Excerpts from a proposal to study the effects of treating Gulf War Illness using an innovative detoxification method

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Specific Elements of the Hubbard Sauna Detoxification Method

Niacin: Niacin administration is a vital component. The following is a summary of niacin's functions that may account for its benefit. Niacin affects adipocytes, initially inhibiting lipolysis for one hour, then causing a dramatic increase in free fatty acid (FFA) release from adipose tissue for over 24 hours (39,40,41). Release of free fatty acids has been shown to be accompanied by a release of fat-stored toxins in animal studies (42,43), as well as in human studies of serum PCBs after weight loss (44). Xenobiotics can then be distributed to hepatic enzyme biotransformation, and biliary or renal excretion processes. Also, prostaglandin D2 release causes vasodilation in the skin (45,46), potentially increasing movement of xenobiotics from deeper circulation through the dermal tissues for redistribution into sebum and/or into sweat gland. This normally relatively minor excretory route is increased with increased sweating in the sauna.

An equally important function of niacin, unrelated to potential mobilization of lipophilic chemicals, is the requirement for nicotinamide adenine dinucleotide phosphate (NADPH) in order to regenerate reduced glutathione (GSH) (47). Recent work with cultured human aortic endothelial cells found that niacin increased NADPH levels by 54% and GSH by 98% (48). Additionally, niacin inhibits vascular inflammation by decreasing production of reactive oxygen species and inflammatory cytokines (48). This in vitro work may explain some of the benefits of the Hubbard regimen, alleviating symptoms associated with inflammation such as pain. Niacin also was found to reduce the fibrinogen concentration in plasma and stimulate fibrinolysis in men (49), which could improve a hypercoaguable state found in some GWV (50).

Thirdly, more than 500 enzymes require niacin (51). In particular, niacin is required to maintain the co-enzymes nicotinamide adenine dinucleotide (NAD) and NADPH involved in biotransformation (52). NAD/P concentrations in tissues can be increased with high dose niacin or niacinamide (53). NAD is the coenzyme for all dehydrogenase enzymes such as those for metabolism of alcohol, acetaldehyde and other xenobiotics. NADPH and GSH are required for biotransformation and elimination of many compounds, including foreign compounds such as drugs or contaminants (54). Glutathione detoxification pathways depend on availability of NADPH (47) required to regenerate GSH. Thus if xenobiotic metabolizing enzymes are dependent on NAD/P, there must be a continuous, adequate supply.

Fourthly, NADH is the major redox carrier in mitochondria and energy production fails if there is insufficient NAD. NAD is depleted when needed as a substrate for repair of DNA strand breaks due to damage from xenobiotics (55). Here is an intriguing possibility that directly links the benefits of niacin and recovery from exposure to xenobiotics. Insufficient NAD could then result in local, intracellular failures in xenobiotic biotransformation as well as reduced availability of GSH. Xenobiotics may in fact set up *intracellular pellagra* (pellagra is a classic vitamin deficiency disease characterized by dermatitis, diarrhea, and dementia) in susceptible tissues. This could be analogous to recent work showing that HIV infection induces a state of decreased intracellular NAD and nicotinamide referred to as intracellular pellagra (56). Cognitive changes, rashes and pathogen free diarrhea, the cardinal features of pellagra, are found in patients with HIV infection, similar to symptoms of GW illness. Thus, it is possible that a nonpersistent xenobiotic could become 'persistent' if it sets up a local pellagragenic effect inhibiting the NAD(P) redox and detox reactions necessary for its own

metabolism. NAD/P concentrations in tissues can be increased with high dose niacin (53). Such flooding of the affected tissues with niacin may allow detoxication steps to proceed. It is of note that many drugs are capable of inducing niacin deficiency or pellagra, including carcinogenic alkylating agents, izoniacid and other hydrazines, tricyclic antidepressants and the anti-convulsant carbamazipine (57).

Fifthly, recent research has identified a wide array of signaling pathways that involve NAD and NADP. Both NAD and NADP represent precursors of intracellular calcium-mobilizing molecules which trigger muscle contraction, neuronal ion fluxes, catecholamine secretion, insulin secretion and T-cell activation (52). A xenobiotic induced intracellular depletion of NAD/P could have again dysregulated key functions, potentially restored by high doses of niacin as provided in the detoxification regimen.

Exercise: Twenty to thirty minutes of aerobic exercise, which may be low impact, is done at the beginning of each daily session, immediately after taking the daily dose of niacin. It is begun gradually depending on fitness level. Aerobic exercise results in doubling of adipose blood flow and a substantial post exercise lipolysis and lipid mobilization from adipose tissue beginning ~ 1 hr post exercise and continuing ~ 3 hrs (58). Mobilizing free fatty acids has been shown to mobilize fat stored pesticides (42, 43) and PCBs (59). “As reported by Kang in the RAC report (2008), 35% of ill GWV said vigorous exercise made their symptoms worse, while 18% said light exercise made symptoms worse, but 16% found light exercise helpful. Thus the exercise component of the detoxification protocol will have to be provided at whatever level the veteran can find tolerable, and increased very gradually, as tolerated.

Sauna/sweating: The tradition of sauna use is very old, especially in northern latitudes. Sweating is promoted for 2.5 to 4.5 hours daily in a well-ventilated Finnish style sauna (60), with short breaks for hydration, cool showers (61) and electrolyte replenishment as needed to offset losses. The sauna temperature is moderate, from 140’ to 180’F, which is lower than that used in health clubs, and is well tolerated. Physiologic effects have been well described in the literature. The sauna is a form of heat stress whereby the increased thermal load activates heat loss mechanisms including increased circulation through the skin and sweating (62). The blood flow to the skin increases from a baseline of 5-10% to 60-70% of the cardiac output (63). Maximal sweating occurs within 15 minutes and the fluid loss may be as high as 2 liters per hour in an acclimatized person (64). Sweating is mediated by the hypothalamus and is associated with an increase in noradrenaline (65, 66). Recent research has reported that sauna therapy improves endothelial dysfunction in subjects with hypertension, hyperlipidemia, diabetes mellitus, obesity, and smoking (67). The sauna has been found to be safe for persons with stable coronary heart disease, and may lower blood pressure in persons with hypertension and improve congestive heart failure (68,69).

Phamacokinetic effects have been minor for the orally administered drugs which have been studied (e.g. midazolam, ephedrine, propranolol and tetracycline). Systemic absorption of subcutaneously administered drugs (insulin) is increased (70). Only two published observational articles were found on use of the sauna as a sole modality to detoxify or to enhance elimination of xenobiotics. One described elimination of mercury via sweat for mercury exposed workers (71) and the other, in Russian, stated “sauna increased excretion with sweat fluid of toxic substances (lead, thiuram, captax, sulphenamide C) that penetrated the body during work” (72). Lipophilic contaminants such as PCBs and dioxins have been identified in sebum (73,74) and numerous xenobiotics have been identified in sweat including heavy metals (71,75), antibiotics (76), cocaine and heroin (77) , and other drugs of abuse (78). Some loss of toxins via sweat is thus probable, given sufficient sweating, if these can be mobilized from tissue storage compartments. Water, electrolytes and trace elements lost during exercise plus sweating must be appropriately replaced (79,80).

Sweat is frequently reported as black or colored during the regimen, for instance in approximately 30 percent of all World Trade Center cases (personal communication New York Rescue Workers Detoxification Project physician, Dr. Gelb). A published case report of a worker exposed to soot and ash from cleaning filters from an oil-fired generator exuded an oily black substance from her skin for 3 weeks during treatment with the sauna detoxification protocol (81) (author's note: this was later analyzed and found to be a 12-carbon chain terpene). A published case report of a highly PCB exposed woman with severe symptoms including chloracne was determined to have a PCB content of 66 ppm (total of 17 congeners) measured in skin lipids (82).

Supplemental Polyunsaturated Oils: Two or more tablespoons of a cold-pressed blend of walnut, peanut, soy, and safflower oils along with lecithin as a source of phosphatidylcholine are provided daily. Walnut and soy oils are rich in omega-3 fatty acids, while safflower, soy and peanut oils are rich in omega-6 fatty acids. Oils have 3 roles: (1) early animal trials with mineral oil (83) and later human trials with the sucrose-polyester olestra (84) enhanced gut excretion of lipophilic toxins. Polyunsaturated oils present in the gut can act to prevent re-uptake of xenobiotics being eliminated through bile (which may be reabsorbed via enterohepatic recirculation) as well as enhance passive diffusion across the intestinal mucosa (34). (2) Dietary fats can induce modifications in membrane lipid composition that are associated with changes in the rates of membrane-linked cellular processes (85). (3) It has been recently shown that an oily meal that increases triglyceride levels will draw the lipophilic compound DDT from peripheral tissues into the blood compartment (86). In those cases where allergies preclude the use of the stated blend of oils, others may be substituted, including olive oil.

Supplemental Micronutrients: Supplementation with vitamins, minerals, and electrolytes offsets losses due to sweating and provides amounts more than adequate for increased metabolic demand as well as for antioxidant protection. Presuming that the regimen is effectively mobilizing xenobiotics, induction of the cytochrome P450 enzymes could potentially contribute to chemical toxicity. It is vital to protect against toxic effects and reactive oxygen species via an antioxidant defense system that is fully functional and includes enzymes, antioxidants and free radical scavengers, together with the antioxidant vitamins C, E and A, and trace elements iron, zinc, magnesium, selenium, copper, and manganese. The individual components get utilized and require replenishment (87-90). Vitamins and minerals in the regimen are administered in a five-stage schedule based on the dose of niacin, which gradually increases, as detailed in tables in the Protocol section below.

Preliminary Data on the Hubbard Sauna Detoxification Regimen: Early uses and studies of the Hubbard sauna detoxification method addressed such persistent lipophilic xenobiotics as PCBs, PBBs, DDT and HCB, showing both reduction in adipose or serum levels, and reduction in symptoms. Later studies included outcome measures such as neurobehavioural tests and functional status/quality of life measures such as the Rand SF-36 Questionnaire.

Efficacy Studies: *(1) Reductions in body burdens of lipophilic xenobiotics:* It has been demonstrated in several trials that the regimen does reduce body burdens of several persistent organohalides. Importantly, these xenobiotics may be mere markers for others, or for a composite effect that has not per se been measured. There is no straightforward correlation between particular chemicals and particular symptoms. However, it has been demonstrated that the regimen is indeed a detoxification process, as detailed in Table 1.

Table 1: Reduction of Body Burden

Study	Sample	Organohalide Tests	Key Findings	Comments
Schnare, 1984 (92)	Healthy males (n=7) age 20-30	Adipose levels of 6 PBB congeners, 7 PCB congeners, DDE, heptachlor epoxide and dieldrin pre, post and at 4-month post treatment follow-up	Reduction total PBBs of 34% and total PCBs of 34% ($p<0.05$) with 58% at and 38% at follow-up ($p<0.01$).	Persistence in humans of PBBs well established. Lean body mass before and after showed a 0.45% reduction in body fat(n.s.), demonstrating true body burden reductions rather than compartment shift.
Schnare, 1986 (93)	Healthy male electrical workers (n=10) with ongoing occupational exposure to HCB and PCBs, treated (n=5), matched controls (n=5)	Adipose, serum and skin oil levels of HCB, 5 chlorinated pesticides and 9 PCB congeners pre, post and at 3-month follow-up. Participant serum levels measured at 4 day intervals during treatment.	Adjusted for re-exposure as represented in the control group, HCB body burdens were reduced by 30% post and 28% at 3 months. Mean reduction of PCBs was 16% post and 14% at 3 months. Analysis of variance indicates these reductions are statistically significant (f less than 0.001). Enhanced excretion appeared to keep pace with mobilization, as blood-serum levels in the treatment group did not increase during treatment.	Lack of increase in serum levels during treatment suggests mobilization keeping pace with excretion.
Tretjak, 1990 (94)	Symptomatic male capacitor workers (n=11) and male matched coworkers as controls (n=13) with high exposures to PCBs in Semic, Yugoslavia	Adipose and serum levels of 18 PCB congeners, before, after and at 4-month post treatment follow-up. Adipose levels ranged from 22-562 ppb in serum and 2-77 ppm in fat.	For 6 treatment group A adipose PCBs decreased 30% (n.s.) and serum PCBs 42% ($p<.05$). Improvement in chloracne, rashes, dry thickened skin, conjunctivitis and eyelid swelling.	Treatment group composed of 2 sub-groups, one (B) of which had concomitant disease which had less adipose reduction. Exposure levels were high and all participants had long term symptoms of poor health.
Tretjak, 1990 (82)	Case report female capacitor worker highly exposed to PCBs	PCBs in adipose, serum, skin oils and nipple discharge.	Adipose 102 ppm reduced to 37 ppm; serum 512 ppm reduced to 261 ppm; skin lipids measured 66 ppm; nipple discharge 712 ppm - ceased during treatment.	Multisymptom illness resolved at end of treatment.
Dahlgren, 2007 (95)	Personnel (n=7) exposed due to the collapse and subsequent fire of the World Trade Center (WTC) September 11, 2001.	Serum PCBs and dioxins	23.4% mean reduction by weight (lipid based) of all halocarbons. WHO-TEQ for mono-ortho PCBs was decreased by 24.4%.	

(2) Symptoms, function and quality of life: Neurocognitive tests were assessed in 3 studies with consistent and significant improvements. (See Table 2.) The first (1982) study of the program included 2 neurobehavioral tests. On the Wechsler Adult Intelligence Scale IQ there was a mean increase in of 6.7 points ($p<0.001$). On the Minnesota Multiphasic Personality Inventory profiles decreased on most scales with large reductions on scale 3 and 4 ($p<0.01$)(38). In 1989 a peer reviewed study of 14 firemen who had been exposed to PCBs and byproducts at a transformer fire and explosion had poorer neurocognitive test scores than control firemen from the same city (91).

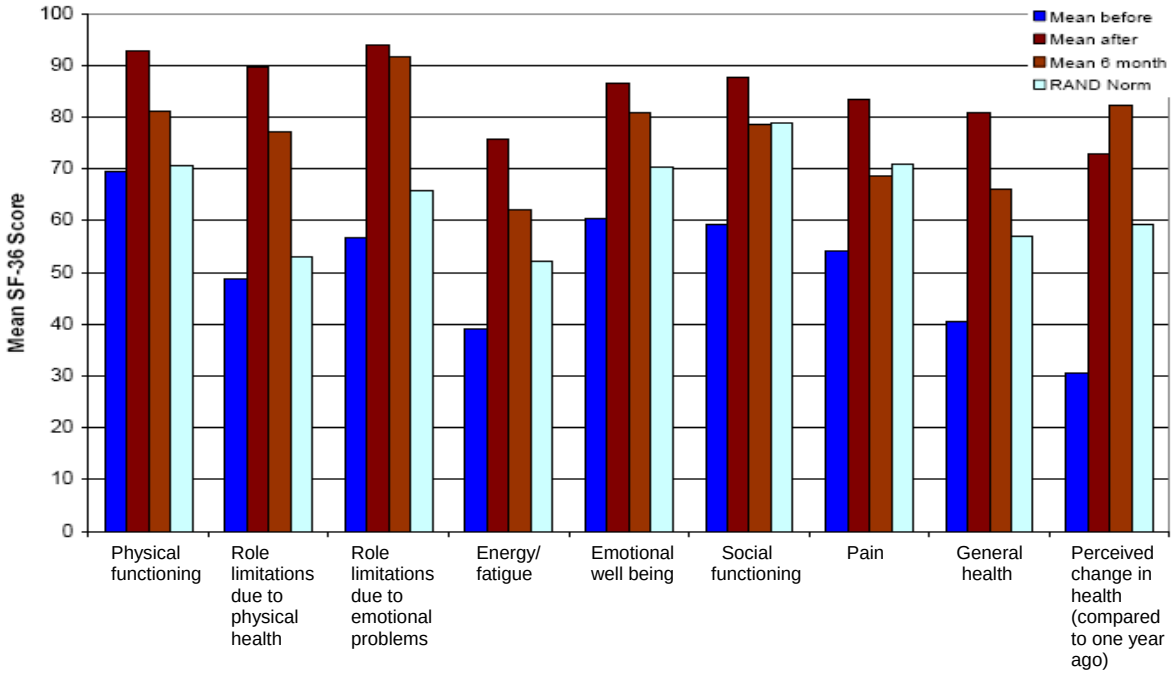
Table 2: Symptom Improvement

Study	Sample	Tests	Key Findings	Comments
Schnare, 1982 (38)	Group with mixed exposures including illicit drugs (n=103) and controls (n=19).	Wechsler Adult Intelligence Scale IQ and Minnesota Multiphasic Personality Inventory	On the Wechsler Adult Intelligence Scale IQ there was a mean increase in of 6.7 points ($p<0.001$). On the Minnesota Multiphasic Personality Inventory profiles decreased on most scales with large reductions on scale 3 (hysteria) and 4 (amoral, asocial) ($p<0.01$).	
Kilburn, 1989 (91)	Firemen exposed to PCBs and byproducts in a transformer fire and explosion (n=14) poorer neurocognitive test scores than non exposed matched firemen (n=14) from the same city	Neurobehavioural test battery before and after protocol: memory, cognitive and perceptual motor speed via stories, visual images, & digits backwards, block design, embedded figures, Culture Fair, trail making and choice reaction time.	Following treatment memory tests were improved. For both stories and visual reproduction, Trails B, a cognitive and motor performance test, and cognitive functions measured by block designs and embedded figures improved significantly ($p<0.05$), and the improvement in Culture Fair was just short of significant.	Impairment in memory and cognitive function compared to controls had been protracted and was tested 6 months after exposure in the fire.
Tsyb, 1998 (96)	Males aged 20 to 40 yrs (n=24) randomly selected from a cohort with confirmed body burdens exceeding levels of 5,000 kilobecquerel (kBq) of radioactive cesium, residents in radiation contaminated Chernobyl district.	Diagnostic psychological evaluations (including both objective and subjective evaluations of selfperception, activity, moods, and emotional reactions) were conducted.	Evaluation of psychosocial states revealed a significant ($p<0.05$) positive change in the psychoemotional status of the program participants. Anxiety decreased from 23.48% to 9.09%, activity and ability to work increased from 40.9% to 46.96% and from 60.24% to 80.36%, respectively. It was stated that the HM "possesses a powerful psychotherapeutic potential that has been associated with significant improvement in the general health of the participant with increases in physical and mental endurance, activity level and resistance against stress."	
Unpublished, 2009	Rescue workers and individuals exposed to the WTC collapse/fire results from before and after HM (n=188) and at 6-month follow-up (n=25)	RAND SF-36	Substantial improvement in all domains of health related quality of life as measured by the RAND SF-36 after HM (n=188) and at 6-month follow-up (n=25) ($p<0.001$) when comparing before/after scores.	

Following detoxification, memory tests were improved, for both stories and visual reproduction. Trails B, a cognitive and motor performance test, as well as cognitive functions measured by block designs and embedded figures also improved significantly ($p<0.05$), and the improvement in Culture Fair was just short of significant (91).

In the1998 report of the study of Chernobyl exposed residents, evaluation of psychosocial states revealed a significant ($p<0.05$) positive change in the psychoemotional status of the program participants. Anxiety decreased from 23.48% to 9.09%, activity and ability to work increased from 40.9% to 46.96% and from 60.24% to 80.36%, respectively. It was stated that the program "*possesses a powerful psychotherapeutic potential that has been associated with significant improvement in the general health of the participant with increases in physical and mental endurance, activity level and resistance against stress."(*96).

(3) Quality of life:SF-36: Health-related functional status on 8 domains impacting quality of life was measured by the RAND SF-36 in persons exposed to the WTC collapse/fire results from before and after detoxification (n=188) and at 6-month follow-up (n=25) with $p < 0.001$ when comparing before/after scores for all health categories (unpublished data).



(4) Symptom scores: A case series of WTC Rescue Workers intervention cohort (8) reported clear improvement in scores (see above) on symptoms and the SF-36 before and after the detoxification intervention. This cohort, now comprising over 900 New York firemen policemen, EMTs, paramedics and other WTC first responders, has similarities to the Gulf War cohort in that there was a complex exposure to multiple chemicals, with chronic sequelae in a significant proportion of the exposed. Although the impact was predominantly respiratory from inhalation of smoke and highly alkaline dust, other systems/functions besides respiratory including neurocognitive, musculoskeletal and immune were also affected, and became persistent in a substantial proportion of the more highly exposed (97).

Excerpts from Gulf War Illness protocol

Steps of the Sauna Detoxification Regimen

The following steps comprise the daily sauna detoxification regimen. Trained staff members fully supervise each participant on the program and ensure it is being carried out according to standardized methods. Detailed manuals describe the exact delivery methods and each facility has a highly trained Case Supervisor who reviews each subject's progress on a daily basis and additionally ensures medical advice is followed precisely. The intervention continues under daily supervision until the veteran meets completion criteria. (4 to 6 weeks average to completion, 3-5 hour daily therapy, daily report 15 minutes)

- Participant sits down for a 15 minute interview with the attending staff member who reviews and records the number of hours slept, food eaten, vitamins taken. Weight blood pressure and pulse are taken and recorded. (Daily Report Form)
- Participant is administered specific niacin dose for the day per written instructions of Case Supervisor, based on reactions from the previous day.
- Participant does 20-30 minutes of aerobic exercise on treadmill or exercise bicycle or as advised by physician.
- Participant changes into sauna attire and spends the rest of the program time in the sauna at 140–180F (60–80C) for 2.5–5 hours with short showers and cool-off breaks and food as needed.
- Set quantities of vitamins, minerals, and oils are measured out each day, provided to the participant, and recorded on the Daily Report Form. The exact nutrient doses increase in stages corresponding to increases in niacin dose (see schedule below).
- Attending staff observe each participant and ensure they also take sufficient amounts of water, salt and potassium during their program time. This is also recorded on the Daily Report Form.
- Once the regimen is completed for the day the participant showers and dresses and meets again with the staff member for a 15-minute staff interview to review and record in the Daily Report Form what occurred during the program that day. Weight, blood pressure and pulse are again measured and recorded. A summary is also written onto a Daily Report Summary and maintained on the top inside of the participant folder.
- The Case Supervisor reviews every Daily Report Form and any staff notes after each sauna session to make program decisions and determine the rate of increase of niacin and corresponding supplements for each participant for the following day.
- The Site Physician monitors individual participant progress as needed.
- There is a precise combination of objective and subjective phenomena that indicate a participant has completed the program. There is no specific niacin dose at which the program is completed, but it would be unlikely for most participants to finish at doses below 2500-3000 mg. All manifestations must have ceased and the participant should get no new reactions even at high niacin doses. Often the participant will volunteer a statement which indicates he or she is done.

Schedule of Niacin and other Supplements: Administration of vitamins, minerals, oils occurs on a precise schedule based on the dose of crystalline niacin. This includes vitamins A, D, C, E, B complex, B1 and minerals that include calcium, magnesium, iron, zinc, manganese, copper, iodine, sodium and potassium. The polyunsaturated oil is a blend that typically includes soy, walnut, peanut and safflower oils and can be modified as needed to address individual allergies. The following table shows the amount of vitamins administered at each range of niacin dose.

Table of Vitamins

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Niacin	100 – 400 mg	500 – 1400 mg	1500 – 2400 mg	2500 – 3400 mg	3500 – 5000 mg
Vitamin A	5,000–10,000 IU	20,000 IU	30,000 IU	50,000 IU	50,000 IU
Vitamin D	400 IU	800 IU	1200 IU	2000 IU	2000 IU
Vitamin C	250 – 1000 mg	2 – 3 gm	3 – 4 gm	4 – 5 gm	5 – 6 gm
Vitamin E	800 IU	1200 IU	1600 IU	2000 IU	2400 IU
Vitamin B complex*	2 tablets	3 tablets	4 tablets	5 tablets	6 tablets
Vitamin B1	350 – 600 mg	400 – 650 mg	450 – 700 mg	750 – 1250 mg	800 – 1300 mg

*A balanced B-50 complex

Table of Minerals

(All figures in milligrams except those for Cal-Mag*)

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Calcium	500 – 1000	1000 – 1500	1500 – 2000	2000 – 2500	2500 – 3000
Magnesium	250 – 500	500 – 750	750 – 1000	1000 – 1250	1250 – 1500
Iron	18 – 36	36 – 54	54 – 72	72 – 90	90 – 108
Zinc	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
Manganese	4 – 8	8 – 12	12 – 16	16 – 20	20 – 24
Copper	2 – 4	4 – 6	6 – 8	8 – 10	10 – 12
Potassium	45 – 90	90 – 135	135 – 180	180 – 225	225 – 270
Iodine	.225 – .450	.450 – .675	.675 – .900	.900 – 1.125	1.125 – 1.350
Cal-Mag*	1 – 1½ glasses	1 – 2 glasses	1 – 2 glasses	2 – 3 glasses	2 – 3 glasses

*each glass contains 1.2 g calcium gluconate and 660 mg magnesium carbonate for an elemental calcium – elemental magnesium ratio of approximately 2:1

Notes:

- The multi-mineral tablet used also includes Chromium, Selenium & Betaine.
- A trace mineral supplement is also included as part of the regimen.

More information on nutritional supplements

Vitamin	Source
Niacin	Crystalline niacin
Vitamin A & D combined	Fish liver oil
Vitamin C	Vitamin C and rosehips
Vitamin E	d-alpha-tocopherol
Vitamin B complex	B1, B2, B6, B12, Pantothenic acid, Folic acid, Biotin, PABA, Choline, Inositol, Niacinamide
Vitamin B1	Thiamine HCL
Minerals & Electrolytes	
Multi-Mineral Complex	Calcium, Magnesium, Iron, Zinc, Manganese, Copper, Potassium, Iodine, Chromium, Selenium, Betaine
Trace minerals	72 trace minerals
Potassium	Potassium Gluconate
Salt	Sodium Chloride
Cell salts	Calcarea fluorica 6x calcarea phosphorica 3x calcarea sulphurica 3x ferrum phosphoricum 3x Kali muriaticum 3x Kali phosphoricum 3x Kali sulphuricum 3x Magnesia phosphorica 3x Natrum muriaticum 3x Natrum phosphoricum 3x Natrum sulphuricum 3x
Calcium Gluconate (Cal-Mag)	Calcium gluconate powder
Magnesium Carbonate (Cal-Mag)	Magnesium Carbonate powder
Cider Vinegar (Cal-Mag)	Filtered organic raw unpasteurized apple cider vinegar
Oils	
All Blend Oil	Cold pressed safflower oil, peanut oil, walnut oil and certified organic, non-GMO soybean oil
Lecithin	100% pure lecithin granules
Evening Primrose Oil	100% pure Evening Primrose Oil

Excerpts from Gulf War Illness protocol

Laboratory tests commonly ordered as part of the screening process

1) Comprehensive Metabolic Panel (CMP 14)
   Glucose, Calcium, Albumin, total Protein, Sodium, Potassium, CO2, Chloride, Blood Urea Nitrogen, Creatinine without eGFR, Alkaline Phosphatase, ALT, AST, total Bilirubin.

2) Lipid Panel
   Cholesterol, LDL, HDL, Triglycerides

3) Complete Blood Count (CBC) With Differential
   Hematocrit; hemoglobin; mean corpuscular volume (MCV); mean corpuscular hemoglobin (MCH); mean corpuscular hemoglobin concentration (MCHC); red cell distribution width (RDW); percentage and absolute differential counts; platelet count; red cell count; white blood cell count.

4) Thyroid Function
   T4, Total and T3 Uptake, Calculated Free T4, TSH
   (Calculated Free T4 will be reported whenever Total T4 and T3 Uptake are ordered on the same request form without its own test #.)

5) Urinalysis
   Color: yellow, straw or amber.
   Specific gravity: 1.005-1.030; pH: 5-8; WBC: 0-5/HPF; RBC:0-2/HPF; EPI: 0-5/HPF
   Negative: urobilinogen, protein, glucose, ketones, bilirubin, occult blood, leukocyte esterase, nitrite.

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