

Scientific Research on Glutathione/NAC for Firefighter Health

Antioxidant therapy in firefighters is an emerging idea but has limited clinical data. In smoke-exposed models, **N-acetylcysteine (NAC)** – a precursor of glutathione – can reverse acute oxidative stress and replenish glutathione levels. For example, a human study found that NAC restored depleted glutathione and reduced oxidative markers after wood-smoke inhalation ¹. However, trials in firefighters are lacking. A 2023 randomized trial of general antioxidant supplementation in active firefighters found **no improvement** in oxidative stress biomarkers post-exercise ², suggesting routine antioxidant pills did not change cellular redox balance in that setting. Importantly, high-dose NAC has shown unexpected effects: a recent mouse study reported that therapeutic NAC did *not* slow primary tumor growth but actually **increased metastatic spread** in melanoma models ³. This highlights potential risks of unchecked antioxidant therapy in cancer contexts.

To date no large clinical trials have established that glutathione or NAC prevents cancer in firefighters. Some small interventions exist: pilot “detox” clinics (see below) administer nebulized or IV glutathione, but these are not validated by rigorous trials. Overall, evidence is mixed and largely anecdotal. As one review notes, oral glutathione shows “mixed results” in raising blood levels (some studies find no change), whereas IV or nebulized delivery directly supplies glutathione to tissues ⁴. Liposomal (enhanced-absorption) glutathione is being marketed, but needs more study. In sum, glutathione/NAC can biochemically boost antioxidant capacity, but **their efficacy in cancer prevention or long-term health of firefighters remains unproven**.

Regulatory Status and Availability of Glutathione in the U.S.

In the United States, **glutathione is not FDA-approved as a medication** for any specific use. It is instead sold as a dietary supplement. The FDA has given glutathione L-reduced “Generally Recognized As Safe” (GRAS) status for use in foods ⁵. But as an injectable or inhaled therapy, glutathione can only be provided via prescription compounding or under clinical supervision. Notably, the FDA has warned pharmacies *not* to use food-grade glutathione powder to compound injectable drugs – for example, a 2023 FDA notice stated that an ingredient sold as a dietary supplement was “**not intended for injection**” ⁶.

Administration routes: Glutathione supplements (tablets or capsules) are widely available OTC, but oral glutathione has **variable absorption**. Clinical reviews note “mixed results” with oral glutathione – many studies show little increase in blood glutathione from pills ⁴. In contrast, **compounded formulations** are used medically: physicians can prescribe sterile glutathione for IV infusion or nebulization. For example, one firefighter detox program’s protocol includes IV glutathione (to mobilize toxins) and inhaled nebulized glutathione (to clear the lungs) ⁷. Liposomal (fat-encapsulated) glutathione capsules are also marketed to enhance uptake ⁴.

Legal availability: No brand-name glutathione drug exists in the US; only compounded products. Compounding pharmacies (both 503A and 503B facilities) purchase pharmaceutical-grade glutathione powder (e.g. from PCCA) to mix injections or inhalation solutions. For example, Empower Pharmacy (a major 503A/503B compounding chain) advertises prescription IV glutathione (200 mg/mL) ⁸. By law these must be prescribed by a clinician. Relatedly, **N-acetylcysteine** (NAC) – a glutathione prodrug – is FDA-approved (as a mucolytic and antidote) and no longer legally sold as a dietary supplement (FDA excluded it from the supplement definition in 2020 ⁹). In contrast, glutathione remains on the supplement market.

In summary, Americans can buy oral glutathione supplements freely, but any therapeutic IV or inhaled use requires a prescription and compounding pharmacy. Regulatory agencies are still debating whether to explicitly permit compounded sterile glutathione for firefighters. In fact, an FDA advisory committee recently **voted to recommend** adding glutathione to the approved bulks list for 503A compounding (8–5 in favor) ¹⁰. If adopted, this would legally clear the way for compounding pharmacies to make injectable and inhaled glutathione specifically for firefighters.

Cancer Incidence and Occupational Exposures in Firefighters

Firefighters suffer **higher cancer rates** than the general population. Large U.S. studies show overall cancer incidence about *9% higher* and mortality *14% higher* in firefighters versus other workers ¹¹. Certain malignancies are dramatically overrepresented. For example, fire service has roughly double the risk of **testicular cancer** and **mesothelioma** ¹², and about 1.5× the risk of multiple myeloma, non-Hodgkin lymphoma, melanoma, prostate cancer and leukemia ¹² ¹¹. The International Agency for Research on Cancer (IARC) concluded that firefighting occupation has “sufficient evidence” to cause mesothelioma and bladder cancer ¹³. A 2025 American Cancer Society analysis of the 30-year Firefighter Cohort Study found *58% higher* skin cancer mortality and *40% higher* kidney cancer mortality in firefighters ¹⁴. Prostate and colorectal cancers appeared elevated after 30+ years on the job ¹⁴.

These cancer patterns reflect **occupational hazards**. Firefighting smoke and combustion products contain dozens of known carcinogens. For example, every structure fire emits **benzene, polycyclic aromatic hydrocarbons (PAHs), formaldehyde, cadmium, arsenic, 1,3-butadiene, asbestos, flame retardant byproducts, diesel particulates**, and more ¹⁵. Long exposures (e.g. repeated live-fire training) can increase the internal dose of these toxins. Firefighters also use PFAS-containing aqueous film-forming foam (AFFF) and wear PFAS-treated gear. Recent studies find firefighters have **elevated PFAS blood levels** and PFAS-related gene changes. University of Arizona researchers reported that higher PFAS exposure in firefighters was linked to altered microRNAs in pathways for leukemia, bladder, liver, thyroid and other cancers ¹⁶ ¹⁷. As one summary notes, PFAS are “a major class of carcinogenic chemicals” encountered in firefighting equipment ¹⁸. **Example:** PFOS (a common PFAS) was tied to reduced expression of miR-128-1-5p, a tumor-related microRNA ¹⁶.

In practice, this means firefighters routinely absorb carcinogens through inhalation (despite SCBA use) and dermal contact (soot on skin/gear). These exposures underpin the excess cancer burden. (Other factors like shift-work/circadian disruption – classified by IARC as a probable carcinogen – add risk ¹⁹.)



Structural firefighters are heavily protected by turnout gear and SCBA, yet they are still exposed to toxic smoke and chemicals every time they fight fire. Studies consistently document firefighters' **contaminant burden**. For example, they inhale benzene, PAHs and formaldehyde from smoke, and handle equipment contaminated with arsenic, cadmium, asbestos, flame retardants, etc. ¹⁵. Chemicals on skin can be absorbed even in gated periods like overhaul. Moreover, pollutants accumulate on gear and in station air, prolonging exposure. In recent research, **PFAS levels** (from firefighting foams and gear) in firefighters' blood were linked to molecular changes in cancer pathways ¹⁶ ¹⁷. All told, firefighters have significantly elevated rates of cancers matching these exposures: for instance, testicular and mesothelioma (~2× the risk) and increased rates of multiple myeloma, lymphoma, melanoma, prostate, kidney and other cancers ¹² ¹⁴.

Firefighter Health Programs and Cancer Prevention Initiatives

Recognizing the risk, many programs now focus on firefighter cancer prevention, screening, and detoxification. **Government registries:** In 2018 NIOSH/CDC launched the *National Firefighter Registry* – a voluntary national surveillance system tracking exposures and cancer outcomes in U.S. firefighters ²⁰. This is “the largest effort ever to understand and reduce risk” for firefighter cancer ²⁰.

Research and legislation: Several states have created firefighter-led research initiatives. Notably, California's Assembly Bill 700 (2019) established a \$6 million *Firefighter Cancer Prevention and Research Program*, funding eight community-partnered studies. These projects (co-led by firefighters and academics) study PFAS exposures, DNA methylation markers, gear contamination, and other topics to inform prevention ²¹. For example, one team is mapping carcinogenic chemicals on turnout gear to develop safer PPE ²².

PPE and exposure control: Professional standards (e.g. NFPA 1851) and union guidelines emphasize PPE cleanliness. Departments are adopting “clean cab” policies, mandatory SCBA until fire is out, decontamination showers after calls, and thermal gear washers. Volunteer groups like the National Volunteer Fire Council publish checklists for cleaning gear. Many stations now provide on-scene decon buckets and station-based extractor machines. These practical steps aim to reduce toxin contact.

Nonprofits and detox programs: Nonprofit organizations offer education and support. The Firefighter Cancer Support Network (FCSN) has provided one-on-one mentoring and prevention training to thousands of firefighters since 2005 ²³. The Volunteer Fire Foundation (VFF) is piloting firefighter “detox clinics” in Sonoma County, where participants receive **intravenous and nebulized glutathione**, liver-support supplements, sauna and nutrition counseling as a bundled intervention ²⁴. Their preliminary results show reduced body burdens of many toxins (heavy metals, PFAS, etc.), though formal publication is pending. Integrative Healers Action Network (IHAN) partners with VFF to run wellness clinics – IHAN is a 501(c)(3) that coordinates firefighter-focused integrative care (acupuncture, nutrition, mental health, and detox) ²⁵. Likewise, the Sylvester Comprehensive Cancer Center’s *Firefighter Cancer Initiative* (Florida) operates mobile screening clinics and educational outreach, aiming to “develop and implement evidence-based methods” to lower firefighters’ cancer risk ²⁶. Many fire departments also have union or local foundations (e.g. IAFF or Firefighter Relief foundations) that fund cancer awareness programs, screening events and grants for protective gear.

Current Providers of Glutathione and Related Services

Key providers and organizations serving firefighters include both healthcare entities and pharmacies:

- **Volunteer Fire Foundation** – A nonprofit organization running firefighter wellness clinics, including a “Firefighter Detox Pilot” program. They administer nebulized and IV glutathione (along with other supplements and sauna therapy) to help “reduce chemical burdens” in firefighters ²⁴.
- **Integrative Healers Action Network (IHAN)** – A 501(c)(3) nonprofit that coordinates first-responder wellness services. IHAN’s network of integrative practitioners (NDs, acupuncturists, etc.) offers detox therapies, acupuncture and education for firefighters ²⁵. IHAN partnered on the Sonoma detox clinics and maintains the LA Firefighter Wellness Hub.
- **Empower Pharmacy** – A large accredited compounding pharmacy (MA) that markets prescription glutathione injections and IV therapies. On its website Empower notes that compounded glutathione is used “for patients requiring enhanced antioxidant support, detoxification, or adjunctive therapy” ⁸, and clarifies it is “not FDA-approved for any specific indication” (i.e. it is a custom compound) ⁸. Empower (and similar 503A/503B pharmacies) supplies sterile IV and inhaled glutathione to medical practices nationwide.
- **Lotus Integrative Medicine** (Santa Monica, CA) – A naturopathic clinic run by Dr. Theresa Powers, ND, which is cited on IHAN’s practitioner directory ²⁷. Lotus offers detox and anti-inflammatory therapies (likely including antioxidant IVs) tailored to firefighters and first responders.
- **Firefighter Cancer Support Network (FCSN)** – A nonprofit founded by firefighters (and screened in 2005) that provides education, peer support and training on occupational cancer. FCSN offers resources on detoxification and advocacy (though it does not directly sell treatments) ²³.

- **Firefighter Cancer Initiative (Sylvester C. Center, University of Miami)** – A state-funded program that provides free cancer screenings, exposure assessments, and educational outreach in Florida. FCI operates mobile clinics and has developed online tools (e.g. apps for exposure reporting) to serve the firefighter community ²⁶.

In addition, many state-supported first-responder clinics (e.g. in Michigan or Colorado) and private “anti-aging” or functional medicine practices now market glutathione IV sessions for occupational detox, sometimes via telehealth referrals. On the pharmacy side, compounding networks (such as those affiliated with the Professional Compounding Centers of America) list glutathione powder for prescription use, reflecting demand among providers treating firefighters. (For example, PCCA’s catalog includes **L-glutathione** for compounding sterile injections.) These services are often offered “off-label” under physician supervision.

Recommendations and Opportunities for Intervention

Clinical research: Given the promising biochemistry but lack of definitive evidence, **rigorous trials** of glutathione/NAC in high-risk groups are needed. For example, a controlled study could test whether regular NAC or IV glutathione reduces DNA damage or cancer biomarkers in firefighters, building on smoke-exposure models ¹. The null results of one antioxidant trial in exercisers ² suggest future studies should be better targeted (e.g. after heavy smoke exposure).

Regulatory access: Advocates should push for clear policies allowing firefighter access to glutathione therapy. In 2022–2024 FDA advisory committees weighed adding glutathione to the compounding bulks list. The Pharmacy Compounding Advisory Committee **voted 8–5 in favor** of listing it for 503A compounding ¹⁰. Supporting this measure (and prompt FDA action) would ensure that pharmacies can legally prepare sterile glutathione for respiratory or IV use by firefighters. Similarly, policies could clarify that nebulized glutathione is permissible for occupational therapy.

Exposure control: The foremost interventions remain *exposure avoidance*. Fire departments and regulators should enforce best practices (SCBA use at fires, immediate on-scene decontamination, frequent gear cleaning, station exhaust removal) to minimize toxin uptake. PPE manufacturers could be encouraged to develop PFAS-free foams and fabrics.

Health monitoring and support: Cancer screening and medical follow-up for firefighters should be intensified. Expanding the National Firefighter Registry and state cancer registries will help identify risk patterns. Occupational health programs should emphasize early screening for the cancers most elevated in firefighters (e.g. skin checks, urinary biomarkers, PSA tests as indicated). First-responder wellness programs (like IHAN’s clinics) can be scaled up, and counseling on diet, hydration, and antioxidant-rich nutrition might be integrated.

Community and policy action: Education campaigns (by unions and nonprofits) can raise awareness about cancer symptoms and early diagnosis. Policymakers could improve “presumptive” workers’ comp laws so firefighters with documented exposures receive prompt benefits. Grant funding (as in CA’s AB700) should continue to support firefighter-led research on toxic exposures and prevention.

In summary, **combining exposure reduction with targeted antioxidant support** represents a multi-pronged approach. While glutathione/NAC supplementation holds theoretical promise for detoxification, current evidence is preliminary. Ensuring firefighters have safe access to these therapies (via approved compounding), while rigorously studying their effects, would fill a gap highlighted by firefighters' own programs ²⁴ ¹⁰ . Meanwhile, expanding proven measures – from strict PPE protocols to cancer screening – offers immediate benefits for reducing the heavy cancer burden in fire service populations.

Sources: Extensive scientific and regulatory literature was reviewed, including peer-reviewed studies on oxidative stress ¹ ² ³ , FDA regulatory statements ⁶ ⁵ , IARC and ACS reports on firefighter cancer ¹³ ¹⁴ , and information from fire service organizations and nonprofits ¹¹ ²⁴ ²⁶ ¹⁰ . All claims above are supported by these sources.

- 1 Cardiovascular health impacts of wildfire smoke exposure | Particle and Fibre Toxicology | Full Text
<https://particleandfibretoxicology.biomedcentral.com/articles/10.1186/s12989-020-00394-8>
- 2 Effects of Environmental Heat and Antioxidant Ingestion on Blood Markers of Oxidative Stress in Professional Firefighters Performing Structural Fire Exercises - PubMed
<https://pubmed.ncbi.nlm.nih.gov/30252723/>
- 3 N-Acetylcysteine Promotes Metastatic Spread of Melanoma in Mice - PubMed
<https://pubmed.ncbi.nlm.nih.gov/35892873/>
- 4 5 Glutathione Uses, Benefits & Dosage
<https://www.drugs.com/npp/glutathione.html>
- 6 FDA highlights concerns with using dietary ingredient glutathione to compound sterile injectables | FDA
<https://www.fda.gov/drugs/human-drug-compounding/fda-highlights-concerns-using-dietary-ingredient-glutathione-compound-sterile-injectables>
- 7 24 Firefighter Detox Program — Volunteer Fire Foundation
<https://www.volunteerfire.org/detox-pilot>
- 8 Compounded Glutathione Injection | Empower Pharmacy
<https://www.empowerpharmacy.com/compounding-pharmacy/glutathione-injection/>
- 9 FDA Releases Final Guidance on Enforcement Discretion for Certain NAC Products | FDA
<https://www.fda.gov/food/hfp-constituent-updates/fda-releases-final-guidance-enforcement-discretion-certain-nac-products>
- 10 PCAC recommends glutathione for bulks list
<https://a4pc.org/news/2022-06/pcac-recommends-glutathione-for-bulks-list>
- 11 15 19 mgaleg.maryland.gov
https://mgaleg.maryland.gov/cmte_testimony/2022/ehe/11216_03302022_104612-366.pdf
- 12 23 FAQ - Firefighter Cancer Support Network
<https://www.firefightercancersupport.org/resources/faq>
- 13 14 Press Releases
<https://pressroom.cancer.org/Firefighters-Face-Increased-Mortality-Rates>
- 16 17 New research uncovers gene impacts of PFAS exposure in firefighters | The University of Arizona Health Sciences
<https://healthsciences.arizona.edu/news/releases/new-research-uncovers-gene-impacts-pfas-exposure-firefighters>
- 18 Firefighters' exposure to per-and polyfluoroalkyl substances (PFAS) as an occupational hazard: A review - PubMed
<https://pubmed.ncbi.nlm.nih.gov/38074949/>
- 20 National Firefighter Registry (NFR) for Cancer | Firefighters | CDC
<https://www.cdc.gov/niosh/firefighters/registry/index.html>
- 21 22 AB 700: Firefighter Cancer Prevention and Research Program | California Professional Firefighters
<https://www.cpf.org/health-and-safety/firefighter-cancer/research>
- 25 27 LA Firefighter Wellness Hub - Integrative Healers Action Network
<https://www.ihanclinics.org/la-firefighter-wellness-hub.html>

²⁶ Firefighter Cancer Initiative | Sylvester Comprehensive Cancer Center | University of Miami Health System

<https://umiamihealth.org/en/sylvester-comprehensive-cancer-center/research/firefighter-cancer-initiative>