2nd
SUBMISSION

TO

FOOD STANDARDS AUSTRALIA & NEW ZEALAND

APPLICATION A1039

LOW THC HEMP AS A FOOD

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Introduction

The Industrial Hemp Association of Victoria has previously made a comprehensive submission to FSANZ in the first round of submissions called for in March 2011. This submission is supplementary to the original submission, focussing on those questions that FSANZ has now posed. Only the questions that can be appropriately and satisfactorily addressed by the Association will be answered.

In developing or varying a food standard, FSANZ is required by its legislation to meet three primary objectives which are set out in section 18 of the FSANZ Act. These are restated:

- the protection of public health and safety; and
- the provision of adequate information relating to food to enable consumers to make informed choices; and
- the prevention of misleading or deceptive conduct.

In developing and varying standards, FSANZ must also have regard to, inter alia, the desirability of an efficient and internationally competitive food industry;

This Association believes that FSANZ has fulfilled its obligations in all three of its primary objectives. They have diligently researched the overseas markets for hemp food, have reviewed their previous decisions, have summarised the issues in plain language for consumers; and FSANZ has acknowledged that misleading and deceptive conduct must be prevented by considering what labelling requirements are most appropriate.

It must be emphasised that hemp seeds, no matter what variety of *Cannabis sativa*, contain no THC. We acknowledge that FSANZ is honouring their requirement to protect public health and safety by anticipating that there *may be* contaminants of THC during the processing of the seed (coming from other parts of the hemp plant). This being the case, FSANZ must therefore recommend maximum levels of THC in the food. In a way, this is similar to the labelling on, for example, wine: "May contain traces of nuts and eggs". Obviously, it is not intended that nuts and eggs are additives to wine but in the course of wine production, these "contaminants" may enter the product. The labelling is primarily intended to warn allergy sufferers that there may be allergens present. To the "man on the street", traces of THC in hemp food as recommended can be compared exactly with the "traces of allergens" labelling in other products. The difference is that hemp food may contain residues of the mother plant, not contaminants from another source.

In relation to the stated "preferred approach" of FSANZ (i.e. that Option 2B be adopted), we agree, with some qualification. This will be explained later in this submission but relates to the levels of THC proposed to be applied as the recommended maximum acceptable levels in food.

Using the same various numbering and headings in the FSANZ paper, we comment as follows:

Issue/Problem

It is fundamental to discussion on this matter that the clear distinction between hemp and marijuana continues to be made. The previous application A360 was rejected because the Ministerial Council felt that the consumer is confused about the difference between hemp and marijuana. This is simply a matter of education, not the broad associations that have previously been proffered by politicians. Again, the poppy seed industry is a direct comparison. Opium is to poppy seeds as Marijuana is to hemp seeds. Poppy seeds are a long established, acceptable food. Hemp should also be accepted as a food. FSANZ identifies that hemp seed food products are contrary to Standard 1.4.4 which prohibits all species and by-products of *Cannabis sativa* from being termed a food.

It is incongruous that Australia includes all species of *Cannabis sativa* in this Standard. The United Nations Single Convention on Narcotic Drugs has the following definition for *Cannabis* in Article 1:

> "(b) "Cannabis" means the flowering or fruiting tops of the Cannabis plant (excluding the seeds when not accompanied by the tops) from which the resin has not been extracted, by whatever name they may be designated." (Emphasis added).

Further, Article 28 of the Convention states:

> "2. This Convention shall not apply to the cultivation of the Cannabis plant exclusively for industrial purposes (fibre and seed) or horticultural purposes."

Put simply, industrial hemp is not a drug.

Cannabis appears in Schedule III of the Single Convention which has the result that if a *Cannabis* preparation, because of the substances which it contains, is not liable to abuse and cannot produce ill effects; and the drug therein is not readily recoverable then it is not a drug.

Industrial hemp is therefore NOT an illicit substance under the Single Convention, to which Australia has been a signatory since March 1961 (51 years). Marijuana is a drug under the Single Convention and is subject to the restrictions. In our view, the Australian government itself, through its legislation, enforcement and advisory instrumentalities, therefore has a positive obligation to educate consumers on the health benefits of hemp.

FSANZ itself has the obligation of "the promotion of consistency between domestic and international food standards" and must have regard to this clear differentiation of hemp and marijuana by the United Nations Single Convention.

We again reiterate that hemp is not a narcotic and should therefore be included as a food.

2.3 Hemp and drug regulations

As stated above, the definition of hemp in the United Nations has, for the past 50 years, been specifically excluded under the definition of a drug. It is not a poison and its nutritional properties are well documented. These facts negate the need for FSANZ to consider hemp as a risk to human safety.

Risk Management

6.1.1 Question for submitters: "Will the inclusion of a maximum level in the Code for hemp seed oil products be an issue for hemp seed oil products produced or imported into New Zealand?"

The maximum level of THC deemed acceptable in foods internationally differs between countries. It would be ideal for Australia and New Zealand to adopt maximum acceptable levels that have been implemented in the major hemp producing nations, more particularly Canada, where the level is 10 parts per million. However, it is noted that Belgium's hemp food legislation has directly adopted the levels proposed in the earlier Australian hemp food application A360. There needs to be flexibility assured within the proposed amendments to the Code to allow for future amendments to bring Australia into line with any international standards as and when proscribed.

6.2 After implementation of the hemp food approvals by FSANZ, any representations suggesting that hemp food products, are psychoactive would clearly be misleading. Labelling and advertising laws are well covered by trade practices legislation, both Federally and by State.

We understand and acknowledge that representations of the Cannabis leaf motif on hemp food labelling could send confused messages about the food value and safety of anything that may display that motif, including products sold illicitly. However, we believe that the majority of the population would realise the difference between hemp and marijuana. The vast majority of consumers who would not ordinarily seek out the illicit substance, would accept appropriate product labelling (nutritional panels, etc.) – they would not purchase from disreputable or "seedy" outlets. A comparison could be made with mushrooms – the average consumer would purchase from mainstream retail outlets and not street vendors or pedlars or harvest it themselves from the wild.

We acknowledge that consumers, having had the experience of tasting and benefitting from approved hemp seed food products, may believe that they can safely use higher THC varieties of Cannabis. We could liken this to whether a consumer chooses to have hot milk before retiring at night or take a prescribed medication to assist them in sleeping. And then if a sleeping tablet, would it be herbal or prescription? And how strong would be the prescription? Product labelling and fair trading legislation, as well as media reports, together already assist consumers in making decisions about what they choose to eat or drink or, indeed, smoke.

6.4 Question for submitters: "Are there other methods of distinguishing between the seeds of hemp and drug varieties of cannabis?"

In practical terms, this question is answered by asking whether any drug enforcement agent who found a person in possession of Cannabis seeds without a licence to possess them would, in practice, need to differentiate. In such a scenario, the person in possession may be arrested. However, after a germination test, the variety could still be proven to be hemp and not an illicit substance under the Single Convention and any possible drug charges would not be enforceable. Lesser charges of possession without a licence would, of course, apply. Conversely, the seed could prove to be high in THC in which case the offender would reasonably be prosecuted. Other criminal offences rely on testing such as DNA or drugs laboratory testing so there is no reason this should be any different.

Question: "Are there other methods of rendering hemp seeds non-viable ...?"

It is understood that expert scientific submissions are being made separately to FSANZ. However, we note that heat treatment of seeds renders them not only unviable but also of little or no food value (in the same way that other seeds such as flax and sesame do not tolerate heat). Heat treatment would therefore not be appropriate.

In addition, it must be emphasised that if the current licensing laws in each state remain in place, the source of the seed must be declared, and the growing of the crop is regularly monitored and tested through the relevant licensing authority.

6.5 Questions relating to THC and drug testing:

Given the minute levels of THC proposed to be approved under Option 2B, it is highly unlikely that a positive drug test would result after consumption of hemp food. There is a far greater likelihood that poppy seed products, currently available in mainstream retail outlets, would return a positive result. This Association commissioned an Australian toxicologist to report on current THC testing in Australia. A copy of his report appears in Appendix A.

6.7 UN Conventions

As stated above, The Single Convention on Narcotic Drugs 1961 specifically excludes hemp as being narcotic. Prohibition of hemp food on the basis that it is a drug or associated with a drug is simply wrong.

8.2 FSANZ seeks advice on the number of businesses and hemp licences currently existing in Australia and New Zealand.

With respect, this is perhaps not relevant to trying to calibrate the market potential of hemp food. There are several businesses, including major corporations, who would stock hemp product if it were legal. Current hemp retailers are severely restricted – they only sell imported clothing and other textiles (predominantly from China) and imported animal feed (which is generally graded for human consumption

overseas). The recent plethora of expensive advertising by major food companies, including Blackmores, Nature's Way, Goodman Fielder and many others, for omega food and food supplement products (flax, fish and krill oils, breads, etc.) are the best indicators of potential markets for an alternative, sustainable food product, locally grown. Perhaps this promotional activity is in anticipation of approval of this current hemp food application: approval will provide an ecologically better and more palatable omega food source with better dietary value.

When hemp foods are approved, a wider market for other hemp products will become possible – there is potential for the fibre to be used for anything from animal bedding or garden mulch to building products and even for textile manufacture (for export), giving a more ecologically sustainable alternative to cotton. The costs that do not appear to have been considered by FSANZ are the hidden costs – the opportunity costs and the environmental costs – of NOT having hemp approved as a food.

Environmental cost:

Please refer to Annexure B which is an extract from a report by Skaidra Smith-Heisters from March 2008 entitled "Illegally Green: Environmental Costs of Hemp Prohibition". Whilst this is a discussion of the environmental costs of hemp alternatives, it highlights the possible solutions that hemp could provide. As mentioned previously, the recommendations regarding levels of THC are at odds with international levels, e.g. Canadian levels where all food can contain up to 10 parts per million. This has the potential of stifling the pace of development of the hemp food industry in Australia and detracting from its competitiveness on the world market.

Economics:

Whilst we believe that FSANZ is primarily focussed on assessing food and its economics, the broader agricultural economics are affected by any decision on hemp food. There being no substantive industry in Australia at present, the following commentary is an extract from "Revival of Industrial Hemp: A systematic analysis of the current global industry to determine limitations and identify future potentials within the concept of sustainability", Revised Version, December 9th, 2005 (Author: Erin Michelle Young, LUMES). It discusses the North American market:

> " The most up-to-date and complete review of hemp crop profitability was compiled by Fortenbery and Bennett (2004) for North America. They presented five profit estimate reports from the USA and Canada during the year's 1998 and1999. The results produced a wide array of estimates, ranging from - $241.30 to $316.45 per acre (-$596.27 to $781.96 per ha) for fiber production alone and -$294.64 to $605.91 per acre for dual purpose crops (-$728.07 to $1,497.24 per ha), given in 2001 USD (Fortenbery & Bennett, 2004). These estimates do not take into account any costs that are incurred for licensing, monitoring and verification that may be legally required ..."
>
> "... Considering the whole life cycle of industrial hemp products, below-average inputs required during the cultivation of hemp are only a small part of the potential environmental benefit. Comparisons of industrial hemp to hydrocarbon or other conventional industrial feedstocks show that, generally, hemp requires substantially less energy for manufacturing, often is suited to less-toxic means of processing, and provides competitive product performance (especially in terms of durability, light weight, and strength), greater recyclability and/or biodegradability, and a number of value-added applications for byproducts and waste materials at either end of the product life cycle. Performance areas where industrial hemp may have higher average environmental costs than comparable raw materials result from the use of water and fertilizer during the growth stage, greater frequency of soil disturbance (erosion) during cultivation as compared to forests and some field crops, and often relatively high water use during the manufacturing stage of hemp products.

> Unlike petrochemical feedstocks, industrial hemp production offsets carbon dioxide emissions, helping to close the carbon cycle. Overall, social pressure and government mandates for lower dioxin production, lower greenhouse gas emissions, greater bio-based product procurement, and a number of other environmental regulations seem to directly contradict the wisdom of prohibiting an evidently useful and unique crop like hemp. Ultimately, the environmental costs incurred by the prohibition of hemp cultivation in the United States cannot be calculated purely in the abstract. The full potential for industrial hemp in domestic agriculture and industry can only be tested by unrestricted inclusion in the U.S. market, along with other top biological feedstocks."

The comments in relation to the US market are still applicable in Australia, even though the US consumes hemp food product imported from Canada, farmers there cannot grow hemp. Australian farmers can grow hemp (under licence) but without a viable market (food), they are constrained.

Conclusion

This Association remains firm in its commitment to pursuing the approval of hemp food. We appreciate the process that FSANZ has undertaken to date, and we are committed to the continued promotion of hemp, not only as a food but in the development of myriad manufacturing applications in Australia which will attract new investment and employment.

13th February 2012

Lyn Stephenson
President
Industrial Hemp Association of Victoria
Melbourne, Victoria

Re: Drug Test Results following Hemp Food Consumption

Dear Ms. Stephenson:

You and your association have retained Australian Workplace Drug Testing Services, represented by Dr. Michael Robertson Ph.D. as consultants in toxicology. You have requested a review pertinent documents and records to form conclusions regarding 1) the presence of any positive THC drug test results that were attributed to consumption of hemp foods 2) whether there are any studies on THC drug testing in relation to consumption of hemp foods and 3) respond to the additional questions outlined in the body of the report.

Documents provided for review include:

- Application A1039 Low THC Hemp as a Food, dated 7th December 2011
- SD1 Risk Assessment Report
- SD2 Application A360 Final Assessment Report
- SD3 Cost Benefit Analysis
- SD4 Request for Information
- SD5 Australia and New Zealand Hemp Regulations
- SD6 International Hemp Regulations

Experience and expertise in the field of drug and alcohol testing

The following is a brief summary of my professional experience as it relates to drug and alcohol testing and further detail can be obtained from curriculum vitae. I am currently employed as an independent forensic toxicologist and Senior Consultant with Independent Forensic Consulting (IFC), and consulting toxicologist to Australian Workplace Drug Testing Services (AWDTS). I have been qualified as an expert in drug and alcohol-related matters, having spent almost 15 years as a forensic toxicologist involved in the testing and interpretation of human samples for workplace, clinical and medico-legal clients. I earned my Ph.D. in forensic medicine at Monash University, specialising in forensic toxicology and studied and trained at the Victorian Institute of Forensic Medicine (VIFM) where my research identified the risk associated with drugs and driving and whose research subsequently lead to the implementation of roadside drug testing in Victoria.

As a qualified trainer in the workplace collection and testing of breath, urine and oral fluids in compliance with AS 3547-1997, AS/NZS 4308:2008 and AS 4760-2006, I perform drug and alcohol training throughout Australia for a variety of clients to ensure compliance with the Australian Standards.

1. Background

It is understood that hemp-seed does not contain Δ^9 tetrahydrocannabinol (THC), the primary active component of the Cannabis plant, nor does hemp-seed produce THC and as such if thoroughly cleaned and processed, hemp-seed and hemp-seed products should contain no THC. However the calyx surrounding the seed is known to contain small quantities of THC and as such may 'contaminate' the processed hulled hemp-seed leaving small quantities of THC within the final product i.e. hulled seed, hemp-seed oil etc.

In early studies evaluating the possibility that hemp seed products may cause positive workplace drug screens, the consumption of hemp-seed and hemp-seed products have been reported in the literature to cause drug-positive urine results for both immunoassay screening devices and subsequent laboratory based confirmation by gas-chromatography mass spectrometry (GC-MS)[1],[2]. In more recent studies[3] however the likelihood of drug positive urine samples appears to have been reduced significantly, largely due to the decrease in the THC content of hemp-seed as a result of improved processing and cleaning.

No studies have been performed in Australia evaluating the effects of hemp-seed products on ether urine or saliva testing, however previous studies evaluating urine remain valid given the technology for screening (immunoassay) and confirmation (GC-MS) are consistent with current technologies used by on-site screening devices and laboratory-based confirmation in Australia.

Based on a tolerable daily intake (TDI) of 6 µg/kg (body weight) per day, THC content in hemp-seed is proposed to be controlled at 5 mg/kg and10 mg/kg for hemp-seed oil and 0.2 mg/kg for other hemp-seed products.

[1] Fortner et al. Marijuana-positive urine test results from consumption of hemp seeds in food products. JAT, 1997:21. Pp 476 - 481

[2] Bosy and Cole. Consumption and quantitation of Δ^9 tetrahydrocannabinol in commercially available hemp seed oil products

[3] Leson et al. Evaluating the impact of hemp food consumption on workplace drug tests. JAT, 2001:25(8). pp 691 - 8

2. Current Testing

The current Australian Standards outline the requirements for workplace and medico-legal testing for both urine and oral fluid samples and currently dictate the levels at which drug presence is regarded as positive or negative as outlined below.

a. Urine
According to Australian Standard (AS/NZS 4308:2006) when screening a sample of urine, the cutoff is 50 µg/L for 'cannabis metabolites' and when confirmed, 15 µg/L for the major carboxylic acid THC metabolite or THC-COOH.

Lesson et al., when using the same cutoff values and similar technologies to those outlined in the current Australian Standard, found that the consumption of the equivalent of 450 µg THC per day for 10 days did not produce a false positive urine screen or lead to a THC content that would have lead to a failure of the current Australia Standard drug testing programs for workplace testing. Further when a dose equivalent to the currently proposed TDI of 6 µg per day in a 100 kg individual (0.60 mg/day), Leson et al. found only one subject would have tested positive based on screening technology however were well below the confirmation cutoff and as such would not have been regarded as positive per the Australian Standard. This is in contrast with current issues with poppy-seed derived morphine which is well documented to not only cause a positive screening result for opiates but also a positive confirmation, leading to difficulties in interpretation.

Whilst it is unclear how much hemp-seed product is likely to be consumed on a daily basis, based on a tolerable daily intake (TDI) of 6 µg/kg (body weight) per day these results suggest that positive urine drug screen when tested in accordance with current Australian Standards would be unlikely following the consumption of low THC hemp-seed and even less likely that THC levels in urine would be high enough to exceed the confirmation cutoff.

b. Oral Fluid (saliva)
According to the Australian Standard (AS 4760 - 2006) when screening a sample of oral fluid, the cutoff is 25 ng/mL for THC and when confirmed, 10 ng/mL for THC.

No studies have been performed on the effect of the consumption of hemp-seed products on oral fluid testing devices and whilst the amounts of hemp-seed oil required to give a positive reading has been calculated on a theoretical basis within the supporting documentation, this would only be able to be confirmed by performing some experiments in line with previous studies evaluating urine detection rates given variations in the sensitivity and accuracy of on-site oral fluid

screening devices, the amount of THC retained in the oral cavity prior to testing etc.

3. Impairment

   Of note, none of the published studies referred to above note any THC-related impairment of the subjects and based on the amounts of hemp-seed product likely to be consumed (6 μg/kg (body weight) per day), THC-related impairment would not be expected.

4. Additional Questions:

   a. Can you provide information on the type of saliva tests that are available, including sensitivity of the tests:

      A variety of oral fluid tests are available commercially. These include onsite screening devices such as Onsite Oral 5, SalivaScan, ExpressCheck, Oralert, Oratect, Drugwipe 5 and Cozart's DDS and Rapiscan systems together with laboratory based non-portable screening devices and confirmation techniques such as gas-chromatography mass spectrometry (GC-MS) and liquid chromatography mass-spectrometry (LC-MS).

      All tests are required to be sensitive enough to establish if the concentration of THC is above or below the cut-offs outlined in the current Australian Standards. As such all screening devices have sensitivity at or about 25 ng/mL. In contrast the confirmation techniques generally have a sensitivity of low nanogram per mL content of THC i.e. 1 to 2 ng/mL however will only report results in line with the Australian Standard i.e. 10 ng/mL.

   b. What saliva THC tests are currently in use in Australia and New Zealand? For these tests, what levels of detection of THC are currently used? Can you provide information on the methodology of these tests and the costs of conducting these tests?

      There are many screening devices available in both Australia and New Zealand and as such they cannot all be listed however they do include the one's listed above. To be used in accordance with the Australian Standards (note there are no NZ standards, as they did no sign on for oral fluid testing), they must all conform to the required sensitivities outlined in the current standard. The testing methodology although, slightly different from manufacturer to manufacturer, are all based on immunoassay techniques. As such the specificity of the test may vary from manufacturer to manufacturer leading some to produce more false positive and false negatives than others.

Whilst I do not remain up to date on current costs of testing, onsite test kits generally cost approximately $20 to $40 per kit, laboratory based screening generally cost less than $100 and confirmation between $100 and $200 depending on the laboratory.

c. Outline other THC testing methodologies that are used in Australia and New Zealand (for example, urine and blood)?

Other testing methodology associated with urine include immunoassay-based screening techniques, both onsite and laboratory-based together with mass-spectrometric confirmation techniques. Like oral fluid devices, there are many onsite urine testing available via various suppliers and therefore cannot be listed however an example is the MicroScreen test cup. Relative to oral fluid devices, the urine screening devices are generally more specific and accurate than oral fluid and are targeting the metabolites of THC, not the parent drug THC as outlined in the respective Australian Standard.

Testing of blood is typically laboratory based and may involve both an immunoassay screen or direct confirmation by GC-MS or LC-MS. These tests are more specific and more sensitive and typically look for both THC and its major metabolite.

d. Which analytical laboratories currently conduct confirmatory THC testing, for example blood tests? How much do these tests cost?

A range of laboratories, both private pathology laboratories, government laboratories and hospital-based laboratories typically provide confirmation in urine, blood and oral fluids. As outlined above, costs for screening are generally less than $100 and the cost of confirmations between $100 and $200. These labs should be NATA accredited and certified to test samples in accordance with the respective Australian Standard. A list of the 50+ laboratories accredited for urine testing and 10+ accredited for oral fluid testing can be found via the NATA website: http://www.nata.com.au/

Sincerely,

Michael D. Robertson, Ph.D.
Forensic Toxicologist

Part 3

Environmental Costs of Hemp Substitutes

The parallel histories of industrial grain alcohol and hemp, from early prevalence in domestic industrial applications to taxation, prohibition, and relative obsolescence, also share at least one broad-reaching environmental implication: elevated industrial emissions resulting from the replacement of these carbohydrates with hydrocarbon industrial feedstocks. Many commodities which came to replace traditional uses of industrial hemp in the United States in the last century and a half also carried considerable environmental baggage.

Cotton and polyester production are two good examples of industries that replaced industrial hemp. Both are high-performance materials with unique qualities. Polyester fiber manufacturing requires six times the average energy required to produce either cotton or industrial hemp fiber, generating particulate pollution, as well as carbon dioxide, nitrogen oxides, sulphur oxides, and carbon monoxide.[16] Cotton is one of the most water- and pesticide-intensive crops in the world.[17] The United States is the second largest producer of cotton, accounting for roughly a fifth of world production. Health effects due to pesticide use are a concern for both humans and wildlife, particularly bird and amphibian species. One researcher has estimated environmental and societal damages as a result of pesticide use in the United States at a value of $9.6 billion annually.[18] Because industrial hemp has far greater natural pest and weed resistance than cotton does, fewer inputs are needed for economic cultivation of this crop. Even new technologies that allow for more precise application of pesticides and genetic engineering for herbicide-tolerant and insect-protected cotton still leave cotton well outside the environmental performance range of hemp.[19]

Industrial hemp experts consider it a low-input, low-impact crop.[20] Inputs required for cultivation of any crop are an important environmental consideration because of the pollution created in their production and left behind from their use—from the manufacture of chemical fertilizers, herbicides and pesticides, to their shipment, storage, and delivery in the field. Depending on the irrigation source, crop irrigation can also represent a substantial energy input for any crop. For example, irrigating California's crop land is the state's single largest water commitment. Pumping for crop irrigation accounts for 5 percent of the state's total energy use, and more than 90 percent of the state agricultural sector's electricity use—though the dollar value of this cost is often subsidized by below-market water pricing for agricultural applications.[21]

Petroleum is inextricably tied to conventional agricultural production through the use of inorganic fertilizers. The U.S. General Accountability Office (GAO) reported in 2003 that the cost of natural gas accounted for up to 90 percent of the cost of nitrogen fertilizer in the United States. Decreased domestic natural gas supplies resulted in decreased domestic nitrogen fertilizer production and lower crop yields as recently as 2001.[22] Natural gas prices spiked again in 2005, and testimony to the United States Senate Committee on Energy and Natural Resources stated that "almost one-third of U.S. crop production is derived from nitrogen fertilizer" and over 93 percent of the total cash cost of production of nitrogen fertilizer is from the cost of natural gas.[23]

The U.S. imports most of the nitrogen fertilizer it uses. Worldwide, fertilizer production consumes approximately 1.2 percent of the world's energy and is responsible for about 1.2 percent of the total emission of the greenhouse gases.[24] Additionally, nitrogen fertilization of soils accounted for 9 percent of U.S. industrial greenhouse gas emissions in 2005 (60 percent of total nitrous oxide emissions).[25] Fertilizers can also cause environmental damage when they leach from soils, contributing to eutrophication (the nutrient-loading of waterbodies). Eutrophication resulting from agricultural runoff is, along with soil erosion, one of the leading causes of water impairment in the United States.[26]

The contribution of petroleum products to carbon dioxide emissions has become a topic of considerable policy attention recently, helping to renew interest in plant-derived industrial feedstocks. Industrial hemp products help to mitigate elevated atmospheric carbon dioxide levels through carbon sequestration.

Wood-based paper manufacturing, which has replaced the use of agricultural fibers like hemp for papermaking, is the fourth most energy-intensive industry in the United States today, accounting for 5.6 percent of industrial carbon dioxide emissions in 2005.[27] Paper manufacturing from wood pulp also typically requires the use of sulphur and chlorine, chemicals known to cause environmental harm. The high chemical and energy requirements of wood pulping result from the need to remove the lignin content (a type of plant glue) and isolate the useful cellulose present in the raw material. The balance of cellulose to lignin is more favorable in fiber crops, and hemp is a prime example.

The legal status of hemp particularly impedes its use in emerging technologies, such as composite construction materials. Concrete and fiberglass, used for their strength and insulating properties in construction, both require large amounts of energy for their manufacture. The production of nonmetallic mineral products (including cement, glass and lime) is the smallest subgroup of carbon dioxide emissions from manufacturing in the United States today, but cement and lime production are by far the most carbon-intensive manufacturing types in terms of CO_2 produced per BTU used, and contribute 2.8 and 0.7 percent of emissions, respectively.[28] Research is currently underway in Britain to determine whether industrial hemp-based building alternatives to concrete and lime can be used to construct "carbon-neutral" energy-efficient houses.[29] Composite materials can also deliver considerable fuel energy savings when used to replace heavier mineral composites in transportation, such as automobile interiors. Greater exploitation of industrial hemp in these kinds

of construction materials in the United States is limited, perhaps to a greater degree than the applications discussed above, by the lack of a domestic hemp fiber supply.

Finally, U.S. policy not only prohibits experimentation with industrial hemp, it directly subsidizes the production of competing commodities that might be environmentally inferior. High-yield hemp crops are often said to grow best in the same areas that produce corn and wheat. In 1995, the USDA also investigated hemp as an alternative for tobacco farming.[30] The Environmental Working Group reports that, from 1995 to 2005, U.S. direct agricultural subsidy programs amounted to $51.3 billion for corn, $21.0 billion for wheat, and $530 million for tobacco.

Cotton, a fiber comparable in many ways to hemp, was the third-highest subsidized crop in the period at $15.8 billion.[31] Timber and petroleum also benefit from implicit subsidies through U.S. Forest Service timber extraction and foreign policy programs, respectively.

Fuels derived from crops in the United States are eligible for additional government support in the form of tax breaks and tariffs, as well as state and federal grants and loans for infrastructure development. According to the American Enterprise Institute, "the single largest energy tax expenditure in the U.S. budget is the tax credit for alcohol fuels, with a five-year revenue cost of $12.7 billion," primarily benefiting corn-based ethanol.[32] Canola and soybeans, other competitors in the biofuel market, are also subsidized. In 2007 alone, the U.S. Department of Energy announced $585 million in grants to roughly one dozen companies working to produce cellulosic ethanol.[33]

The balance of prime croplands used for food, fiber, and biomass production should be viewed in the context of the massive agricultural subsidy programs in the United States and abroad that interfere with optimal levels and locations of agricultural production.