated with decreased sperm motility and concentration academic.oup.com academic.oup.com. Organophosphates have estrogenic effects that might disrupt menstrual cycles or ovulation in women. A veteran who was exposed to these insecticides and later faces infertility could leverage such findings. Though VA doesn’t directly compensate for infertility (aside from providing healthcare like IVF in some cases), demonstrating service-related cause could support other claims (e.g., an endocrine disorder).





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



- **Birth Defects in Offspring:** An important question is whether veterans' exposures might affect their children's health (generational effects). Research in this area is mixed. Some studies of civilian populations found that **prenatal exposure** to certain pesticides is linked to birth defects – for instance, a study in California showed **mothers' household exposure to chlorpyrifos during pregnancy was significantly associated with a higher risk of a congenital heart defect (pulmonary valve stenosis) in the baby** ncbi.nlm.nih.gov. Another analysis indicated that maternal exposure to organophosphates as a class might modestly increase risk of some birth defects, though results were inconclusive ncbi.nlm.nih.gov. In terms of paternal exposure (the veteran being the father), evidence is less clear: one Gulf War study in the 1990s suggested a slight increase in certain birth defects among children of deployed veterans, but pinpointing pesticides vs. other exposures was not possible. The IOM (2018) "Generational Health Effects" report ultimately found no conclusive unique reproductive risk in post-9/11 veterans compared to Gulf War veterans from pesticides ncbi.nlm.nih.govncbi.nlm.nih.gov. Still, experimental research raises concern – in a striking animal study, female rats given a combination of permethrin and DEET during pregnancy produced offspring (and "grand-offspring") with increased rates of reproductive organ disease and developmental abnormalities pmc.ncbi.nlm.nih.gov pmc.ncbi.nlm.nih.gov. This **transgenerational epigenetic inheritance** study showed sperm DNA methylation changes in descendants of exposed rats, suggesting that the pesticide mixture caused heritable changes pmc.ncbi.nlm.nih.govpmc.ncbi.nlm.nih.gov. While such effects are not yet confirmed in humans, they highlight a possible mechanism whereby a veteran's exposure could impact their children (for example, via epigenetic changes in sperm). If a veteran's child has a birth defect or health issue, it is difficult to get VA benefits for it (aside from Agent Orange's spina bifida program), but the veteran may still cite emerging science in support of healthcare or research.
- **Female Veterans' Reproductive Health:** Female service members deployed post-9/11 could have direct impacts – for example, if a female veteran was pregnant in a deployment or shortly after, pesticides could pose a risk to that pregnancy. High-dose exposures to organophosphates can cause acute cholinergic symptoms in the mother, which might threaten a pregnancy. Even at lower doses, there's concern for **miscarriage or preterm birth**. A few studies have noted higher miscarriage rates in women with pesticide-heavy occupations. The IOM (2003) found insufficient





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



evidence linking insecticides to increased **spontaneous abortion** in Gulf War veterans nap.nationalacademies.org. However, given what is known from civilian data, pregnant service members are now usually kept away from pesticide spraying duties. Additionally, women may experience **menstrual irregularities** after toxic exposure. From a VA benefits perspective, a female veteran who has ovarian dysfunction or premature ovarian failure might raise the question of toxin exposure (though data specifically on permethrin/DEET causing this is lacking).

- **Developmental and Neurodevelopmental Outcomes:** Children of veterans who were exposed to neurotoxic pesticides might have higher risk of developmental delays or disorders (if the exposure happened pre-conception or during gestation). Notably, studies of children whose mothers had high organophosphate exposure (like chlorpyrifos) show these kids can have lower IQs and neurodevelopmental issues years later, due to in utero effects on the developing brain. If a female veteran used a lot of DEET/permethrin while unknowingly pregnant, it's plausible (though not proven) this could mildly affect the baby's development. As for **male veterans**, any effect on offspring would likely be through epigenetic changes in sperm – a hypothesis supported by the animal study mentioned above pmc.ncbi.nlm.nih.gov. The VA's Volume 11 (2018) report on generational health did not find definitive proof of higher birth defect rates in children of Gulf War/post-9/11 vets, but it recommended further monitoring ncbi.nlm.nih.gov. For now, claims related to generational effects (except Agent Orange in Vietnam vets) are generally not granted by VA. Nonetheless, it's an area of active scientific and legislative interest, and veterans should document any concerns in registries or studies (e.g. the VA's voluntary birth defects registry for Gulf War children).

Dermatologic Conditions

- **Chronic Dermatitis and Skin Lesions:** During deployments, many service members experienced **acute skin rashes** due to direct use of DEET and other pesticides publichealth.va.gov. VA and DoD records note that “*some troops developed rashes as a consequence of their use*” of personal pesticides in the Gulf War publichealth.va.gov. In most cases, these were irritant or allergic reactions that resolved after stopping use. However, for some veterans, severe chemical exposure





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



may lead to long-standing skin issues. **Allergic contact dermatitis** can develop to substances like permethrin or DEET – once sensitized, a person might have recurrent eczema flare-ups upon re-exposure. A veteran who had a DEET rash in service could later have chronic dermatitis requiring ongoing treatment. The VA has DBQs for skin conditions, and service medical record documentation of a rash from issued insect repellent would strongly support service connection for any persistent skin condition post-service.

- **Photosensitivity and Pigmentation Changes:** Certain chemicals, such as psoralens in some insecticide carriers or by-products, can cause the skin to become photosensitive. While DEET and the listed pesticides are not known for this, prolonged skin inflammation from a rash could leave residual hyperpigmentation or scarring. Veterans have reported chronic dry skin, scaling, or sensitivity in areas that had severe “**GW rash**” episodes after heavy pesticide use in desert conditions. These could be classified as dermatitis or even **psoriasis-like** conditions if they persisted (though true psoriasis link to pesticides is not established).
- **Skin Cancer:** The pesticides in question are not strongly linked to skin cancer in literature, with one exception: as noted under cancers, **melanoma risk** was elevated in those with high lifetime carbaryl exposure pubmed.ncbi.nlm.nih.gov. It’s unclear if short-term military use of carbaryl (e.g. in base area delousing or pest control) would meaningfully affect melanoma risk. Nonetheless, a veteran who develops melanoma or another skin cancer at a young age might explore whether wartime chemical exposure played a role. More directly, **Agent Orange** exposure is linked to a specific skin condition (chloracne) and possibly melanoma, but that’s a different context (Vietnam). For post-9/11 vets, there isn’t an established link between permethrin/DEET and chloracne or skin malignancy.
- **Persisting Skin Sensitivity:** Some veterans describe a syndrome of **multiple chemical sensitivity (MCS)** after the war – where they experience rashes, headaches, etc., with various chemical exposures. Pesticides are often among the triggering agents cited. Though MCS is not officially recognized by the VA as a diagnosis, it overlaps with chronic multisymptom illness. A veteran might note that since deployment, they can no longer tolerate certain household chemicals or get hives when exposed – potentially due to an immune system primed by the intense exposures during service. From a nexus letter standpoint, one could argue the veteran has a chronic skin condition





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



(like eczema or chronic urticaria) precipitated by service, given the temporal relationship and excluding other causes.

- **Hair Loss or Nail Changes:** While not commonly reported, extremely severe poisoning from certain pesticides can affect skin appendages. Arsenical pesticides (not in our list) can cause nail changes, but pyrethroids and organophosphates generally do not. Some vets with Gulf War Illness report unusual hair loss, which they sometimes attribute to toxic exposures (though stress and nutrition could be factors too). This remains anecdotal without solid research backing.

In sum, dermatologic effects from the listed pesticides are usually **immediate or short-term** (rashes, irritation publichealth.va.gov). Long-term skin diseases directly caused by these chemicals are not well documented, aside from potentially persistent dermatitis in those who were sensitized. However, any veteran who had documented skin reactions in theater and continues to have skin problems should highlight that history in disability claims. The VA will consider continuity of symptoms from service when evaluating skin conditions.

Conclusion and VA Considerations

Key Chronic Conditions Potentially Linked to Pesticide Exposure: Based on VA reports and scientific studies, the chronic health issues of greatest concern include:

- Neurological disorders (especially Parkinson's disease apdaparkinson.org, neurocognitive deficits, peripheral neuropathy, and possibly ALS nap.nationalacademies.org),
- Certain cancers (notably non-Hodgkin lymphoma and multiple myeloma publications.iarc.fr pubmed.ncbi.nlm.nih.gov, prostate cancer publications.iarc.fr, lung cancer pubmed.ncbi.nlm.nih.gov, and melanoma with high carbamate exposure pubmed.ncbi.nlm.nih.gov),
- Respiratory conditions (asthma and chronic bronchitis/COPD associated with long-term respiratory irritation sciencedirect.com),
- Autoimmune diseases (rheumatoid arthritis and lupus, supported by epidemiological links to insecticides pubmed.ncbi.nlm.nih.gov/news-medical.net),





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



- Reproductive effects (potential fertility issues and birth defect risks, though human data is mixed ncbi.nlm.nih.gov/news-medical.net), and
- Chronic multisymptom illness (Gulf War Illness, a constellation of fatigue, pain, and cognitive problems linked by some to pesticide exposure publichealth.va.gov).

It is important to note that **VA evaluations** of Gulf War veterans have sometimes downplayed specific causes. For example, a VA conclusion was that current evidence was insufficient to pin Gulf War Illness on pesticides alone publichealth.va.gov, whereas the VA's own advisory committee found an association publichealth.va.gov. Despite this, VA has established presumptions for undiagnosed illnesses in Gulf War vets, meaning a veteran doesn't have to prove the exact toxin – so long as they have chronic unexplained symptoms, they can get service connection (this would cover many pesticide-related issues). For more defined conditions like Parkinson's or cancer, the veteran does need to provide a nexus. This is where the above scientific findings become crucial.

Using the Evidence for DBQs and Nexus Letters: When preparing Disability Benefits Questionnaires or nexus letters, clinicians should:

- **Document the Veteran's Exposure** – note if they wore permethrin-treated uniforms for prolonged periods, regularly applied high concentrations of DEET, or served in pest control duties (mixing/spraying malathion, etc.). Military records or personal statements can establish this. (Example: "Veteran was stationed at Tallil Air Base where extensive pesticide spraying (malathion, resmethrin, permethrin-based fogs) was conducted in 2003 ncbi.nlm.nih.gov.")
- **Identify the Chronic Condition** – give a medical diagnosis if possible (e.g. Parkinson's disease, diagnosed in 2020) or describe symptoms if it's an undiagnosed illness (e.g. chronic fatigue, memory loss, joint pain starting a year after deployment).
- **Explain the Link with Supporting Research** – cite reports and studies showing the association. For instance, if the veteran has Parkinson's, the nexus letter might say "*Epidemiologic studies show that veterans with significant insecticide exposure have higher rates of Parkinson's disease apdaparkinson.org. Given this veteran's exposure to organophosphate pesticides in service and the lack of other risk factors, it is as likely as not that the Parkinson's is service-connected.*" If the condition is cancer, reference IARC conclusions (e.g. malathion and NHL publications.iarc.fr) or





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



AHS findings (e.g. chlorpyrifos and lung cancer pubmed.ncbi.nlm.nih.gov). For autoimmune issues, note the increased risk of RA with malathion/carbaryl news-medical.net. Whenever possible, use VA or IOM sources as they carry weight: e.g., quoting the Research Advisory Committee's finding that pesticides are linked to Gulf War Illness publichealth.va.gov, or the National Academy's conclusions.

- **Address Other Factors** – acknowledge if the veteran has other exposures (burn pits, solvents, etc.) or habits (smoking) that could also contribute, but clarify that pesticide exposure is a *known* risk factor for the condition in question. This helps strengthen the argument that the condition is “at least as likely as not” related to service.

The **VA's Own Publications** and directives can be useful citations. The VA Public Health site explicitly lists the pesticides used in theater (including DEET, permethrin, organophosphates, pyrethroids) publichealth.va.gov and advises veterans to seek evaluation if concerned. While VA concluded no *conclusive* causation for multisymptom illness, it continues to research health trends publichealth.va.gov. Moreover, the **Federal Register** notices can contain VA's rationale for any presumptive decisions or denials related to pesticides – these can be cited to show the issue has been formally considered.

Conclusion:

Chronic health conditions potentially stemming from post-9/11 pesticide exposure span multiple organ **systems**. Veterans suffering from cancers, neurological disorders, autoimmune diseases, respiratory ailments, or persistent unexplained symptoms should be evaluated in light of their exposure history. Both scientific evidence and VA-recognized research support a nexus in many cases, even if not every relationship is officially presumptive. By presenting clear medical rationales backed by studies (IOM reports, VA advisory committee findings, epidemiological research), clinicians can assist veterans in establishing service connection for these long-term health effects of their honorable service.





ONE TEAM ONE MISSION

THESE THINGS WE DO THAT OTHERS MAY LIVE



Sources:

- Deployment pesticide use and exposure documentation ncbi.nlm.nih.gov/publichealth.va.gov
- VA and IOM reports on Gulf War exposures and health outcomes publichealth.va.gov
- Epidemiologic studies linking pesticides to chronic conditions: neurological apdaparkinson.org, academic.oup.com, cancer publications.iarc.fr, pubmed.ncbi.nlm.nih.gov, autoimmune pubmed.ncbi.nlm.nih.gov/news-medical.net, respiratory sciencedirect.com, etc.
- IARC Monograph conclusions on organophosphate insecticides publications.iarc.fr.
- National Academy of Sciences **Gulf War and Health** reviews (Volumes 2, 8, 11) ncbi.nlm.nih.gov/nap.nationalacademies.org.
- VA Public Health statements on pesticides and veterans publichealth.va.gov/publichealth.va.gov.

