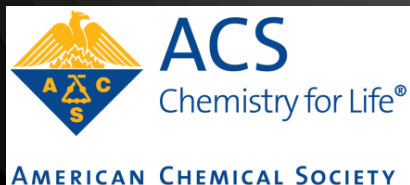


Chemicals

The Good, The Bad & The Ugly



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APPALACHIAN STATE UNIVERSITY

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Appalachian State University
Boone, NC
August 22st, 2017

Hazard and Risk



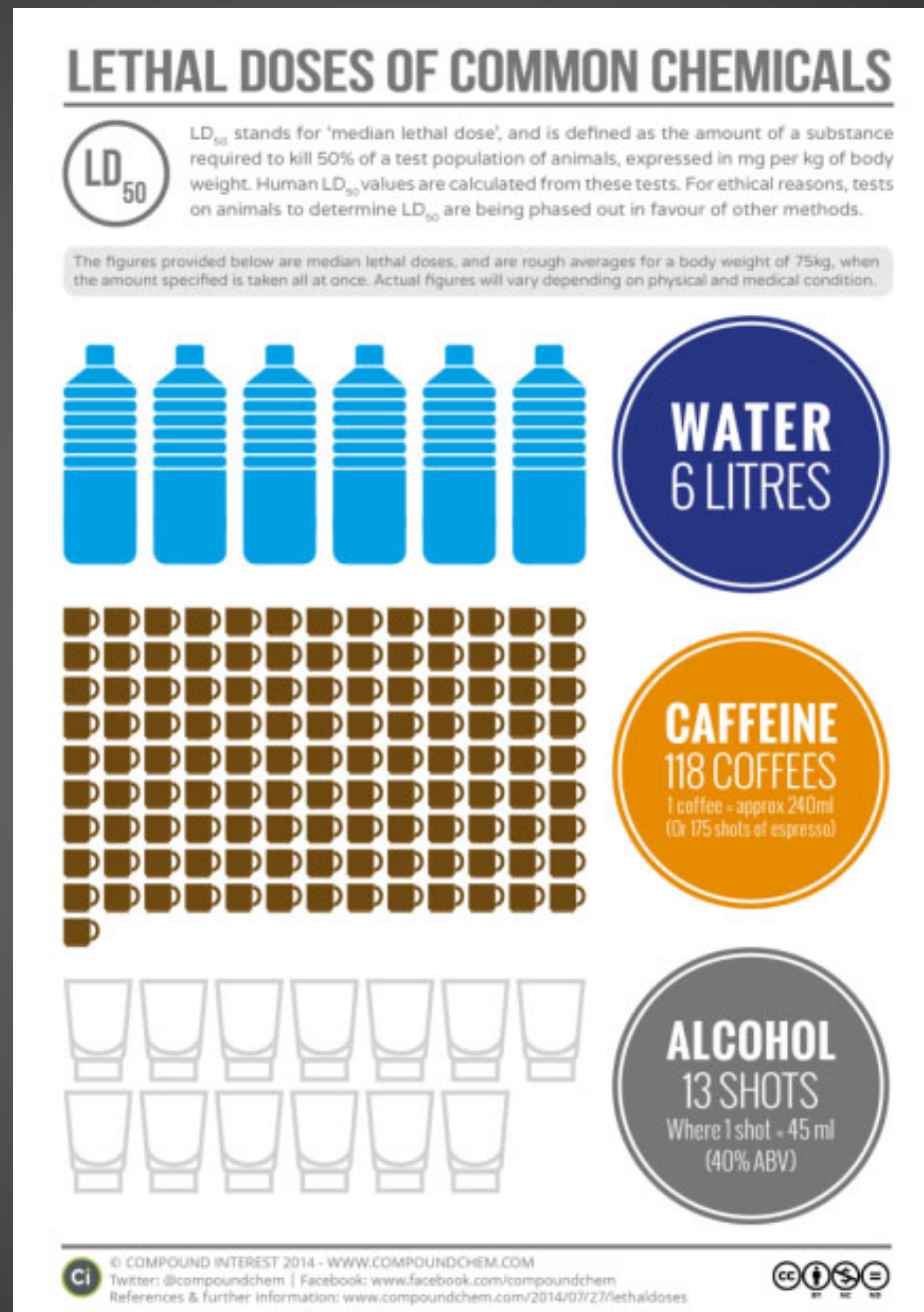
All chemicals have the potential to be hazardous.

TRUE or FALSE?



The incidence of hyponatremia appears to be between 13% and 15% among endurance athletes. There seems to not be a single case of death resulting from sports-related dehydration in the medical literature. – MDalert

There are more than 2,200 alcohol poisoning deaths in the U.S. each year – an average of 6 alcohol poisoning deaths every day - CDC



According to [a review of the medical literature](#), there were only 45 caffeine-related deaths reported between 1959 and 2010.

Hazardous chemical means...

...a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees.

CFR 29 1910 1450

Risk

- *a situation involving exposure to danger(noun)*
- *act or fail to act in such a way as to bring about the possibility of (an unpleasant or unwelcome event (verb)*

The Concise Oxford Dictionary



Hazard & Risk in Terms of Chemical Use

- **Hazard** is a potential to cause harm or damage
- **Risk** on the other hand considers the likelihood, exposure, and consequence presented by hazards

Additionally -

- Hazards are dangers intrinsic to a substance and
- For a particular chemical, risk can be reduced - hazard cannot



Human Perception of Risk



“Dihydrogen monoxide (DHMO) exposure if a worldwide crisis”

- Dihydrogen Monoxide (DHMO) is a colorless and odorless chemical compound
- Referred to by some as Dihydrogen Oxide, Hydrogen Hydroxide, Hydronium Hydroxide, or simply Hydric acid.
- Its basis is the highly reactive hydroxyl radical, a species shown to mutate DNA, denature proteins, disrupt cell membranes, and chemically alter critical neurotransmitters.
- The atomic components of DHMO are found in a number of caustic, explosive and poisonous compounds such as sulfuric acid, nitroglycerine and ethyl alcohol.

<http://www.dhmo.org/>



For Every Chemical...



*If a risk is imposed,
no risk is too small -*

**If a risk is freely assumed,
no risk is too large**

Author Unknown



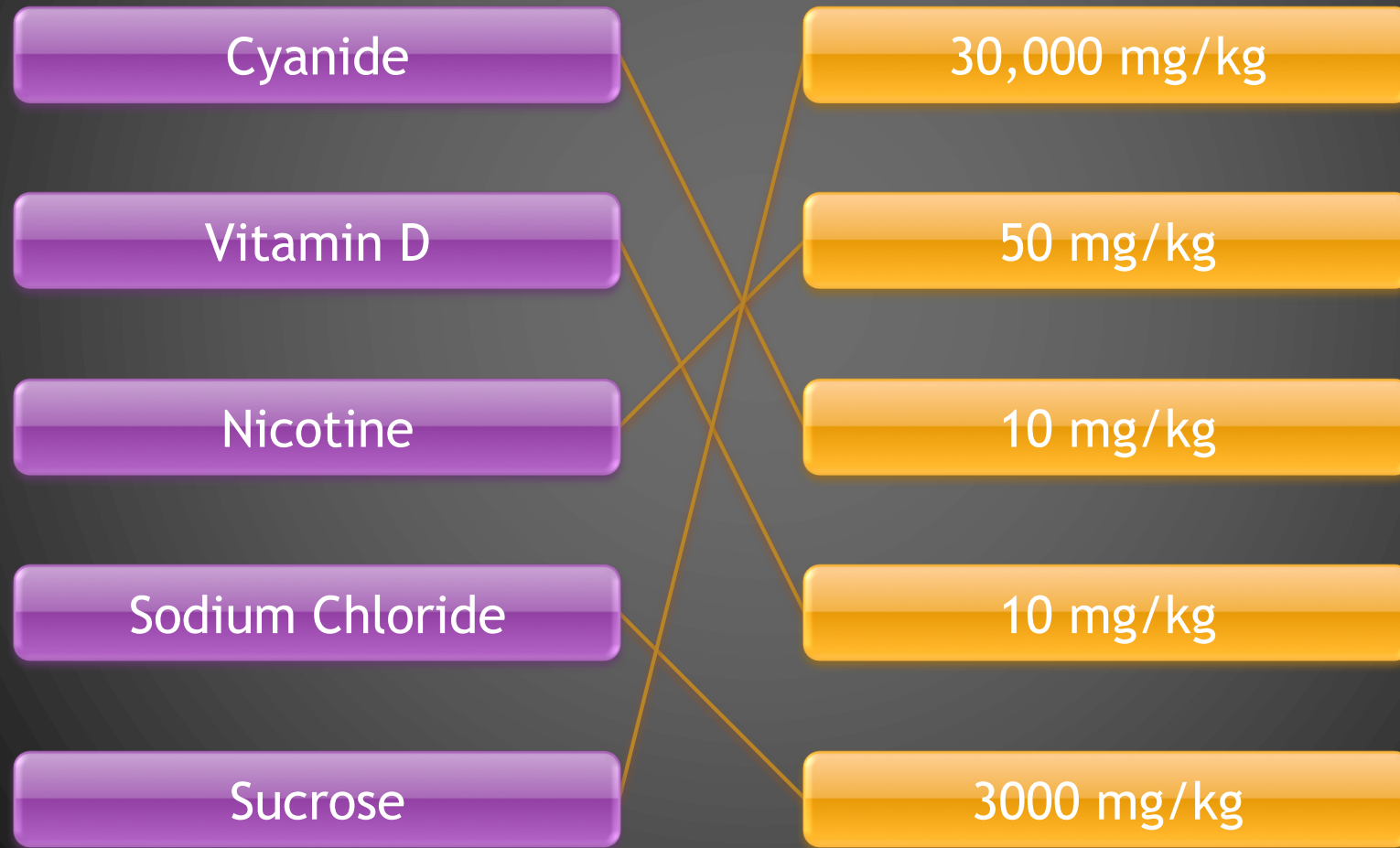
Exposures Currently Publically Accepted.

(The General Consensus is that the Benefit Outweighs the Risk)

- Chlorination of drinking water
- Fluorination of drinking water
- Immunization of children
- Medical screening for disease
- Utilizing nuclear reactions for energy



How Lethal is It?



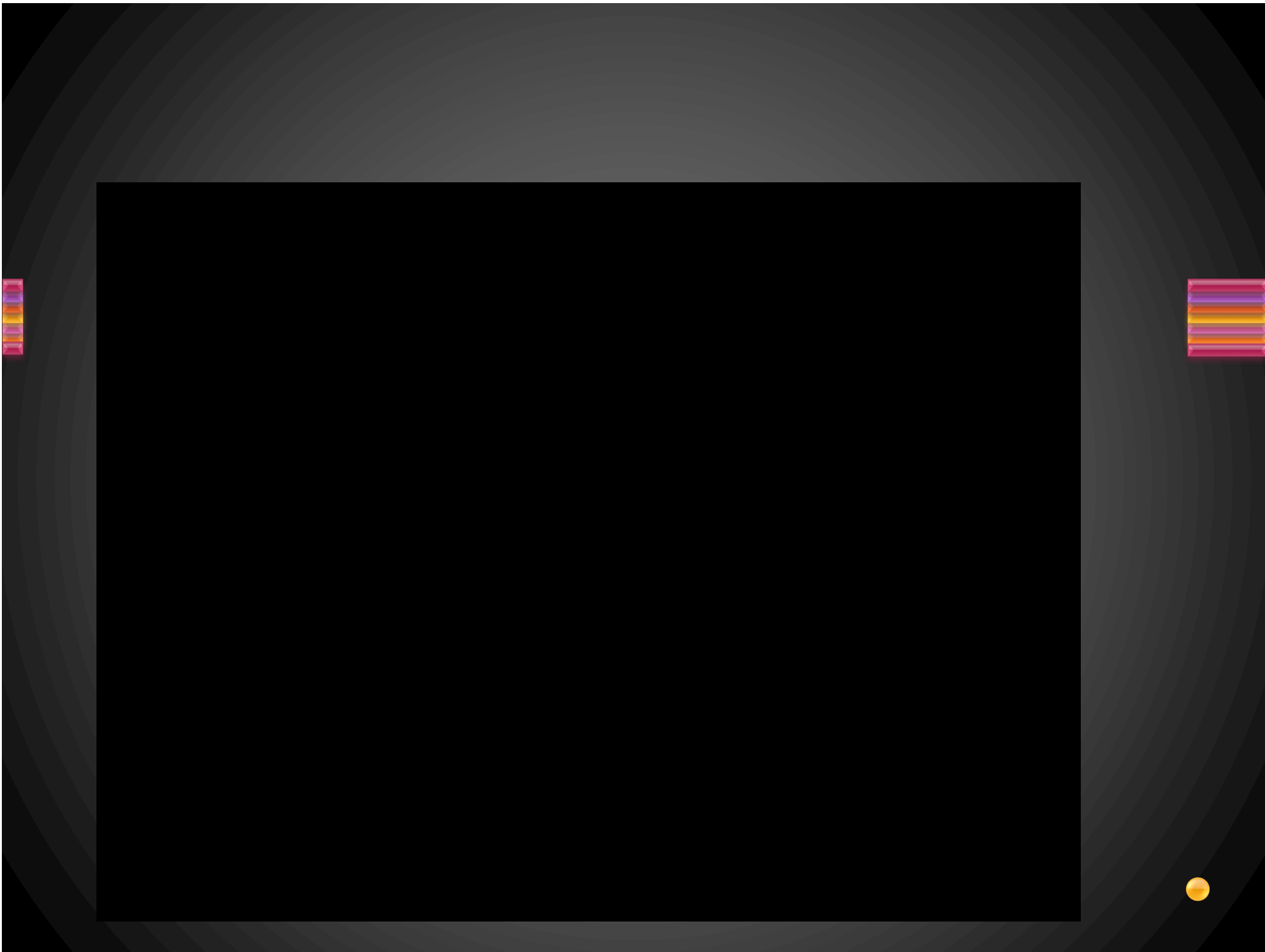


Wisk Commercial The Tackle [Low, 480x360](1).mp4

Public Perception of Chemicals in Products

Advertising Rules the Roost





Factors That Can Influence Our Individual Perception of Risk

- Personal experience of the adverse effect/event.
- Social & cultural background and beliefs
- The ability to exercise control over a particular risk
- People often have a tendency to over estimate very low risk and to under estimate very high ones.
- The extent to which information is gained from different sources e.g. from the media

Agius, Health, Environment & Work.2009



Perceptions Propagated by Advertising

- “Natural” substances are perceived as “less risky” than “synthetic” or “manmade” substances
- “Organically grown” food is synonymous with safe food
- Products that are “chemical free” are safe - (implies all chemicals are bad)
- “Pure” substances are safer than impure ones
- Proven “by science”
- If you can’t pronounce the ingredients - its bad for you





What Does It Really Mean?



“Non-Toxic”

- Without poisonous qualities
- A substance that does not pose a hazard to humans
- Non-toxic substances are safe to use, and do not harm humans and the environment (EPA 2010)
- NO regulation of the use in advertising, labeling, etc.

TABLE 4.2 Probable Lethal Oral Dose for Humans

Toxicity Rating	Animal LD ₅₀ (per kg)	Lethal Dose When Ingested by 70-kg (150-lb) Human
Extremely toxic	Less than 5 mg	A taste (less than 7 drops)
Highly toxic (DANGER)	5 to 50 mg	Between 7 drops and 1 teaspoonful
Moderately toxic (WARNING)	50 to 500 mg	Between 1 teaspoonful and 1 ounce
Slightly toxic (CAUTION)	500 mg to 5000 mg	Between 1 ounce and 1 pint
Practically nontoxic	Above 5000 mg	Above 1 pint

From Prudent Practices: Chapter 3 , Table 4.2

“All- Natural”

INGREDIENTS OF AN ALL-NATURAL EGG



INGREDIENTS: AQUA (75.8%), **AMINO ACIDS (12.6%)** (GLUTAMIC ACID (14%), ASPARTIC ACID (11%), VALINE (9%), ARGININE (8%), LEUCINE (8%), LYSINE (7%), SERINE (7%), PHENYLALANINE (6%), ALANINE (5%), ISOLEUCINE (5%), PROLINE (4%), TYROSINE (3%), THREONINE (3%), GLYCINE (3%), HISTIDINE (2%), METHIONINE (3%), CYSTINE (2%), TRYPTOPHAN (1%)); **FATTY ACIDS (9.9%)** (OCTADECENOIC ACID (45%), HEXADECANOIC ACID (32%), OCTADECANOIC ACID (12%), EICOSATETRAENOIC ACID (3%), EICOSANOIC ACID (2%), DOCOSANOIC ACID (1%), TETRACOSANOIC ACID (1%), OCTANOIC ACID (<1%), DECANOIC ACID (<1%), DODECANOIC ACID (<1%), TETRADECANOIC ACID (<1%), PENTADECANOIC ACID (<1%), HEPTADECANOIC ACID (<1%), TETRADECENOIC ACID (<1%), HEXADECENOIC ACID (<1%), EICOSENOIC ACID (<1%), DOCOSENOIC ACID (<1%), OMEGA-6 FATTY ACID: OCTADECADIENOIC ACID (12%), OMEGA-3 FATTY ACID: OCTADECATRIENOIC ACID (<1%), EICOSAPENTAENOIC ACID (EPA) (<1%), OMEGA-3 FATTY ACID: DOCOSAHEXAENOIC ACID (DHA) (<1%); **SUGARS (0.8%)** (GLUCOSE (30%), SUCROSE (15%), FRUCTOSE (15%), LACTOSE (15%), MALTOSE (15%), GALACTOSE (15%)); **COLOUR** (E160c, E160a), E306, E101; **FLAVOURS** (PHENYLACETALDEHYDE, DODECA-2-ENAL, HEPTA-2-ENAL, HEXADECANAL, OCTADECANAL, PENTAN-2-ONE, BUTAN-2-ONE, ACETALDEHYDE, FORMALDEHYDE, ACETONE); SHELL (E170), ALSO CONTAINS BENZENE & BENZENE DERIVATIVES, ESTERS, FURANS, SULFUR-CONTAINING COMPOUNDS AND TERPENES.

AN ALL-NATURAL BANANA



INGREDIENTS: WATER (75%), **SUGARS (12%)** (GLUCOSE (48%), FRUCTOSE (40%), SUCROSE (2%), MALTOSE (<1%)), STARCH (5%), **FIBRE (3%)** (E460, E461, E462, E464, E466, E467) **AMINO ACIDS** (GLUTAMIC ACID (19%), ASPARTIC ACID (16%), HISTIDINE (11%), LEUCINE (7%), LYSINE (5%), PHENYLALANINE (4%), ARGININE (4%), VALINE (4%), ALANINE (4%), SERINE (4%), GLYCINE (3%), THREONINE (3%), ISOLEUCINE (3%), PROLINE (3%), TRYPTOPHAN (1%), CYSTINE (1%), TYROSINE (1%), METHIONINE (1%)), **FATTY ACIDS (1%)** (PALMITIC ACID (30%), OMEGA-6 FATTY ACID: LINOLEIC ACID (14%), OMEGA-3 FATTY ACID: LINOLENIC ACID (8%), OLEIC ACID (7%), PALMITOLEIC ACID (3%), STEARIC ACID (2%), LAURIC ACID (1%), MYRISTIC ACID (1%), CAPRIC ACID (<1%)), ASH (<1%), PHYTOSTEROLS, E515, OXALIC ACID, E300, E306 (TOCOPHEROL), PHYLOQUINONE, THIAMIN, **COLOURS** (YELLOW-ORANGE E101 (RIBOFLAVIN), YELLOW-BROWN E160a), **FLAVOURS** (ETHYL HEXANOATE, ETHYL BUTANOATE, 3-METHYLBUT-1-YL ETHANOATE, PENTYL ACETATE), E1510, NATURAL RIPENING AGENT (ETHENE GAS).

INGREDIENTS OF ALL-NATURAL BLUEBERRIES



INGREDIENTS: AQUA (84%), **SUGARS (10%)** (FRUCTOSE (48%), GLUCOSE (40%), SUCROSE (2%)), **FIBRE (2.4%)** (E460, E461, E462, E464, E466, E467) **AMINO ACIDS** (GLUTAMIC ACID (23%), ASPARTIC ACID (18%), LEUCINE (17%), ARGININE (8%), ALANINE (4%), VALINE (4%), GLYCINE (4%), PROLINE (4%), ISOLEUCINE (3%), SERINE (3%), THREONINE (3%), PHENYLALANINE (2%), LYSINE (2%), METHIONINE (2%), TYROSINE (1%), HISTIDINE (1%), CYSTINE (1%), TRYPTOPHAN (<1%)), **FATTY ACIDS (<1%)** (OMEGA-6 FATTY ACID: LINOLEIC ACID (30%), OMEGA-3 FATTY ACID: LINOLENIC ACID (19%), OLEIC ACID (18%), PALMITIC ACID (6%), STEARIC ACID (2%), PALMITOLEIC ACID (<1%)), ASH (<1%), PHYTOSTEROLS, OXALIC ACID, E300, E306 (TOCOPHEROL), THIAMIN, **COLOURS** (E163a, E163b, E163c, E163f, E160a) **FLAVOURS** (ETHYL ETHANOATE, 3-METHYL BUTYRALDEHYDE, 2-METHYL BUTYRALDEHYDE, PENTANAL, METHYLBUTYRATE, OCTENE, HEXANAL, STYRENE, NONANE, NON-1-ENE, LINALOOL, CITRAL, BENZALDEHYDE, BUTYLATED HYDROXYTOLUENE (E321)), METHYLPARABEN, E1510, E300, E440, E421 and **FRESH AIR** (E941, E948, E290).

ChemicalSafetyFacts.org/

“All- Natural”

- NO regulatory control of this term
- Not synonymous with “organic”
- DOES NOT mean “healthy”
- “Natural foods are processed without preservatives or additives, but may have been grown with the use of pesticides or processed by other conventional methods.” ([FDA](#))
- “The Food and Drug Administration (FDA) [regulates](#) the term ‘natural’ only as it applies to added color, synthetic substances, and flavors.”

“Pure”

- Not impure
- 100 % of the substance is present with no contamination
- A solution or substance which consists of a single type of atom or molecule
- There are very few “pure” things on earth
 - Refined sugar is one of the purist food substances (99.80%)
- Ask someone what “pure” water is!



“Organic” Means -

- A. A carbon containing compound
- B. A labeling term that refers to an agricultural product produced in accordance with Organic Foods Production Act (OFPA) of 1990
- C. Having properties associated with living organisms
- D. A simple, healthful, and close to nature lifestyle
- E. All of the above



Organic Does NOT mean

- “Chemical Free”
- “Safe”
- “Healthy”
- “Non-Toxic”
- And may not mean -
 - Synthetic Chemical Free (Synthetic substances allowed for use in organic crop production)

Synthetic Chemicals



- A **synthetic chemical** is a chemical produced by human-designed chemical reactions. Synthetic chemicals may or may not be found in nature.
- A synthetic chemical is chemically and physically identical to its natural counterpart
- **HOWEVER** - The purity of a synthetic chemical may not match its natural counter part. This depends on how carefully the chemical reactions and purification steps were performed
- Problems can arise when a natural ingredient is replaced with synthetic chemical which is not chemically the same and has been created to be “better” than the natural one



“Chemical” Synonyms in the Media

- Additives
- Preservatives
- Artificial ingredients
- Pesticides
- Insecticides
- Herbicides
- Synthetic

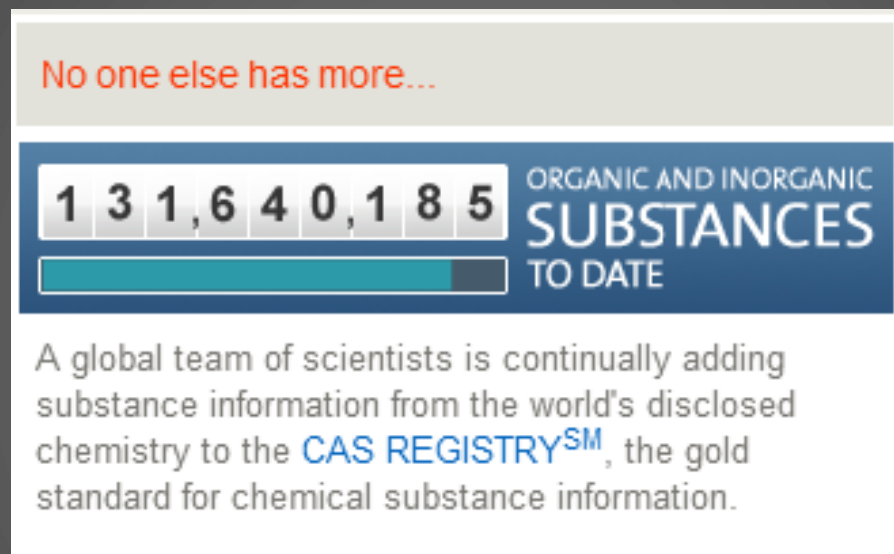




In the popular
consciousness the word
“chemical” has acquired a
suggestion of artificiality
or toxicity



CAS (Chemical Abstracts Service)



131+ million registered substances – with around 75% of them considered “organic”



OSHA regulates all hazardous chemicals for the workplace

TRUE or FALSE?

OSHA has Standards for
~30 chemicals



National Toxicology Program (NTP)

- More than 84,000 chemicals are registered for use in the United States - only about 7700 of these are used in “significant” amounts
- Each year, an estimated 2,000 new ones are introduced for use in such everyday items
- We do not know the effects of many of these chemicals on our health, yet we may be exposed to them while manufacturing, distributing, using, and disposing of them or when they become pollutants in our air, water, or soil.
- Relatively few chemicals in use are thought to pose a significant risk to human health...



Chemical Free Products



A “CHEMICAL FREE” product is composed of_____.

??????????

Wild and Pure Chemical Free Non-Toxic Body & Linen Sprays



Wild and Pure Simple Body Care believes that nature provides a bountiful reserve of safe ingredients that can be used in body care products to contribute to a positive, healthy lifestyle. Wild and Pure guarantees that all of the products are clean, natural, non-toxic, not tested on animals, hypoallergenic and completely chemical free making these products favored amongst people prone to allergies and other sensitivities!

Lavender Oil
Rabbit LD50 skin >
5gm/kg (5000mg/kg)

Wild and Pure Simple Body Care believes that nature provides a bountiful reserve of safe ingredients that can be used in body care products to contribute to a positive, healthy lifestyle. Wild and Pure guarantees that all of the products are clean, natural, non-toxic, not tested on animals, hypoallergenic and **completely chemical free** making these products favored amongst people prone to allergies and other sensitivities!

[Wild and Pure Chemical Free Non-Toxic Facial Products](#)



The Internet Loves Chemical Free Cleaners

27 Chemical-Free Recipes for DIY Spring Cleaning

Top 10 Chemical-Free Cleaning Tips

Homemade All-Purpose Chemical Free Cleaner




Homemade All-Purpose Chemical Free Cleaner

For a long time I had my go to all-purpose store bought cleaning solution that I grabbed for every little cleaning task imaginable. I **wiped down my counters with it**, cleaned the bookshelves, the walls, and had it handy for any little sticky grimy spot that popped up. When I finally came to my senses about the chemicals I was spraying around my home, I knew I needed my own solution (one that wouldn't make me hold my breath when I sprayed it!) Does this cleaner kill 99.99% of bacteria or germs? No. And I am very much ok with that.



Chemical Free Sunscreen

**Free Shipping**
Over \$100 in US & Canada
Over \$300 Internationally
30 Day Money-back Guarantee

Home / Shop by Category / Face / Sunscreen / Chemical Free Sunscreen SPF 58

CATEGORIES

Shop by Category ▾

Shop by Skin Type ▾

Shop Men Skin Care ▾

BRANDS


Skin911

Me! bath

Agera

Vital Assist Skincare

Guinot



Skin911
Chemical Free Sunscreen SPF 58

\$40.00

SKU:
f58

Availability:
Ships Next Business Day. \$100 Ships Free USA CAN.

Quantity:

ADD TO CART

Ingredients: Active: 10% Titanium Dioxide, 4% Zinc Oxide. Other: Water, Caprylic/Capric Triglyceride, Ethylhexyl Hydroxystearate Benzoate, Dimethicone, Cyclomethicone, Melissa Officinalis (Balm Mint) Leaf Extract, Butylene Glycol, Talc, Octyldodecyl Neopentanoate, Butyloctyl Salicylate, Cetearyl Glucoside, Cetearyl Alcohol, Glyceryl Stearate, PEG-100 Stearate, Tocopherol, Tocopheryl Acetate, Retinyl Palmitate, PVP/Elcosene Copolymer, Styrene/Acrylates Copolymer, Sorbitan Laurate, Xanthan Gum, Acrylates/C10-30, Alkyl Crosspolymer, Simethicone, EDTA, Phenoxyethanol, Isopropylparaben, Isobutylparaben, Butylparaben, Iron Oxides.

Skin911 Chemical Free SPF 58 Sunscreen

**Results May Vary*

IMPORTANCE OF CHEMICAL FREE PERSONAL CARE PRODUCTS

The use of **chemical free personal care products** just got a lot more important. Recent studies have shown that chemicals and metals found in the personal care products, that many of us use on a daily basis, can **increase the risk of health issues**.

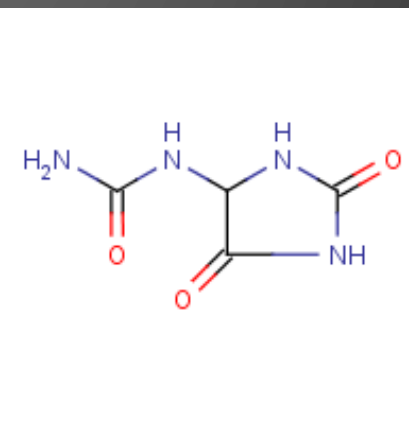


Ingredients

Natural Chemical Free Shampoo Ingredients:

Purified Water, Olive Oil (and) Coconut Oil (and) Potassium Lactate, Vegetable Glycerin, Peppermint Oil*, Fennel Extract*, Hops Extract, Balm Mint Extract, Olive Leaf Extract*, Ginger Extract*, Mistletoe Extract*, Allantoin (Comfrey Root), Citric Acid, Niacin (Vitamin B3), Lemon Grass Oil*, Burdock Root Extract*, Sage Extract*, Rosemary Extract*, Grape Seed Extract*.

*Certified Organic Herb



Earthturns.com

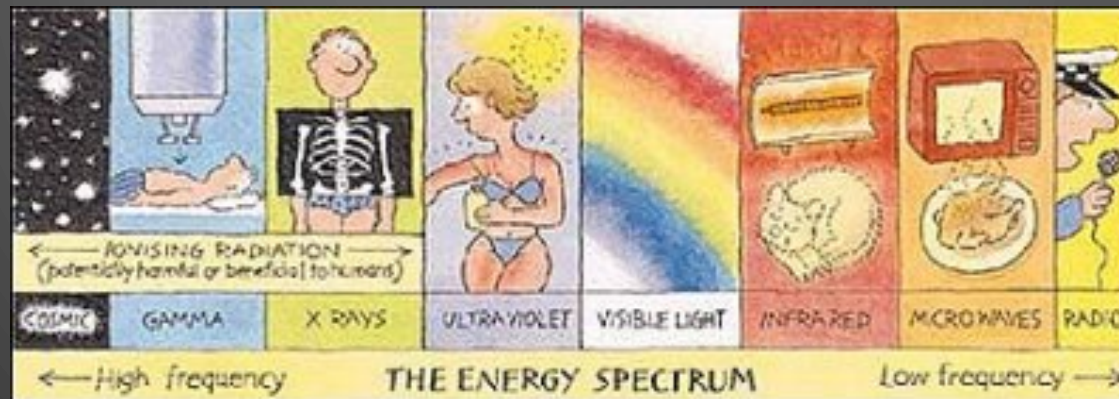




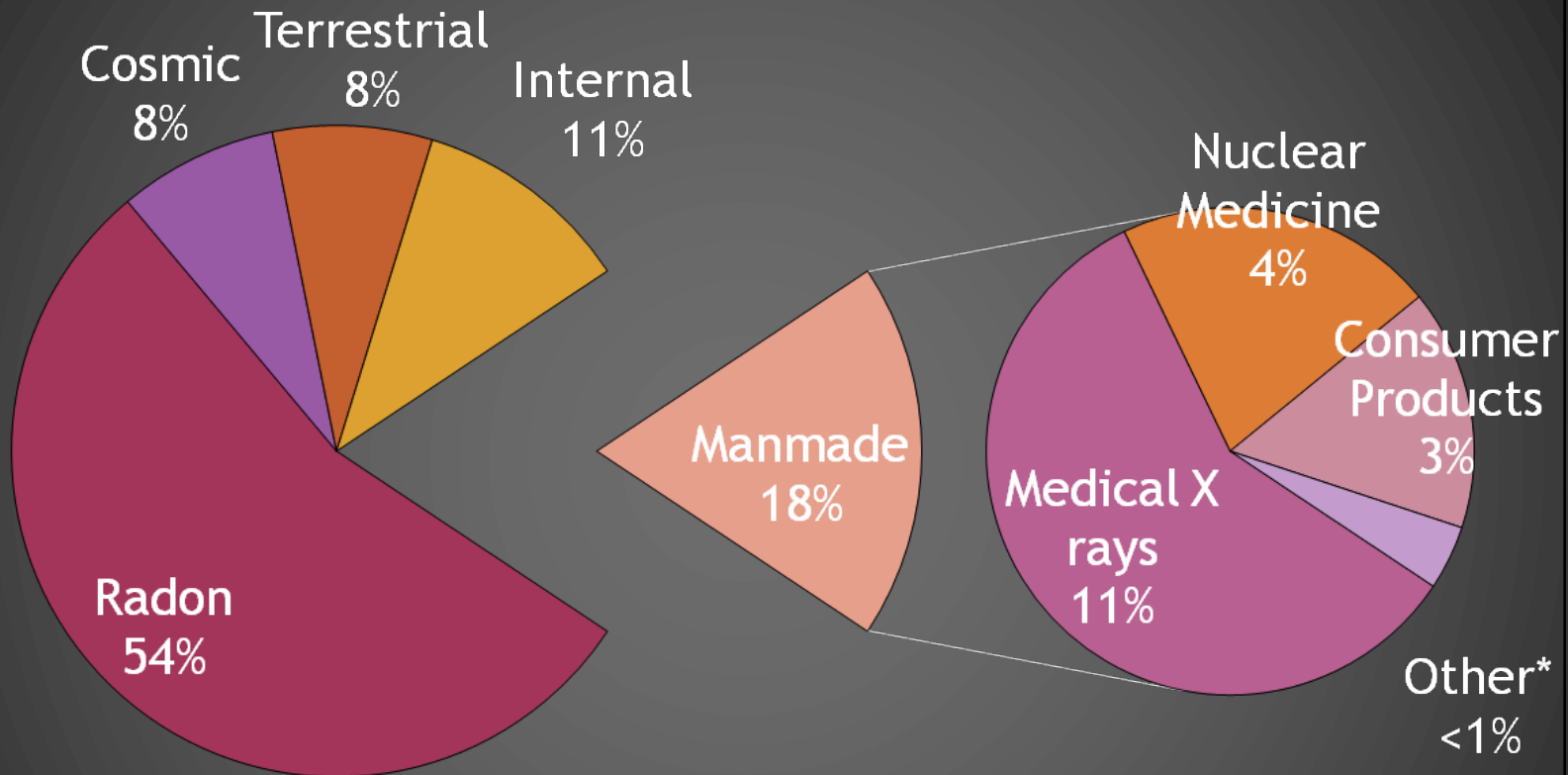
Public Perception of Radiation



Ionizing vs. Non Ionizing



Human Exposure to Ionizing Radiation



*Other: Occupational
Fallout
Nuclear fuel cycle
Misc.

Radioactivity of the Human Body

Radioactivity of the Human Body

R. A. Muller, UCLA – Berkley, LBNL (Emeritus)



- A typical human body contains approximately 40 grams of potassium. About $1/1000$ of this is potassium-40, a radioactive isotope. This means that you contain 0.04 grams = 40 milligrams of a radioactive cancer-producing isotope in your body.
- Atoms of radiopotassium in your body explode approximately 12,000 times every second. Your body is radioactive. Only 11% of the radioactive decays yield a gamma ray, so there are 1,300 self-inflicted gammas per second from your own body.
- This results in an exposure of approximately 0.00018 Sieverts over a 50 year period and is responsible for $1/28000$ of our cancers.
- The results are more astonishing if you consider a large population. There are about 250 million people in the United States. Multiply 250 million by 7 millionths of a cancer per person, and you find that $250 \times 7 = 1750$ people will die of cancer over the next 50 years, induced by their own radioactivity. That averages to 35 per year.