Petition to the NOSB For Approval of Potassium Hydroxide as a Peeling Agent for Thermally Processed Canned Peaches

Submitted by

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San Luis Obispo, CA 93407

Introduction

This proposal will serve as a petition to the NOSB for its consideration for the use of potassium hydroxide as a peeling agent for fresh peaches to be canned.

Current status of potassium hydroxide per 7CFR Part 205.605B indicates that potassium hydroxide is prohibited for use in lye peeling of fruits and vegetables, **except** when used for peeling peaches during the individually quick frozen (IQF) production process.

Since potassium hydroxide use has been approved for lye peeling of peaches to be frozen, our proposal would like the NOSB to consider its approval for essentially the same use but for fresh peaches to be canned.

We have included significant actual in-plant data as well as nutritional data to support our request. We believe, based on all scientific available information, that use of potassium hydroxide is consistent with the logic and scientific reasoning for its previous approval as a process aid for IQF peaches. Moreover, it is both our philosophy and intent to protect the organic integrity of peaches at all stages of peach process handling operations, from field to truck transport to plant through process operations and to the consumer.

It is our fundamental wish that the NOSB carefully consider our petition, our data, our logic and rationale for the use of potassium hydroxide during peeling operations and the potential environmental advantages and benefits of its use.

Petition Outline

Item A: Please indicate which section or sections the petitioned substance will be included on and/or removed from the list.

1. Non-agricultural (non-organic) allowed in or on processed products labeled as "Organic" (95+% organic) or "Made with organic" (70-95% organic) peaches that have been canned or thermally processed.

Note that potassium hydroxide has been NOSB approved for use as a process aid for individually quick frozen peaches during lye peeling operations. Therefore, our intent is to seek NOSB approval for its use for canned peaches during lye peeling operations, so that our request is consistent with the 7CFR Part 205.605b.

Item B
1. The substances chemical or material common name.

Potassium hydroxide: Its chemical formula is KOH and its common name is potash.

2. The manufacturers or producers name, address and telephone number and other contact information of the substance listed in the petition.

The following vendors or suppliers may be used if approved:

Occidental Chemical Corp.
7377 Highway 3214
Convent, LA 70723
Phone- 703 478-0241
Fax- 703 478-0645

Note: MSDS and K-Kosher certificate status information is provided as Attachment No.1.

3. The intended or current use of the substance such as use as a pesticide, animal feed additive, processing aid, nonagricultural ingredient, sanitizer or disinfectant. If the substance is an agricultural ingredient, the petition must provide a list of the types of products for which the substance will be used.

Potassium hydroxide (KOH) is a synthetic, inorganic compound produced by an electrolytic process using only potassium chloride (approved for use in organic foods per 205.605(A)) and water. Its use as a process aid is being petitioned for the lye or caustic peeling of organic peaches which will be marketed as organic canned peaches.

Verification and documentation of its synthetic classification is provided as Attachment No. 2.

4. A list of the crop, livestock or handling activities for which the substance will be used. If used for crops or livestock the substances rate and method of application must be described. If used for handling (including processing) the substances mode of action must be described.

Potassium hydroxide is a strong base that completely dissociates in a water environment to potassium ions (i.e., K^+) and hydroxyl ions (OH^-) according to the following equation.

$$KOH + H_2O \text{-->} K^+ + 2OH^- + H_2O$$

Potassium hydroxide will be used as a less than 2.0% solution (i.e., 2.0 lb KOH (solid)) dissolved in 100 lb of water. Potassium hydroxide can be purchased as a solid (white crystals) or in the form of a water-based solution at different concentrations.

Potassium hydroxide will be used as a spray or batch at a range of 195 F to 205 F for weakening the adhesion of the peel to the flesh of the fruit to facilitate mechanical removal of the peel. The fruit is rinsed with fresh water and further sized and processed into halves, slices or diced for further processing and packaging.

All process operations are provided in a process flow diagram provided as Attachment No. 3.

The chemical-biochemical mode of action of potassium hydroxide is to weaken the glycolytic bonds of pectin which serves as an intracellular "cement" that provides conformation-adhesion properties of the pectin which in turn is primarily responsible for skin adhesion. Pectin is composed of galactose sugar molecules in a polymer form. By weakening the intermolecular forces of adhesion, pectin is more easily removed by further mechanical and water spray operations. It is important to note that there is no breakage of covalent bonds, but disruption of hydrogen, hydrophobic and dipole bonding that allows for weakening of the skin to the flesh, resulting in minimal, if any, chemical changes in the raw peaches. Exposure time is in seconds and the fruit is immediately high pressure rinsed with fresh water.

5. The source of the substance and a detailed description of its manufacturing or processing procedures from the basic component(s) to the final product.

As noted, a detailed manufacturing process is provided as Attachment No. 2.

Overall, potassium chloride (approved per 205.605(A)) is dissolved in water and is subjected to electrolysis (passage of electrical current thru the solution) followed by use of physical separation of the potassium hydroxide as the end product using membrane technology such as reverse osmosis which is currently used for desalination of sea water.

A summary of the manufacturing process is as follows:

$$2KCl + 2H_2O \xrightarrow{\text{Electrolysis}} 2KOH + Cl_2 + H_2 \xrightarrow{\text{Membrane separation}} KOH \text{-->}$$

$KOH \xrightarrow{\text{Dehydration}}$ KOH solid form or liquid solution which may be concentrated by physical means (i.e., evaporation) to a desired concentration.

6. A summary of any available previous reviews by State or private certification programs or other organizations of the petitioned substance. If this information is not available, the petitioner should state so in the petition.

In May, 2001, OMRI's Committee conducted a comprehensive TAP review of potassium hydroxide. A complete copy of this review totaling 17 pages is provided as Attachment No. 4 for NOSB review.

A conclusion noted in the executive summary on page 1 states the following: "Two of the three reviewers agree with the petitioner that this restriction on the use of potassium specific for IQF peaches unfairly restricts its use in other operations and find that environmental effects can be mitigated with the use of good waste water management practices."

In summary, we, the petitioners, are of the belief that it is difficult to understand the logic and science that permits use of potassium hydroxide for peeling of organic peaches for freezing but not for canning, since both processes are identical up to the final stage of processing, i.e. freezing or canning.

7. Information regarding EPA, FDA, and State regulatory registrations, including registration numbers. If this information does not exist, the petitioner should state so in the petition.

Potassium hydroxide is FDA approved as generally recognized as safe (GRAS) as a direct human food ingredient. It meets the food chemicals codex specifications for use as a formulation aid, pH control agent, processing aid and stabilizer as defined in Section 170.3(O) of the Food Chemicals Codex and 21CFR 184.1b.

Further documentation of FDA status is provided in Attachment No. 5, as well as in the OMRI review per Attachment No. 4.

8. The Chemical Abstract Service (CAS) number or other product numbers of the substance and labels of product that contains the petitioned substance. If the substance does not have an assigned product number, the petitioner should state so in the petition.

The following identification numbers and codes are documented both in Attachments 4 and 5 for potassium hydroxide.

1) CAS number 13130-58-3
2) Food Chemicals Codex 170.3(O)
3) 21CFR 184.1(b)
4) EPA 40CFR 302.4 and 40CFR 117

9. The substance's physical properties and chemical mode of action including (a) chemical interactions with other substances, especially substances used in organic production; (b) toxicity and environmental persistence; (c) environmental impacts from its use and/or manufacture; (d) effects of human health; and, (E) effects on soil organisms, crops or livestock.

A. Potassium hydroxide is approved by the FDA in the alkalization of chocolate (i.e., cacao nibs, chocolate liquor) to produce dark chocolate which has been shown to have more available antioxidants due to treatment with KOH. Additionally, KOH is used in the production of caramel color and breakfast cocoa and principally as a pH control agent where the addition of sodium ions is not wanted, for example, in low sodium food products. Therefore use of KOH over NaOH (sodium hydroxide) contributes potassium ions needed for proper electrolyte balance which is important in many people susceptible to hypertension and/or high blood pressure.

For its FDA approved use in peeling of fruit, KOH causes minimal, if any, chemical or biochemical changes, but contributes important potassium ions, which is of significant micro nutritional benefit to consumers.

Use of potassium hydroxide, approved by the FDA is comprehensively reviewed in the OMRI TAP review provided as Attachment No. 4.

B. Toxicity and Environmental Persistence
Historically, lye peeling using sodium hydroxide has disadvantages of discharging sodium ions in the plant waste water effluent creating increases in salinity of the water and soil. In contrast, plant discharge of plant waste water effluent containing residual potassium hydroxide contributes potassium ions which serve as an essential. However, all waste water effluent is regulated and is subject to state and local regulations. Additionally, the waste water effluent should not be alkaline, as the natural acidity of the fruit will serve to partially or completely neutralize the alkalinity thereby creating a more environmentally friendly effluent.

Toxicological information for all FDA approved uses of potassium hydroxide in food such as lye peeling does not specifically document any toxicological information from eating food treated with dilute potassium hydroxide. Exclusive review of the literature provided general toxicological information on potassium hydroxide itself, which is documented in Attachment No. 6. This is a peer review abstract based literature review of all handling aspects, manufacture, use, safety in worker handling, and toxicity-biomedical effects.

C. Environmental Impacts from its Use and/or Manufacture
As noted, the use of potassium hydroxide will have a positive environmental effect as opposed to use of sodium hydroxide, which is also approved per 205.605, but not for lye peeling.

Also, as reviewed, when potassium hydroxide is produced from electrolysis with further separation using membrane technology both end products, chlorine gas and hydrogen gas, are collected and used for further industrial application. Therefore, manufacture should have no negative environmental effects as referenced in Attachment No. 2.

D. Effects on Human Health
As noted on page 3 of the OMRI TAP review provided in Attachment No. 4, potassium hydroxide is highly corrosive and can cause burns of eyes, skin and mucus membrane. Therefore, worker training in handling potassium hydroxide is an important requirement

E. Effect on Soil Organisms, Crops or Livestock
As noted, process waste effluent, whether used for field irrigation in supplying potassium as a micro nutrient or discharged into a municipal bio solids treatment center, would provide significant advantages when compared to sodium hydroxide. As documented in Attachment No. 7 the City of Lodi, CA issued a Soil and Ground Water Investigation of Existing Conditions Report dated September 2006 and concluded use of potassium hydroxide by the Pacific Coast Producers plant would be considered an environmentally superior source of caustic since the waste water would add an essential plant nutrient to the crop land.

10. Safety information about the substance including Material Safety Data Sheet (MSDS) and a substance report from the National Institute of Environmental Health Studies. If this information does not exist, the petitioner should state so in the petition.

Attachment No. 1 includes the MSDS for potassium hydroxide. Also, please see the Certificate of Registration of our vendor to produce and supply potassium hydroxide to our food processing facility. Please note that the potassium hydroxide is Kosher certified.

11. Research information about the substance which includes comprehensive substance research reviews and research bibliographies, including reviews and bibliographies which present contrasting positions to those presented by the petitioner in supporting the substance's inclusion on or removal from the National List. For petitions to include non-organic agricultural substances onto the National List, this information item should include research concerning why the substance should be permitted in the production or handling of an organic product, including the availability of organic alternatives. Commercial availability does not depend upon geographic location or local market conditions. If research information does not exist for the petitioned substance, the petitioner should state so in the petition.

An industry wide research study presented at the ACDSANC meeting in April, 2010, titled "How Commodities Impact Agricultural Groups," contained a study "Canned and Frozen Cling Peach Study," that measured Vitamin A, Vitamin E, Vitamin C, antioxidants and phenolic compounds and concluded that canned peaches were 7 times higher than fresh, with Vitamin E 2-3 times higher in canned, with fresh peaches having higher levels of Vitamin C compared to either canned or frozen. This is to be expected since Vitamin C is the most heat stable of all water soluble vitamins with a wide range of values reported for total antioxidants and phenolic compounds.

This study definitely documents that canned peaches (with alkali lye peeling) are not significantly lower in total water soluble vitamin content when compared to both fresh and frozen. The entire paper is provided as Attachment No. 8.

It should be further noted that alkali peeling of peaches results in superior quality from a sensory perspective and less solid waste when compared to steam peeling. This is the major reason why no organic canned peaches exist in the retail market of high sensory quality. Therefore, from a purely economic perspective, use of potassium hydroxide in the lye peeling of organic peaches will result in a superior quality product that would allow consumers the opportunity to enjoy a premium organic product at a reasonable cost.

As noted in the OMRI TAP review provided in Attachment No. 4, a comprehensive bibliography is documented as well as contrasting professional positions regarding support of potassium hydroxide for inclusion in 205.605B. It should also be noted that two of the three reviewers supported inclusion of potassium hydroxide in 205.605(B) for lye peeling operations.

12. "Petition Justification Statement" for inclusion of the use of potassium hydroxide for lye peeling of canned peaches.

The following points of justification summarize the important considerations of this proposal.

i) Potassium hydroxide is already approved by the NOSB for peeling of IQF peaches.
ii) Use of potassium hydroxide for lye peeling does not result in significant vitamin loss.
iii) Use of potassium does not significantly change the pH of the peaches and therefore does not cause or create any chemical modifications of the peaches both internally and on the surface.
iv) Use of potassium hydroxide in lye peeling of delicate fruits such as peaches results in minimal loss in texture, flavor, appearance and aroma compared to steam or mechanically peeled peaches providing a product with superior sensory appeal for consumers. No other existing process or treatment can provide an equivalent quality product.
v) Use of potassium hydroxide provides a cost effective approach to peeling of organic peaches which will assist in providing consumers with a competitive retail price that will further make organic peaches more available in the retail market place.
vi) Potassium hydroxide is FDA approved for a wide range of applications in various and different food products. For example, it is used in the Dutch process of producing dark chocolate in the production of organic soap products and many other applications as documented in Attachment No. 4.

We believe there is compelling logic and scientific reasoning for its approval for lye peeling of organic peaches for canning.

13. Confidential Business Information Statement

CBI-deleted

CBI-deleted

CBI-deleted

In summary the results of both internal studies suggest minimal risk, if any, to maintenance of organic integrity and we wish to conclude that based on all scientific evidence, use of potassium hydroxide for the lye peeling of canned peaches should be approved by the NOSB.

Attachment No. 1

MSDS
of
Potassium Hydroxide
(Caustic Potash) and
Kosher Certification

Certificate of Registration

Occidental Chemical Corporation
Convent-Taft Plant

266 Highway 3142 **Taft, LA 70057**	**7377 Highway 3214** **Convent, LA 70723**

Is hereby granted the right and license to use the QSR® Registered Firm Symbol and to be listed in the Quality Systems Registrars, Inc. "Register of Certified Quality Systems" under the conditions specified in QSR®'s Contract and ISO 9001:2008 for the following scope:

Manufacture of Chlorine, Sodium Hydroxide, Potassium Hydroxide and Ethylene Dichloride. (This certificate covers the site at 266 Highway 3142, Taft LA 70057 and 7377 Highway 3214, Convent, LA 70723.)

Exclusions: 7.3 Design and development; 7.5.2 Validation of processes for production and service provision.

The period of registration is from December 10, 2009 to June 10, 2010.
Registered Firm Since June 11, 1993.

Certificate Number: QSR-107

Scott R. Kleckner
President

December 14, 2009
Date

MGMT. SYS.
RvA C 052

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www.qsr.com

STAR-K KOSHER CERTIFICATION

February 18, 2010
4 Adar 5770

Occidental Chemical Corporation
P.O. Box 809050
Dallas, TX 75380

This is to certify that the product specified in the product listing below, distributed by OCCIDENTAL CHEMICAL CORPORATION of the above address, is Kosher and under our supervision.

PLEASE NOTE THE FOLLOWING CONDITIONS OF CERTIFICATION:
All products listed below are Pareve.
All products listed below are Kosher for Passover.
All products listed below are certified Kosher when manufactured by Occidental Chemical Corp. - Deerpark of Deerpark, TX; or Occidental Chemical Corp. - Taft/Hahnville of Hahnville, LA; or Vopak Terminal of Deerpark, TX, as stated on label.
This letter of certification is valid through February 28, 2011 and is subject to renewal at that time.
The UKD# is an identification number assigned by the Star-K for tracking purposes. The integrity of this document is guaranteed only when Security Enforcement Codes appear in the lower corners of this page.

BRAND	UKD#	PRODUCT LISTING
OCCIDENTAL CHEMICAL CORPORATION	SK6LE1RDKBM	Caustic Potash, Dry or Liquid

Eliyahu Shuman
Rabbi Eliyahu Shuman
Director of Supervision

Effective through 02/28/2011
Page 1 of 1

OxyChem
continued -
Caustic Potash
Food and Drug Administration (FDA) Status

FDA CP 01/09

Occidental Tower
5005 LBJ Freeway, Suite 2200
Dallas, Texas 75244-6119
800-752-5151

Occidental Chemical Corporation
A subsidiary of Occidental Petroleum Corporation

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SAFETY DATA SHEET

OxyChem®

Responsible Care® Good Chemistry at Work

CAUSTIC POTASH LIQUID (ALL GRADES)

MSDS No.: M31866 **Rev. Date:** 2009-Dec-03 **Rev. Num.:** 04

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Company Identification:	Occidental Chemical Corporation 5005 LBJ Freeway P.O. Box 809050 Dallas, Tx 75380-9050
24 Hour Emergency Telephone Number:	1-800-733-3665 or 1-972-404-3228 (U.S.); 32.3.575.55.55 (Europe); 1800-033-111 (Australia)
To Request an MSDS:	MSDS@oxy.com or 1-972-404-3245
Customer Service:	1-800-752-5151 or 1-972-404-3700
Trade Name:	Caustic Potash Membrane Dilute Solution 45%, 48%, 50%, Caustic Potash Liquid (10-40% Solution)
Synonyms:	KOH, liquid potash, Potassium Hydroxide
Product Use:	Glass manufacture, Cleaner, Process chemical, Petroleum industry

2. HAZARDS IDENTIFICATION

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EMERGENCY OVERVIEW:

Color:	Colorless
Physical State:	Liquid
Appearance:	Clear
Odor:	Odorless
Signal Word:	DANGER

MAJOR HEALTH HAZARDS: CORROSIVE. CAUSES BURNS TO THE RESPIRATORY TRACT, SKIN, EYES AND GASTROINTESTINAL TRACT. CAUSES PERMANENT EYE DAMAGE. EFFECTS OF CONTACT OR INHALATION MAY BE DELAYED.

2. HAZARDS IDENTIFICATION

PHYSICAL HAZARDS: Mixing with water, acid or incompatible materials may cause splattering and release of heat. Do not store in aluminum container or use aluminum fittings or transfer lines, as flammable hydrogen gas may be generated.
ECOLOGICAL HAZARDS: This material has exhibited moderate toxicity to aquatic organisms.
PRECAUTIONARY STATEMENTS: Do not get in eyes, on skin, or on clothing. Do not breathe vapor or mist. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation.
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POTENTIAL HEALTH EFFECTS:

Inhalation: May cause severe irritation of the respiratory tract with coughing, choking, pain and possibly burns of the mucous membranes.

Skin contact: Causes skin burns.

Eye contact: Causes serious eye damage.

Ingestion: Causes burns.

Chronic Effects: None known.

Medical Conditions Aggravated by Exposure: Respiratory system (including asthma and other breathing disorders)

See Section 11: **TOXICOLOGICAL INFORMATION**

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	Percentage	CAS Number
Water	49 - 90	7732-18-5
Potassium hydroxide	10 - 51	1310-58-3

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer basic life support (Cardio-Pulmonary Resuscitation and/or Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

SKIN CONTACT: Immediately flush contaminated areas with water. Remove contaminated clothing, jewelry and shoes. Wash contaminated areas with soap and water. Thoroughly clean and dry contaminated clothing before reuse. Discard contaminated leather goods. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

4. FIRST AID MEASURES

INGESTION: Never give anything by mouth to an unconscious or convulsive person. If swallowed, do not induce vomiting. Give large amounts of water. If vomiting occurs spontaneously, keep airway clear. Give more water when vomiting stops. GET MEDICAL ATTENTION IMMEDIATELY.

Notes to Physician: The absence of visible signs or symptoms of burns does NOT reliably exclude the presence of actual tissue damage. Probable mucosal damage may contraindicate the use of gastric lavage.

5. FIRE-FIGHTING MEASURES

Fire Hazard: Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. May react with chemically reactive metals such as aluminum, zinc, magnesium, copper, etc. to release hydrogen gas which can form explosive mixtures in air.

Extinguishing Media: Use extinguishing agents appropriate for surrounding fire.

Fire Fighting: Move container from fire area if it can be done without risk. Cool containers with water. Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode. Avoid contact with skin.

Sensitivity to Mechanical Impact: Not sensitive.

Sensitivity to Static Discharge: Not sensitive.

Flash point: Not flammable

6. ACCIDENTAL RELEASE MEASURES

Occupational Release:
Wear appropriate personal protective equipment recommended in Section 8 of the SDS. Completely contain spilled material with dikes, sandbags, etc. Keep out of water supplies and sewers. Liquid material may be removed with a vacuum truck. Flush spill area with water, if appropriate. This material is alkaline and may raise the pH of surface waters with low buffering capacity. Releases should be reported, if required, to appropriate agencies.

7. HANDLING AND STORAGE

Storage Conditions: Store and handle in accordance with all current regulations and standards. Keep container tightly closed and properly labeled. Do not store in aluminum container or use aluminum fittings or transfer lines, as flammable hydrogen gas may be generated. Keep separated from incompatible substances (see Section 10 of SDS).

Handling Procedures: Avoid breathing vapor or mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. When mixing, slowly add to water to minimize heat generation and spattering.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Regulatory Exposure limit(s):

Component	CAS Number	OSHA Final PEL TWA	OSHA Final PEL STEL	OSHA Final PEL Ceiling
Potassium hydroxide	1310-58-3	-----	-----	-----

OEL: Occupational Exposure Level; OSHA: United States Occupational Safety and Health Administration; PEL: Permissible Exposure Level; TWA: Time Weighted Average; STEL: Short Term Exposure Level

Non-Regulatory Exposure Limit(s):

- **The Non-Regulatory United States Occupational Safety and Health Association (OSHA) limits shown in the table are the Vacated 1989 PEL's (vacated by 58 FR 35338, June 30, 1993).**
- **The American Conference of Governmental Industrial Hygienists (ACGIH) is a voluntary organization of professional industrial hygiene personnel in government or educational institutions in the United States. The ACGIH develops and publishes recommended occupational exposure limits each year called Threshold Limit Values (TLVs) for hundreds of chemicals, physical agents, and biological exposure indices.**

Component	CAS Number	ACGIH TWA	ACGIH STEL	ACGIH Ceiling	OSHA TWA (Vacated)	OSHA STEL (Vacated)	OSHA Ceiling (Vacated)
Potassium hydroxide	1310-58-3	-----	-----	2 mg/m³	-----	-----	2 mg/m³

ENGINEERING CONTROLS: Provide local exhaust ventilation where dust or mist may be generated. Ensure compliance with applicable exposure limits.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Wear chemical safety goggles with a faceshield to protect against eye and skin contact when appropriate. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin and Body Protection: Wear chemical resistant clothing and rubber boots when potential for contact with the material exists. Always place pants legs over boots. Thoroughly clean and dry contaminated clothing before resue. Discard contaminated leather goods.

Hand Protection: Wear appropriate chemical resistant gloves

Protective Material Types: Butyl rubber, Natural rubber, Nitrile, Polyvinyl chloride (PVC), Tychem®

Respiratory Protection: A NIOSH approved respirator with N95 dust/mist filter (1/2 facepiece) or N100 dust/mist filter (full facepiece) cartridges may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits, or when symptoms have been observed that are indicative of overexposure. If eye irritation occurs, a full face style mask should be used. A respiratory protection program that meets 29 CFR 1910.134 must be followed whenever workplace conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Appearance:	Clear
Color:	Colorless

9. PHYSICAL AND CHEMICAL PROPERTIES

Odor:	Odorless	
Molecular Weight:	56.11	56.11
Molecular Formula:	KOH	56.11
Flash point:	Not flammable	
Boiling Point/Range:	216 to 289 F (102 to 143 C)	
Freezing Point/Range:	-128 to 39 F (-89 to 4 C)	
Specific Gravity (water=1):	1.09 - 1.52 @ 15.6 C	
Density:	9.09 - 12.67 lbs/gal @ 15.6 C	
Water Solubility:	100%	
pH:	12 - 14	

10. STABILITY AND REACTIVITY

Reactivity/ Stability: Stable at normal temperatures and pressures.

Conditions to Avoid: Mixing with water, acid, or incompatible materials may cause splattering and release of large amounts of heat. Will react with some metals forming flammable hydrogen gas. Carbon monoxide gas may form upon contact with reducing sugars, food and beverage products in enclosed spaces.

Incompatibilities/ Materials to Avoid: Acids, Flammable liquids, Halogenated compounds, Prolonged contact with aluminum, brass, bronze, copper, lead, tin, zinc or other alkali sensitive metals or alloys

Hazardous Decomposition Products: None known

Hazardous Polymerization: Will not occur

11. TOXICOLOGICAL INFORMATION

TOXICITY:
When in solution, this material will affect all tissues with which it comes in contact. The severity of the tissue damage is a function of concentration, the length of tissue contact time, and local tissue conditions. After exposure there may be a time delay before irritation and other effects occur. The material is a strong irritant and is corrosive to the skin, eyes, and mucous membranes. This material may cause severe burns and permanent damage to any tissue with which it comes in contact.

CARCINOGENICITY: This product is not classified as a carcinogen by NTP, IARC or OSHA.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

- **Aquatic Toxicity:**
  This material is alkaline and may raise the pH of surface waters with low buffering capacity.
  This material has exhibited moderate toxicity to aquatic organisms.

- **Freshwater Fish Toxicity:**
  LC50 (Mosquito fish): 80 mg/L/96 hr (static bioassay in fresh water at 18-19 C)
  LC50 (Fathead Minnow): 179 mg/L/96 hr (static at 22.3-24.7 C)

- **Invertebrate Toxicity:**
  EC50 (Daphnia magna): 60 mg/L/48 hr (static bioassay at 20.3-20.7 C)

- **Algae Toxicity:**
  ErC50 (Selenastrum capricornutum): 61 mg/L/96 hr (static bioassay at 23-23.9 C)

FATE AND TRANSPORT:

BIODEGRADATION: This material will disassociate into ionic form in the aquatic environment. Natural carbon dioxide will slowly neutralize this material.

BIOCONCENTRATION: This material will not bioconcentrate.

ADDITIONAL ECOLOGICAL INFORMATION:
This material has exhibited slight toxicity to terrestrial organisms.

13. DISPOSAL CONSIDERATIONS

Reuse or reprocess, if possible. Dispose in accordance with all applicable regulations. May be subject to disposal regulations: U.S. EPA 40 CFR 261. Hazardous Waste Number(s): D002.

14. TRANSPORT INFORMATION

U.S.DOT 49 CFR 172.101:

PROPER SHIPPING NAME:	Potassium hydroxide, solution
UN NUMBER:	UN1814
HAZARD CLASS/ DIVISION:	8
PACKING GROUP:	II
LABELING REQUIREMENTS:	8
DOT RQ (lbs):	RQ 1,000 Lbs. (Potassium hydroxide)

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME:	Potassium hydroxide, solution
UN NUMBER:	UN1814
CLASS OR DIVISION:	8
PACKING/RISK GROUP:	II

15. REGULATORY INFORMATION

U.S. REGULATIONS

- **OSHA REGULATORY STATUS:** This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200) (US)
- **CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):**
  If a release is reportable under CERCLA section 103, notify the state emergency response commission and local emergency planning committee. In addition, notify the National Response Center at (800) 424-8802 or (202) 426-2675.

Component	CERCLA Reportable Quantities:
Potassium hydroxide	1000 lb (final RQ)

- **EPCRA EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):** Not regulated
- **EPCRA SECTIONS 311/312 HAZARD CATEGORIES (40 CFR 370.21):**
  Acute Health Hazard
- **EPCRA SECTION 313 (40 CFR 372.65):** Not regulated.
- **OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119):** Not regulated

FDA: This material has Generally Recognized as Safe (GRAS) status under specific FDA regulations. Additional information is available from the Code of Federal Regulations which is accessible on the FDA's website.

NATIONAL INVENTORY STATUS

- **U.S. INVENTORY STATUS: Toxic Substance Control Act (TSCA):** All components are listed or exempt
- **TSCA 12(b):** This product is not subject to export notification
- **Canadian Chemical Inventory:** All components are listed

STATE REGULATIONS

Component	Potassium hydroxide
California Proposition 65 Cancer WARNING:	Not Listed
California Proposition 65 CRT List - Male reproductive toxin:	Not Listed
California Proposition 65 CRT List - Female reproductive toxin:	Not Listed
Massachusetts Right to Know Hazardous Substance List	Listed
New Jersey Right to Know Hazardous Substance List	Listed
New Jersey Special Health Hazards Substance List	Listed - corrosive
New Jersey - Environmental Hazardous Substance List	Not Listed
Pennsylvania Right to Know Hazardous Substance List	Listed
Pennsylvania Right to Know Special Hazardous Substances	Not Listed
Pennsylvania Right to Know Environmental Hazard List	Listed
Rhode Island Right to Know Hazardous Substance List	Listed

CANADIAN REGULATIONS
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

WHMIS Classification: E

16. OTHER INFORMATION

Prepared by: OxyChem Corporate HESS - Health Risk Management

HMIS: (SCALE 0-4) (Rated using National Paint & Coatings Association HMIS: Rating Instructions, 2nd Edition)

Health:	3	**Flammability:**	0	**Reactivity:**	1

NFPA 704 - Hazard Identification Ratings (SCALE 0-4)

Health:	3	**Flammability:**	0	**Reactivity:**	1

IMPORTANT:
The information presented herein, while not guaranteed, was prepared by technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OR GUARANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, IS MADE REGARDING PERFORMANCE, SAFETY, SUITABILITY, STABILITY OR OTHERWISE. This information is not intended to be all-inclusive as to the manner and conditions of use, handling, storage, disposal and other factors that may involve other or additional legal, environmental, safety or performance considerations, and OxyChem assumes no liability whatsoever for the use of or reliance upon this information. While our technical personnel will be happy to respond to questions, safe handling and use of the product remains the responsibility of the customer. No suggestions for use are intended as, and nothing herein shall be construed as, a recommendation to infringe any existing patents or to violate any Federal, State, local or foreign laws.

OSHA Standard 29 CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, material safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Material Safety Data Sheet available to your employees.

Attachment No. 2

Caustic Potash Manufacturing

Caustic Potash Manufacturing

Potassium hydroxide or caustic potash (KOH) is a synthetic, inorganic compound produced by an electrolytic process utilizing salt and water. This salt, potassium chloride (KCl), is a mineral that is mined in Saskatchewan, Canada. The liquid and dry grades of caustic potash are manufactured in dedicated equipment in the United States.

Manufacturing Process

The electrolytic conversion of the potassium chloride to potassium hydroxide is an energy intensive process. OxyChem uses membrane technology to manufacture liquid potassium hydroxide along with the co-products of chlorine (Cl_2) and hydrogen (H_2) at its Taft, LA facility.

The chemical reaction is:

$$2\,KCl + 2\,H_2O \quad \lozenge \quad 2\,KOH + Cl_2 + H_2$$

Dry caustic potash is produced at OxyChem's Deer Park, TX facility by evaporating
liquid caustic potash to a concentration of over 90%. This material is then fed to a flaker (cooler) to form KOH flakes. Crystal grade KOH is made either of two ways:

screening the dry KOH to separate it into flake grade and crystal grade product, or;
grinding the flake material and using screens to secure proper sizing

Over-sized and under-sized materials are returned to the process.

Basic Chemicals

Mfging CP 10/09

Occidental Tower
5005 LBJ Freeway, Suite 2200
Dallas, Texas 75244-6119
800-752-5151

Occidental Chemical Corporation

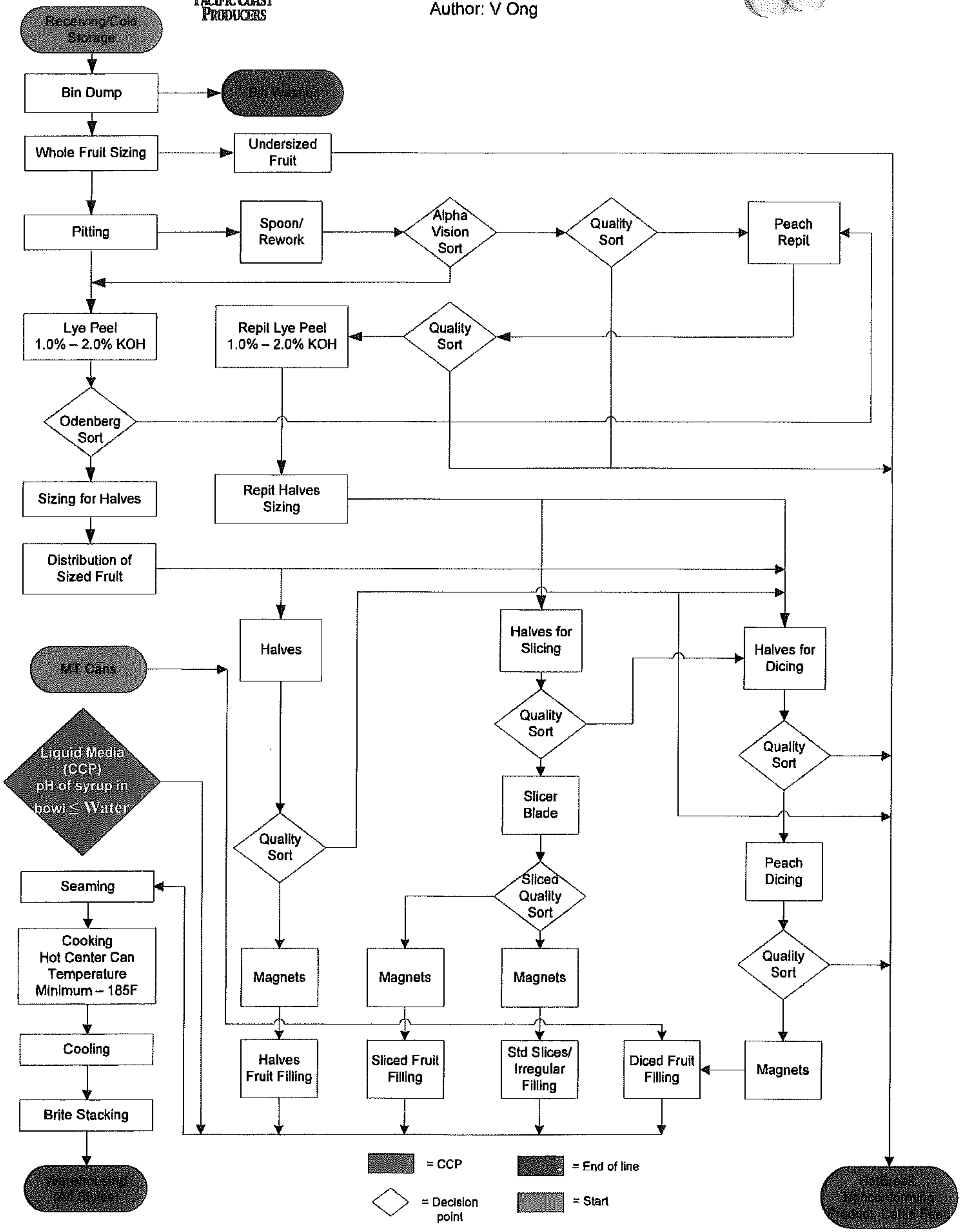
A subsidiary of Occidental Petroleum Corporation

®

Attachment No. 3

Process Flow Diagram
Documenting Use of Potassium Hydroxide
for
Lye Peeling

Food Safety Flowchart for Peaches
Revised March, 2011
Author: V Ong



Attachment No. 4

TAP Review
Conducted by OMRI
Dated May 21, 2001

PACIFIC COAST PRODUCERS

POTASSIUM HYDROXIDE

The following excerpts were obtained to support the positive usage of potassium hydroxide in peach processing. Attached are the complete articles, summaries, or reports in their entirety.

In R.J. Philips & Associates, Inc. Need Statement (as cited in Food Manufacturing Coalition (FMC) Need Statement, Project Code: PT-2-B-(14), dated: June 28, 1996), *Lye peeling involves the use of approximately 10-15% caustic soda (sodium hydroxide) or potassium hydroxide. The operation requires an ample water supply, lye, and a heat source. Products are passed through a heated lye solution, washed with water and typically dipped in acid to neutralize the remaining traces of caustic soda.*

According to the National Organic Standards Board Technical Advisory Panel (as cited in National Organic Standards Board Technical Advisory Panel Review, compiled by Organic Materials Review Institute for the USDA Nation Organic Program, dated: May 21, 2001), *Potassium hydroxide was petitioned to the NOSB for a change in the annotation as listed in 7CFR205.605(b)(27). This currently states that the substance is "prohibited for use in lye peeling of fruits and vegetables." The petitioner requests that this annotation be changed to permit use in the peeling of peaches for use in a process known as individually quick frozen (IQF) product.* (Page 1).

A lye peeling processing method is of concern to the agroecosystem due to handling of waste from the plant. Large volumes of water are used, which enter the waste stream along with the soluble potassium and alkali ions. Lye peeling with sodium hydroxide is more of a disposal problem due to undesirable sodium content that may be soil applied, whereas residual potassium is a plant nutrient, although it would be considered synthetic and not permitted for an organic farming system. (Page 4).

FDA specifies that when used for washing or peeling, potassium hydroxide must be used only in the amount needed, followed by rinsing with potable water to remove, to the extent possible, residues of the chemicals. No limits are placed on food use other than current good manufacturing practices, and the ingredient must meet the specifications of the Food Chemicals Codes. (Page 5).

Lye peeling involves the application or dip of peaches into a heated solution of potassium hydroxide, ranging from 2 – 7% in strength. The lower rates are used on clingstone (non-melting flesh) varieties. Different rates, temperatures, and time of exposure are used for fruits destined for canning or freezing. Peaches for canning are generally exposed at lower concentrations at higher temperatures, which cooks the surface of the fruit. In the process described by the petitioner, peaches destined for freezing are sprayed with a solution maintained at 190 degrees for a period of 1-3 minutes and run through a scrubber machine that removes the fragments of peels by brushing. The peaches are subsequently rinsed with fresh water, treated with ascorbic acid, pitted, and then sliced or diced. The cut peaches then are run through freezing tunnels where they are rapidly frozen by high volume chilled air. (Page 7).

The potassium-rich wastewater from a KOH lye peeling operation should be returned to the land where it provides an essential nutrient (potassium). This is consistent with a system of sustainable agriculture. (Page 14).

<u>*Do you think NOBS should reconsider the blanket allowance for some of the other uses of KOH? What would be the rationale to accept KOH for lye peeling and continue to prohibit NaOH?*</u> *Potassium hydroxide is the more sustainable alternative. The major difference between KOH and NaOH is the environmental disposal issue. Potassium-rich wastewater from a KOH lye peeling operation can be returned to the land where it provides the essential nutrient potassium and water. The wastewater from a NaOH operation would make the soil saline. KOH costs more than NaOH per pound and more KOH is required (its higher molecular weight). But people use KOH to minimize the environmental effect (and total overall system costs).* (Page 15).

Also included are the MSDS sheets on sodium hydroxide and potassium hydroxide, and a summary page comparing both products side by side. A cost comparison, prepared by Stepan is included, based on last year's tonnage. As forecasted, the cost variance of changing to potassium hydroxide indicates a significant increase.

Potassium Hydroxide

Processing

Executive Summary

Potassium hydroxide was petitioned to the NOSB for a change in the annotation as listed in 7CFR 205.605(b)(27). This currently states that the substance is "prohibited for use in lye peeling of fruits and vegetables." The petitioner requests that this annotation be changed to permit use in the peeling of peaches for use in a process known as individually quick frozen (IQF) product.

The NOSB originally recommended this material be prohibited for this use in 1995. However it is permitted for all other FDA permitted uses, which include as a direct food additive, formulation aid, pH adjuster, cleaning agent, stabilizer, thickener, and poultry scald agent. Original concerns regarding lye peeling included the environmental effects of the waste products, and that mechanical or non-chemical alternatives were available for most fruits and vegetables. The stone fruit (peaches, nectarines, and apricots) do not appear to currently have alternative methods available on a commercial scale to achieve peeling without the use of caustic substances.

The reviewers agree that the substance as used commercially is synthetic, although one points out that it may also be naturally produced and has had historical food use. Two out of three reviewers agree with the petitioner that that this annotation unfairly restricts certain types of operations, and find the environmental affects can be mitigated with the use of good wastewater management practices. The third reviewer finds that the principle of minimizing the use of synthetics should be considered more fundamental than the need for a particular form of a product, and is concerned about lack of international acceptance of this material. This reviewer also believes that prohibitions on products and processes will drive innovation and invention for the development of alternative techniques.

Identification

Chemical Name: potassium hydroxide

Other Names: caustic potash, potash lye, potassa, potassium hydrate, and lye (although this usually refers to sodium hydroxide or a combo of both)

CAS Number: 1310-58-3

Other Codes: INS 525

This TAP review is based on information available as of the date of this review.

Summary of TAP Reviewer Analysis [1]

Synthetic / Non-Synthetic:	Allowed or Prohibited:	Suggested Annotation:
Synthetic (3-0)	*Allow (2)*	Used according to FDA regulations (21CFR 173.315) when used for peeling fruits and vegetables. Rinsing is required to remove residues of the lye peeling agent. A certified wastewater disposal (recycling) plan must be in place.
	Prohibit (1)	n/a

1 *This Technical Advisory Panel (TAP) review is based on the information available as of the date of this review This review addresses the requirements of the Organic Foods Production Act to the best of the investigator's ability, and has been reviewed by experts on the TAP. The substance is evaluated against the criteria found in section 2119(m) of the OFPA [7 USC 6517(m)]. The information and advice presented to the NOSB is based on the technical evaluation against that criteria, and does not incorporate commercial availability, socio-economic impact or other factors that the NOSB and the USDA may want to consider in making decisions.*

Characterization

Composition: KOH

Properties: It is a white, highly deliquescent caustic solid, which is marketed in several forms, including pellets, flakes, sticks, lumps, and powders.

How Made:
Food grade potassium hydroxide is obtained commercially from the electrolysis of potassium chloride solution in the presence of a porous diaphragm [21 CFR 184.1631(a)]. The reaction can be characterized as follows:

$$KCl + H_2O \rightarrow HCl + KOH$$

Generally, KOH is considered a by-product of hydrochloric acid and chlorine manufacturing (Curlin, Bommarju, and Hansson, 1991).

Specific Uses:
Its main uses in food processing include use as a direct food additive, formulation aid, pH adjuster, cleaning agent, stabilizer, thickener, and poultry scald agent. It is used in dairy products, baked goods, cocoa, fruits, vegetables, soft drinks, and poultry. Among the main foods that use KOH are: chicken, cocoa, coloring agents, ice cream, and black olives (Ash and Ash, 1995). The petitioned use is to lye peel peaches to be Individually Quick Frozen (IQF) (Finn, 2001).

Non-food uses include: soap manufacture; electroplating; printing; as a mordant for wood; as a highly reactive source of potassium in a wide variety of industrial chemical syntheses and chemical analyses; in veterinary medicine as a caustic used in disbudding calves horns and in aqueous solution to dissolve scales and hair in skin scrapings; manufacture of cleansers; in wart removal and as a 2.5% solution in glycerol as a cuticle solvent. This type of compound is also used in washing powders, some denture cleaners, some non-phosphate "ecology" detergents, and drain-pipe cleaners (Patnaik, 1992, NTP).

Action: Potassium hydroxide is a strong base and is alkaline in solution. It is highly corrosive. Caustic peeling is based on the differential solubilization of the cell and tissue constituents. Pectic substances in the middle lamella are particularly soluble (Lindsay, 1996).

Combinations: It is in aqueous solution. KOH is used with caramel, annatto, turmeric (Ash and Ash, 1995), and soap. Processors will often combine a number of alkali buffering agents (Lindsay, 1996).

Status

OFPA, NOP Final Rule
The relevant OFPA reference to permit use is 7 USC 6517(c)(1)(A)(ii), which states "substance is necessary to the production and handling of the agricultural product because of unavailability of wholly natural substitute products." Currently listed at 7 CFR 205.605(b)(27) as an allowed non-agricultural (nonorganic) substance allowed as an ingredient in or on processed products labeled as 'organic' or 'made with organic (specified ingredients or food group(s)).' The annotation prohibits use in lye peeling of fruits and vegetables. The NOSB recommended the additional annotation that it also be prohibited for use where non-synthetic sodium carbonate is an acceptable substitute (NOSB, 1995). This annotation was not included in the Final Rule.

Regulatory
FDA lists as GRAS for humans (21 CFR 184.1631), which are allowed under 21CFR 173.315(a)(1) - Chemicals used in washing or to assist in the peeling of fruits and vegetables.

EPA/NIEHS/Other Appropriate Sources
EPA – Potassium hydroxide is considered a category C hazardous substance under the Comprehensive Environmental Response, Conservation, and Liability Act (CERCLA) (40 CFR 302.4). The reportable quantity is 1,000 pounds (40 CFR 117). Food processors that use such compounds may be subject to Toxic Release Inventory reporting requirements explained in US EPA, 1998a.

Envirofacts Master Chemical Integrator (EMCI) - did not maintain information on KOH as of April 25, 2001.

NIEHS - National Toxicology Program (NTP) is attached. The toxicology literature on potassium hydroxide is quite extensive and is summarized below under the OFPA criteria.

Status among U.S. Certifiers

Most have prohibited KOH for use in lye peeling of fruits and vegetables, as per NOSB recommendation. Since 1998 and 1999, it has been allowed by Oregon Tilth and QAI for peeling of peaches used for freezing.

International

CODEX – Allowed for pH adjustment for sugar processing (Annex 2, Table 4, Codex, 1999).
EU 2092/91 – Does *not* appear in Annex VI.
IFOAM – Does *not* appear in Appendix 4 (IFOAM, 2000).
Canada – Does *not* appear in Appendix C, Permitted Substances List for processing.
Japan – Allowed for pH adjustment for sugar processing (Processing Table 1).

OFPA 2119(m) Criteria

(1) *The potential of such substances for detrimental chemical interactions with other materials used in organic farming systems.*
This is being considered as a processing material.

(2) *The toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment.*
See processing criteria 3, below.

(3) *The probability of environmental contamination during manufacture, use, misuse or disposal of such substance.*
This is considered below under item 2.

(4) *The effect of the substance on human health.*
The substance is highly corrosive and can cause severe burns of eyes, skin, and mucous membranes (Cheremishinoff, 2000). Generally, studies and surveys regarding the toxicity of potassium hydroxide are included with studies of sodium hydroxide, and they are collectively known as 'caustics' or 'lye.' Lye poisoning results in numerous deaths annually, generally as accidents involving cleaners. Lyes are particularly penetrating and corrosive with tissue. This is due to the solubilizing reactions with protein, saponification of fats, and dehydration of tissue (Gosselin, Smith, and Hodges, 1984). Further health effects are considered in the context of the effect on nutrition in processing criteria 3, below, as well as the consideration of GRAS and residues in processing criteria 5, below.

(5) *The effects of the substance on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock.*
This is primarily of concern in terms of processing waste management, see item 2 below.

(6) *The alternatives to using the substance in terms of practices or other available materials.*
See discussion of alternatives in processing criteria 7, below.

(7) *Its compatibility with a system of sustainable agriculture.*
This is considered more specifically below in the context of organic handling in processing criteria 6, below.

Criteria from the February 10, 1999 NOSB Meeting

(The TAP review contract indicates these criteria are to be used)
A PROCESSING AID OR ADJUVANT may be used if;

1. *It cannot be produced from a natural source and has no organic ingredients as substitutes.*

A traditional naturally-occurring source of potassium hydroxide was produced by the leaching of wood ashes. The 21 CFR states that it is commercially derived from potassium chloride, and requires that the ingredient meet the specifications of the Food Chemicals Codex [21 CFR 184.1631(a)]. Potassium chloride is natural, but electrolysis renders the product synthetic.

Solutions of some natural acids such as citric and tartaric have been used to peel peaches. This works by disintegrating the peel and requires large volumes of water. It also prevents browning. However, this is not apparently used due to the corrosive effect of the solutions on metal equipment (Woodruff, 1986).

Naturally occurring sodium carbonate, or sodium bicarbonate, may be used as a substitute for lye in some food uses, such as pretzel baking. In pretzel manufacture, dough is passed through an alkaline bath of 0.5% sodium hydroxide or 2% sodium carbonate (Lorenz, 1991). This is done to enhance browning reactions and aid gelatinization of the starch that allows for the characteristic smooth, shiny surface of the pretzel.

The FDA also permits potassium hydroxide to be used as an alkali ingredient in cacao nibs [21 CFR 163.110(b)(1)], chocolate liquor [21 CFR 163.111(b)(1)], and breakfast cocoa [21 CFR 163.112(b)(1)]. However, these uses are all optional and the reference in 21 CFR lists sodium carbonate and bicarbonate as FDA approved alternatives to potassium hydroxide for each of these products.

Lye treatment of olives also uses sodium hydroxide in three to five applications of 0.5-1.5% solution to facilitate oxidation and polymerization of natural phenolic compounds in California-style black olives to form a black pigment. It is also used in the production of California-style ripe green olives and Spanish-style pickled green olive to remove bitterness. In all cases the olives are washed to remove the lye (Pederson, 1988). Alternatives for this use are not identified, although rates can be reduced after longer brining periods.

See number 7 for discussion of alternative processes.

2. *Its manufacture, use, and disposal do not have adverse effects on the environment and are done in a manner compatible with organic handling.*

A lye peeling processing method is of concern to the agroecosystem due to handling of waste from the plant. Large volumes of water are used, which enter the waste stream along with the soluble potassium and alkali ions. Lye peeling with sodium hydroxide is more of a disposal problem due to undesirable sodium content that may be soil applied, whereas residual potassium is a plant nutrient, although it would be considered synthetic and not permitted for an organic farming system.

Peach processing plants using lye peeling are generally restricted by state and local waste water treatment requirements, which has resulted in a limited number of plants and sites in operation (O'Bara, 2001). Data supplied by the petitioner indicates that alkalinity of waste is not a factor, due to the natural acidity of the fruit, which must be additionally buffered during on-site treatment (Finn, 2001). Conventional tomato lye peeling processes may use 9800/liters water /ton of tomatoes peeled. Advances in technology to combine lye peeling with mechanical scrubbers reduced the water consumption (Luh, 1988).

Dry caustic peeling was advocated in the 1970s to substantially reduce the amount of plant wastewater discharged (National Canners Association, 1970). This process uses infrared energy at 1650 degrees to condition the surface of fruit that is treated with stronger sodium hydroxide solutions. The peel is removed mechanically by soft rubber scrubbing rolls rather than by water, so that about 90% of the peel is removed as a thick heavy "peanut butter-like" substance, which must be disposed of (Woodroof, 1986). Caustic peeling continues to he considered more effective at peel removal with substantial reduction in wastewater when compared with conventional peeling (Lindsay, 1996).

Disposal of KOH can be potentially dangerous. Mercury cells are used to produce most of the KOH in the United States (Freilich and Petersen, 1996). The stripped mercury is generally recycled and discharge of mercury is forbidden.

3. *If the nutritional quality of the food is maintained and the material itself or its breakdown products do not have adverse effects on human health as defined by applicable Federal regulations.*

Potassium is an essential mineral nutrient. Lye peeling with sodium hydroxide has been shown to reduce the amount of the Pru p 1 protein in peaches (Brenna, et al., 2000). This is regarded as the major allergen in peaches and therefore may be considered of nutritional benefit. Allergans in rosaceae fruit are associated with the skin (Fernandez-Rivas, 1999). The petitioner has submitted experimental data showing no increase in potassium content of the fruit due to the use of potassium hydroxide. In data from 1998, samples tested after hand peeling had comparable levels of potassium to those that had been through the treatment line (average 665 ppm and 661 ppm respectively). After blanching, the potassium content drops substantially, to 422 ppm.

Peeling methods can effect product nutrient loss, with the less flesh removed the better the nutrient retention. Nutrient loss can also occur from leaching out of water soluble constituents or degrading of heat sensitive compounds. Ascorbic acid and thiamin were reduced by 12% by lye peeling, although carotenoids were not reduced. Fruit that is canned without peeling, for instance, retains more nutrients (Saluhnke, 1990). Mechanical peeling, coring, and slicing has the least effect on nutrients, but is not an option for soft fruits.

Freezing of fruit is not shown to contribute to nutrient loss, whereas canned fruit does lose nutrients (Saluhnke, 1990). Oxygen sensitive nutrients such as vitamin C can decline during storage if the fruit is not properly protected.

Fruit maturity is a key factor in the overall quality and level of nutrients found in fruit. Fruit that is picked earlier for satisfactory texture in freezing may not have as high a content of various nutrients, but other forms of processing such as canning and pureeing, will result in a loss of nutrients as well (Eskin, 1991).

4. *Its primary purpose is not as a preservative or used only to recreate/improve flavors, colors, textures, or nutritive value lost during processing except in the latter case as required by law*

KOH does not serve as a preservative nor does it recreate or improve flavor or color. It does aid in preserving texture in the final product, though this is not strictly a recreation of texture.

5. *Is Generally Recognized as Safe (GRAS) by FDA when used in accordance with Good Manufacturing Practices (GMP), and contains no residues of heavy metals or other contaminants in excess of FDA tolerances.*

Potassium Hydroxide is Generally Recognized As Safe under 21 CFR 184.1631. Federally approved food uses are summarized in Table 1.

Table 1
Approved Food Uses of Potassium Hydroxide

Use	21 CFR†
Acrylate ester copolymer coating	175.210(b)
Chocolate and cocoa *(optional ingredient)*	163
Cacao nibs	163.110(b)(1)
Breakfast cocoa	163.112(b)(1)
Chocolate liquor	163.111(b)(1)
Caramel color	73.85(a)(2)(ii)
Defoaming agents used in the manufacture of paper and paperboard	176.210
Formulation aid	170.3(o)(14)
Paper and paperboard components in contact with dry food.	176.180
pH control agent	170.3(o)(23)
Polyethylene resins, carboxyl modified.	177.1600
Poultry scald	9 CFR 424.21
Processing aid	170.3(o)(24)
Stabilizer and thickener	170.3(o)(28)
Textiles and textile fibers.	177.2800
Washing or peeling of fruits and vegetables	173.315(a)(1)

†Unless otherwise noted.
Sources: EAFUS, 2001; 21 CFR 184.1631 (2000); 9 CFR 424.21

FDA specifies that when used for washing or peeling, potassium hydroxide must be used only in the amount needed, followed by rinsing with potable water to remove, to the extent possible, residues of the chemicals. No limits are placed on food use other than current good manufacturing practices, and the ingredient must meet the specifications of the Food Chmeicals Codex. Potassium hydroxide may also be used as a poultry scald agent in an amount sufficient for the purpose. The processing aid must be removed by subsequent cleaning operations (9 CFR 424.21). Maximum amounts allowed are contained in Table 2.

The Food Chemicals Codex (1996) specifications for KOH are as follows:
Identification A 1 in 25 solution tests positive for potassium.
Assay Not less than 85% and not more than 100.5% of total alkali, calculated as KOH.
Carbonate (as K_2CO_3) Not more than 3.5%.
Heavy Metals (as Pb) Not more than 0.002%.
Insoluble Substances Passes test.
Lead Not more than 10 mg/kg.
Mercury Not more than 0.1 mg/kg.

Table 2
Potassium Hydroxide Limitations Under
Current Good Manufacturing Practices
(As Served)

Product Category	Limit	CFR†
cacao nibs	(b) Optional ingredients. The following safe and suitable ingredients may be used: (1) Alkali ingredients. Ammonium, potassium, or sodium bicarbonate, carbonate, or hydroxide, or magnesium carbonate or oxide, added as such, or in aqueous solution. For each 100 parts by weight of cacao nibs, used as such, or before shelling from the cacao beans, the total quantity of alkali ingredients used is not greater in neutralizing value (calculated from the respective combined weights of the alkali ingredients used) than the neutralizing value of 3 parts by weight of anhydrous potassium carbonate.	163.110(b)(1)
caramel color	consistent with good manufacturing practice.	73.85(a)(2)(ii)
chocolate liquor	Optional ingredients. The following safe and suitable ingredients may be used: Alkali ingredients. Ammonium, potassium, or sodium bicarbonate, carbonate, or hydroxide, or magnesium carbonate or oxide, used as such, or in aqueous solution . . .	163.111(b)(1)
breakfast cocoa	(b) Optional ingredients. The following safe and suitable ingredients may be used: (1) Alkali ingredients. Ammonium, potassium, or sodium bicarbonate, carbonate, or hydroxide, or magnesium carbonate or oxide, used as such, or in aqueous solution;	163.112(b)(1)
poultry scald	Amount sufficient for the purpose. The processing aid must be removed by subsequent cleaning operations	9 CFR 424.21
other uses	Not to exceed current good manufacturing practice.	21 CFR 184.1631(c)

Sources: EAFUS, 2001; CFR, 2000, 2001.
†All CFR references are to Title 21 CFR unless noted otherwise.

6. *Its use is compatible with the principles of organic handling*
The use of a synthetic substance to perform a mechanical function such as peeling can be seen as not consistent with objectives of minimizing synthetic substances in handling of organic food. However, use of this material will allow the availability of an organic product otherwise not available, as hand peeling of peaches will not be viable on a commercial scale. Pureed peach products can be produced without chemical peeling techniques, but canned and frozen peaches cannot.

7. *There is no other way to produce a similar product without its use and it is used in the minimum quantity required to achieve the process.*
Apples and pears may be mechanically or steam peeled, as are carrots, potatoes, and sweet potatoes (Luh, 1988). Tomatoes are mechanically or steam peeled and also commonly lye peeled.

Peaches, nectarines, and apricots used in processing may be peeled by a number of methods. These include hand peeling, use of boiling water or steam, high pressure steam, chemical peeling using lye (sodium or potassium alkalis), dry caustic peeling that uses infrared heat and higher concentrations of lye, by freezing, and using acids (Woodroof, 1986).

Hand peeling uses less water and reduces enzyme effects that cause browning (heat and alkali), and wash water is not contaminated. However, this is offset by high cost and increased opportunity for microbial contamination (Woodroof, 1986). Boiling or steam peeling is used for riper peaches and especially for freestone (melting flesh) varieties. According to Woodroof, it is more suited for peaches for juicing and freezing, which are picked riper than those used for canning. However, the petitioner notes that peaches used for individual quick freezing (IQF) must be picked at a firmer stage in order to peel and then successfully slice or dice them. High pressure steam peeling combines steam with high pressure to create a high internal pressure of the fruit. When pressure is reduced, the skin separates from the softened tissue beneath it. The petitioner conducted studies to evaluate the use of steam under pressure for various time periods, but was unsuccessful in obtaining satisfactory results. A longer duration of steam was needed to remove the peel, which resulted in over softening and destruction of the flesh. The petitioner also conducted experiments that combined steaming and hand peeling (slip skinning) which is used in smaller operations. This procedure also requires a riper peach, was tested on freestones, and did not produce fruit that could be sliced or diced for the freezing tunnel.

Freezer peeling reportedly works on very ripe, melting flesh peaches, using equipment similar to those for steam peeling. The peach is frozen quickly to shallow depth, then thawed rapidly, so the skin is released easily. The fruit is then treated with ascorbic acid to prevent browning.

Lye peeling involves the application or dip of peaches into a heated solution of potassium hydroxide, ranging from 2—7% in strength. The lower rates are used on clingstone (non-melting flesh) varieties. Different rates, temperatures, and time of exposure are used for fruits destined for canning or freezing. Peaches for canning are generally exposed at lower concentrations at higher temperatures, which cooks the surface of the fruit. In the process described by the petitioner, peaches destined for freezing are sprayed with a solution maintained at 190 degrees for a period of 1-3 minutes and run through a scrubber machine that removes the fragments of peels by brushing. The peaches are subsequently rinsed with fresh water, treated with ascorbic acid, pitted, and then sliced or diced. The cut peaches then are run through freezing tunnels where they are rapidly frozen by high volume chilled air.

Enzyme peeling was also attempted by the petitioner, without success.

The alternative to chemical peeling, in the absence of commercially viable hand peeling or mechanical peeling, at the present time appears to having organic peaches limited in availability to the pureed forms.

TAP Reviewer Discussion[2]

Reviewer 1 *[West coast--PhD., Food Science and Nutrition professor with inspection and certification experience]*
Disclaimer: I have the following financial interest or conflict related to the use of this substance: I am conducting research on the acidification of alkali peeled tomatoes by-products in an effort to reduce the solid and liquid waste generated from conventional tomato processing plants.

[Agrees that the database is reasonably complete and accurate]
[Agrees with the OFPA criteria evaluation with the following additional comments]

1. It cannot be produced from a natural source and has no organic ingredients as substitutes
I agree with the criteria evaluation.

2. Its manufacture, use, and disposal do not have adverse effects on the environment and are done in a manner compatible with organic handling as described in section 6513 of the OFPA.
No adverse nutritional consequences of using lye peeling

3. If the nutritional quality of the food is maintained and the material itself or its breakdown produces do not have adverse effects on human health as defined by applicable Federal regulations.
Lye peeling maintains by removing the skin, the visual (sensory) quality of the fruit and also acts to help reduce the rate of polyphenyloxidase enzyme activity that reduces the rate of enzymatic browning of the flesh (a notable loss in quality).

4. Its primary purpose is not as a preservative or used only to recreate/improve flavors, colors, textures, or nutritive value lost during processing except in the latter case as required by law
It has broad FDA approval when used according to GMP's.

5. Is Generally Recognized as Safe (GRAS) by FDA when used in accordance with Good Manufacturing Practices (GMP) and contains no residues of heavy metals or other contaminants in excess of FDA tolerances.
I agree with the criteria evaluation.

6. Its use is compatible with the principles of organic handling.
I agree with the criteria evaluation.

7. There is no other way to produce a similar product without its use and it is used in the minimum quantity required to achieve the process.
I agree with the criteria evaluation.

Conclusion – Summarize why this material should be allowed or prohibited for use in organic systems.
My conclusions for this review will be based solely on the basis of consistency and scientific reasoning. Since both KOH and NaOH are approved ingredients according to the NOSB, this means their addition in food products is permanent. They can be directly incorporated into the product formulation and still are approved. With KOH or NaOH use in lye peeling, both KOH and NaOH are prohibited even when rinsed with clean potable water so no residue remains on the product. Therefore, both KOH and NaOH when used in lye peeling should be viewed as a processing aid not an ingredient. It is very difficult to understand how either KOH or NaOH can be approved as direct ingredient and not as a processing aid. This is logically inconsistent with sound reasoning.

Therefore on the basis of consistency the fact that both KOH and NaOH are washed off from the food matrix (no residue) I will recommend that KOH and NaOH be approved for lye peeling of both fruits and vegetables with the annotation that it be used according to FDA CFR regulations and that there be no residual KOH left

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[2] *OMRI's information is enclosed is square brackets in italics. Where a reviewer corrected a technical point (e.g., the word should be "intravenous" rather than "subcutaneous"), these corrections were made in this document and are not listed here in the Reviewer Comments. The rest of the TAP Reviewer's comments are edited for any identifying comments, redundant statements, and typographical errors. Text removed is identified by ellipses [...]. Additions to the TAP review text were incorporated into the review. Statements expressed by reviewers are their own and do not reflect the opinions of any other individual or organization.*

on the product. Therefore the processor must show that KOH is being used as a processing aid and that resulting fresh water washes or rinses are sufficient to remove KOH (or NaOH) residue.

Recommendation Advised to the NOSB:

a. The substance is: __X__ Synthetic ____ Not Synthetic

b. The substance __X__ Should ____ Should not be added to the National List of Allowed Non-organic Ingredients (includes processing aids).

c. *Annotation suggested, including justification:* Must be used in accordance with FDA CFR and when used for lye peeling, no residue must remain on the fruit.

Additional commentary

This has been a very difficult review as I have been torn 50% for not approving and 50% for approval. However, the major issues that I feel decision making should be built upon is consistency in organic integrity. Every time I ask myself why is KOH approved for direct usage as a food ingredient according to the NOP and not as a process aid where it can be removed from the product, I seem to come up with the same conclusion- that KOH also be approved as a process aid for lye peeling of fruits and vegetables.

Reviewer 2 *[A Midwest based consultant in organic handling and processing with extensive background in organic certification and policy development]*

[Agrees that the database is accurate and complete with the following comments]

Another synonym is potassium hydrate.

[Agrees with the Processing Criteria Evaluation with the following comments]

1. *It cannot be produced from a natural source and has no organic ingredients as substitutes.*
   Leached wood ashes, while capable of saponifying animal fats, cannot give the functionality required of modern industry.

2. *Its manufacture, use, and disposal do not have adverse effects on the environment and are done in a manner compatible with organic handling as described in section 6513 of the OFPA.*
   As an industrial chemical whose manufacture does employ the use of other toxic materials, i.e., mercury cells, by-products of chlorine production, etc., KOH does impact the environment. The mere transportation of these chemicals poses a risk. Note the restrictions placed on facilities using this technology based on waste water requirements. In the textile industry, there is growing concern about the disposal of bleaching products and more and more communities are requiring closed systems for KOH & NaOH bleaching.

   The product itself, being highly caustic and corrosive, requires special handling as a hazardous material. It is arguable that this product and its sister product, NaOH, are the two most hazardous and toxic materials currently allowed as ingredients on the National List. There is an extensive medical database on the corrosive and toxic effects of this substance. The petitioner's argument that the waste matter is not a concern because of the need to actually acidify the effluent is faulty logic. By not allowing use of this product, not only are we reducing the amount of toxic chemical production (KOH) and the toxic waste issues that entails, but we also reduce the amount of such materials as muriatic acid entering into the water supply.

   Although the final rules list both KOH and NaOH as approved, I feel these products do not satisfy the criteria listed above

3. *If the nutritional quality of the food is maintained and the material itself or its breakdown products do not have adverse effects on human health as defined by applicable Federal regulations.*
   I agree with the criteria evaluation.

4. *Its primary purpose is not as a preservative or used only to recreate/improve flavors, colors, textures, or nutritive value lost during processing except in the latter case as required by law*
   I agree with the criteria evaluation.

5. *Is Generally Recognized As Safe (GRAS) by FDA when used in accordance with Good Manufacturing Practices (GMP), and contains no residues of heavy metals or other contaminants in excess of FDA tolerances.*
I agree with the criteria evaluation

6. *Its use is compatible with the principles of organic handling*
I agree with the opinion that the use of KOH, as a toxic, synthetic chemical, is not compatible with organic production principles. While it is true that perhaps this product cannot be produced in any other manner with current technology, I don't believe that has been historically a basic criterion for acceptance in the organic production system. The organic industry has used prohibitions on products and processes to drive innovation and invention to replace the environmentally harmful practices often found on conventional farms and in processing facilities. More on this in § 7.

7. *There is no other way to produce a similar product without its use and it is used in the minimum quantity required to achieve the process.*
If by a similar product, one means other fruits, then, yes there are alternative methods of peeling. But it appears to be also true that to peel peaches for freezing, no other technology offers the economy and effectiveness of lye peeling. In fact, the two other peach processors I found, one in California and one in Michigan, actually use NaOH. But the question of acceptability seems to hinge on the commercial availability of this one product, as produced by one processor, the petitioner. While the petitioner has developed a number of persuasive and accurate arguments to support his case, the fact remains that the process is inherently synthetic.

Additionally, the NOSB has wrestled with the issued posed by the use of these products for years and placed the restriction on lye peeling now noted in the final rule. And although the department (NOP) dropped part of the annotation for the two caustics listed, the restriction prohibiting lye peeling was kept. Allowing this use of KOH will also be seen as inconsistent with the same restriction placed on NaOH and be hard to defend.

One historical perspective – Hirzel Canning successfully defended an OCIA standards change for use of this material for tomato peeling. They claimed KOH was preferable to NaOH and developed a questionable evaporation process for the spent caustic, placing large amounts in solid form on land outside the cannery. Soon after, this use was disallowed by IFOAM upon accreditation of OCIA's program and has not been allowed since.

Other methods of peeling attempted to date (but also found unacceptable) have been the use of liquid nitrogen, oxygen and Freon 12. Liquid oxygen use was dangerous around flammable materials, liquid nitrogen did not work well around unripe portions of the fruit and Freon 12 was unacceptable for obvious environmental concerns (fluorocarbon release.)

Conclusion – Summarize why this material should be allowed or prohibited for use in organic systems.
While it is true that this processor does provide a market for organic IQF peaches and that no one to date has developed a large scale commercial process for peeling peaches without synthetic materials, the material itself and past review history support continuing the restriction on the use of KOH as a lye peeling agent. The rule should not be used to concretize current synthetic processes just so one large conventional processor can take advantage of the market potential for frozen organic peaches. One of the overarching principles of organic processing is the development of new, environmentally sensitive and functionally appropriate technologies to replace the ubiquitous use of food grade *chemicals* in our food supply.

Recommendation Advised to the NOSB:

a. *The substance is:* __X_ Synthetic _____ Not Synthetic

b. *The substance* ____ Should __X__ Should not

be added to the National List of Allowed Non-organic Ingredients (includes processing aids).

c. *Annotation Suggested, including justification:*

None.

Additional Commentary - Response to additional questions:

1. *It appears that canning is not commercially possible without lye peeling also. Do reviewers have knowledge of steam or pressure-steam systems for canning operations as well?*
   I have no additional knowledge about steam or pressure steam systems except as presented in the review and literature. The companies I spoke with and the literature I researched were essentially reprints or duplications of the food science currently published and employed. Very little in new developments for processing fruits and vegetables (except with drying technologies) seems to have occurred in the last 10-15 years.

2. *Much of the fruit processing references used are dated. Please add any newsources or info about discounted alternatives as well as any other new and promising technologies.*
   In my literature search, I could find no newer references than those cited. As the food industry has grown concentrated with fewer and larger companies, there seems to be less incentive to spend large amounts of money on new equipment and processes, when the use of functional materials has been shown to be much cheaper and easier to achieve the desired processing and organoleptic properties.

3. *Is there any new information on enzyme peeling? Does anyone do freezer peeling?*
   I don't know.

4. *Are you familiar with any independent studies that look at either hand-peeling, scalding, infrared treatment, or dry-peeling with sodium carbonate or sodium bicarbonate as alternatives to lye peeling?*
   No.

5. *Are there any designs for mechanical peelers?*
   Only on small scale, as best as I can learn.

6.
7. *The petitioner claims to be the only source of IQF organic peaches. Do you know of any other firms processing organic peaches?*
   JR Woods appears to be correct about their peach processing data. I could only find two other plants processing conventional IQF peaches as noted in §7 and none doing organic.

8. *Do you think NOSB should reconsider the blanket allowance for some of the other uses of KOH? What would be the rationale to accept KOH for lye peeling and continue to prohibit NaOH?*
   I personally feel the use of KOH and NaOH is inappropriate for organic handling operations. Only two certifiers currently allow its use, and neither material appears as approved in either the IFOAM or EU list. There is no rationale for accepting one and not the other, since the differences in use, manufacture, and disposal are a matter of degree, not substance.

Reviewer 3 *[East Coast--Ph.D. in biochemistry with food industry experience]*
[Agrees that the database is accurate and complete with the following comments]

Potassium hydroxide is not an "oxidizer." See 21CFR184.1631.

Comment: Potassium hydroxide in food processing can be used in exceedingly minute amounts such as for pH control or in major amounts that trigger CERCLA reporting requirements. Some applications uniquely require potassium hydroxide whereas any alkali hydroxide can be used for lye peeling. The NOSB should get some 'flavor' for the quantitative and qualitative aspects of potassium hydroxide use in food processing. The supporting information does a fair job of communicating some aspects of this dimension. (Lye essentiality for black olives is clear but the reference describes use of sodium hydroxide not potassium hydroxide.)

[Agrees with the Processing Criteria Evaluation with the following comments and amendments]

1. *It cannot be produced from a natural source and has no organic ingredients as substitutes.*
   White ashes from wood have been used traditionally in America as a source of "lye." Wood ash is a crude form of potassium hydroxide. "Potash" ["pot" + "ash"] is defined in the dictionary as the crude potassium hydroxide obtained from wood ash. A solution formed by passing water through wood ashes may comply with the Food Chemicals Codex requirement of a minimum 85% of total alkali as KOH.

According to an internet document (Lerner, 2000), wood ash is about 25% calcium carbonate and contains about 10% potash (K_2O), 1% phosphate and trace amounts of micronutrients. Calcium hydroxide would not be appreciably soluble in the strongly alkaline lye water.

[The criteria evaluation needs to be corrected or amended as follows:]

The FDA regulation for potassium hydroxide specifically states: "Potassium hydroxide is obtained commercially from the electrolysis of potassium chloride solution" [21CFR184.1631(a)]. I do not read this statement as equivalent to: "21CFR specifies that it be derived from potassium chloride." Another manufacturing process -- commercial or non-commercial -- could provide acceptable material.
The statement controlling identity is 21CFR184.1631(b): "The ingredient meets the specifications of the Food Chemicals Codex:"
"Dutch-process cocoa" is preferably prepared with potassium carbonate or sodium carbonate. 21CFR163 may list several alternatives including potassium hydroxide but the carbonates are most commonly used according to several web pages (Intl Cocoa, Ency. Brittanica).

2. *Its manufacture, use, and disposal do not have adverse effects on the environment and are done in a manner compatible with organic handling as described in section 6513 of the OFPA.*
The documentation provided by the petitioner (and vetted by the local water treatment agency) indicates that this petitioner has an environmentally benign system that results in a potassium-rich, pH-neutral solution being returned to cropland with no negative impact on the local hydrology.

This suggests that a condition upon use of an ingredient such as sodium hydroxide or potassium hydroxide is an appropriate and independently vetted waste treatment plan. However, local and State environmental authorities tightly regulate U.S. food processors of all stripes, so such a condition might pose an additional requirement only for an offshore processor.

[The criteria evaluation needs to be corrected or amended as follows:]

The EPA evaluated dry caustic peeling systems for peaches as a means of reducing water usage about 25 or 30 years ago. The reference and an abstract of this study are given at the end. The critical amendment is that water usage may be more important that alkali disposal in considering the environmental effects of any lye peeling process.

3. *If the nutritional quality of the food is maintained and the material itself or its breakdown products do not have adverse effects on human health as defined by applicable Federal regulations.*
I had not been aware that peeling peaches reduced the allergenicity so effectively.

4. *Its primary purpose is not as a preservative or used only to recreate/improve flavors, colors, textures, or nutritive value lost during processing except in the latter case as required by law*
It is important to delete the "oxidizer" allegation under "Specific Uses."

5. *Is Generally Recognized As Safe (GRAS) by FDA when used in accordance with Good Manufacturing Practices (GMP), and contains no residues of heavy metals or other contaminants in excess of FDA tolerances.*
I agree with the criteria evaluation.

6. *Its use is compatible with the principles of organic handling*
Peach puree is routinely produced from intact peaches without peeling. Suitable equipment exists to remove the peels and pits by mechanical means.

[The criteria evaluation needs to be corrected or amended as follows:]

The OFPA [7 USC 6510(a)(1)] states that a person "shall not . . <u>add</u> any synthetic ingredient during the processing or any post harvest handling of the product." The scientific literature clearly indicates that the action of "lye" is to dissolve a layer of peel, enabling a water rinse to remove the peel. The FDA regulation [21CFR173.315(c)] requires rinsing to remove residues of the lye peeling agent. Thus, the lye peeling agent is not <u>added</u> to the food.

The precedent in organic food processing for direct contact between lye (a synthetic substance) and an organic product being an acceptable practice is the acceptance of the use of sodium hydroxide in pretzel manufacture. In pretzel manufacture, dough is exposed to a lye solution prior to baking to achieve the typical brown glaze of the pretzel. The lye is <u>not</u> rinsed off prior to baking and thus lye is "<u>added</u>" to the food in the sense of 7 USC 6510(a)(1).

The non-synthetic substance sodium carbonate is an acceptable substitute for the synthetic substance sodium hydroxide in pretzel manufacture. Nonetheless, both the NOSB and the NOP saw fit to accept sodium hydroxide for lye treatment of and lye addition to "organic" pretzels.

In the present case, potassium hydroxide is a superior source of lye compared to sodium hydroxide, since the neutralized plant effluent adds an essential plant nutrient rather than saline to the cropland to which it is applied.

7. *There is no other way to produce a similar product without its use and it is used in the minimum quantity required to achieve the process.*
[Additional supporting information or comments.]
Based on the documentation supplied and additional searching in library and on internet, I conclude that peaches for halves or frozen peaches cannot be satisfactorily peeled in a commercial operation except by lye peeling. However, "lye" includes at least four substances, both the hydroxides and the carbonates of sodium and potassium. Sodium carbonate is a non-synthetic substance. It would be desirable for a manufacturer to test sodium carbonate to determine if non-synthetic "lye" would work. However, the saline wastewater disposal problem might make this unfeasible and less consistent with sustainable agriculture.

The economics of supply and disposal of lye force the food processor to use the minimum quantity possible.

The USDA/AMS Grading Manual for Canned Clingstone Peaches [see reference list; pages 1-7 enclosed] indicates that peaches for canning must be properly peeled and discusses only lye peeling as the method to remove the peel.

<u>Conclusion – Summarize why this material should be allowed or prohibited for use in organic systems.</u>
In previous reviews of lye peeling, this reviewer has opposed use of lye peeling of fruits and vegetables, in as much as sodium and potassium hydroxides are synthetic substances and contact between such a substance and an organic food was held to violate the organic integrity of that food. I now have a different view.

The OFPA [7 USC 6517(c)(1)(A)(ii)] permits the use of a synthetic substance in food processing when the "substance is necessary to the production and handling of the agricultural product because of unavailability of wholly natural substitute products."
Based on the documentation supplied and additional searching in library and on the internet, I conclude that peaches for halves or frozen peaches cannot be satisfactorily peeled in a commercial operation except by lye peeling. Thus lye peeling is "necessary to the. . . handling of the agricultural product."

The "wholly natural substitute product" is wood ash, a crude form of potassium hydroxide, which has been traditionally used in lye treatment of food (e.g., hominy - see reference, Mountain Laurel). To my knowledge, wood ash is unavailable in adequate quantity and of sufficient and consistent quality to satisfy the commercial need.

The ultimate question then is whether exposure of an organic food to a lye solution constitutes an irreversible degradation of the organic integrity of the food. Both the NOSB and the NOP answered this question in the negative when they accepted sodium hydroxide for lye treatment of and lye addition to "organic" pretzels.

The precedent in organic food processing for the acceptability of direct contact between lye (a synthetic substance) and an organic product is the allowance of the use of sodium hydroxide in pretzel manufacture. In pretzel manufacture, dough is exposed to a lye solution prior to baking to achieve the typical brown glaze of the pretzel. The lye is <u>not</u> rinsed off prior to baking and thus this lye is "<u>added</u>" to the food in the sense of 7 USC 6510(a)(1). Recall that the OFPA [7 USC 6510(a)(1)] states that a person "shall not . . <u>add</u> any synthetic ingredient during the processing or any post harvest handling of the product."

Using a synthetic 'lye' to make pretzels is a greater threat to organic integrity than using the same lye to peel fruit. The scientific literature clearly indicates that the action of "lye" is to dissolve a layer of peel, enabling a water rinse to remove the peel. The FDA regulation [21CFR173.315(c)] requires rinsing to remove residues of the lye peeling agent. Thus, lye <u>is not added</u> to the peeled fruit. Lye <u>is added</u> to the baked pretzel.

Based on this precedent, peeling peaches with potassium hydroxide should be acceptable.

The potassium-rich wastewater from a KOH lye peeling operation should be returned to the land where it provides an essential nutrient (potassium). This is consistent with a system of sustainable agriculture.

<u>Recommendation Advised to the NOSB:</u>

a. The substance is: _X_ Synthetic _____ Not Synthetic

b. The substance _X_ Should _____ Should not be added to the National List of Allowed Non-organic Ingredients (includes processing aids).

c. Annotation Suggested, including justification:

FDA regulations [21CFR173.315] require rinsing to remove residues of the lye peeling agent. A certified wastewater disposal (recycling) plan must be in place.

<u>Additional Commentary - Response to additional questions:</u>

(1) *It appears that canning is not commercially possible without lye peeling also. Do reviewers have knowledge of steam or pressure-steam systems for canning operations as well?*
Not for peach halves or IQF peaches.

(2) *Much of the fruit processing references used are dated. Please add any newsources or info about discounted alternatives as well as any other new and promising technologies.*
The Del Monte website has a discussion of canned fruit processing that states exactly what the old literature does. See references.

(3) *Is there any new information on enzyme peeling? Does anyone do freezer peeling?*
I do not know.

(4) *Are you familiar with any independent studies that look at either hand-peeling, scalding, infrared treatment, or dry peeling with sodium carbonate or sodium bicarbonate as alternatives to lye peeling?*
Yes; the EPA worked with Del Monte about 30 years ago on dry caustic peeling of peaches. A 1974 report is available. See references.

(5) *Are there any designs for mechanical peelers?*
I do not know.

(6) *There appears to be some data that suggests that lye peeling can reduce pesticide residues in fruit. Is there any data to support this? If so, please provide the citation, preferably with a copy of the study.* Yes. National Food Processors Association documents show reduced pesticide residues after peeling fruit. A sentence in an EPA document [HED DOC. NO. 013584; 21 JULY 1999; page 3] states: "Some processing studies indicate that phosmet residues will be reduced through washing and peeling (peach and apple processing studies), and residues are reduced in processing fruits into juices (apples, grapes)." No reference to the original work is given. I have personal knowledge that peeling fruits reduces pesticide levels (unless the pesticide is a systemic one).

(7) *The petitioner claims to be the only source of IQF organic peaches. Do you know of any other firms processing organic peaches?*
I do not know.

(8) *Do you think NOSB should reconsider the blanket allowance for some of the other uses of KOH? What would be the rationale to accept KOH for lye peeling and continue to prohibit NaOH?*
Potassium hydroxide is the more sustainable alternative. The major difference between KOH and NaOH is the environmental disposal issue. Potassium-rich wastewater from a KOH lye peeling operation can be returned to the land where it provides the essential nutrient potassium and water. The wastewater from a NaOH operation would make the soil saline. KOH costs more than NaOH per pound and more KOH is required (its higher molecular weight). But people use KOH to minimize the environmental effect (and total overall system costs).

<u>Conclusion</u>
Two of the three reviewers find it inconsistent that the NOSB recommendation and USDA final rules permit the use of potassium hydroxide as an ingredient, but not as a processing aid for peeling fruits and vegetables. The environmental impact of the use of caustics in chemical peeling can be mitigated through careful waste water management practices, and the allowance of potassium rather than sodium hydroxides is defensible based on the environmental impact of the waste water. The third reviewer finds that the principle of minimizing the use of synthetics should be considered more fundamental than the need for a particular form of a product, and is concerned about lack of international acceptance. The NOSB needs to consider whether it wants to amend the annotation to permit the use of potassium hydroxide only for peaches or stone fruit where there appear to be no alternatives, or to permit for all fruits and vegetables including tomatoes, apples, pears, and potatoes that are currently peeled using steam or mechanical methods.

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*Note: * = included in packet sent to NOSB*

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_______. 1998b. Title III List of Lists: Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act, as Amended. Washington, DC: EPA Office of Solid Waste and Emergency Response.

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*Woodroof, J. G. NB. S. Luh, 1986. *Commercial Fruit Processing.* Avi Publishing Co., Westport CT.

This TAP review was completed pursuant to United States Department of Agriculture Purchase Order 40-6395-0-2900.

Attachment No. 5

FDA Approval Status
of
Potassium Hydroxide

Caustic Potash
Food and Drug Administration (FDA) Status

OxyChem's caustic potash (potassium hydroxide) meets the test requirements specified in the Food Chemicals Codex (FCC), Sixth Edition, 2008.

OxyChem does not represent or warrant general compliance of this product for food use. Each prospective use of a product in a food or food related application must be carefully assessed against appropriate regulations by the user and it cannot be assumed that products meeting FCC test requirements are satisfactory for all uses without such assessment.

FDA regulations include the following references to caustic potash:

21 CFR 184.1631 Potassium Hydroxide (Caustic Potash, KOH, CAS No. 1310-58-3) is affirmed as "Generally Recognized as Safe (GRAS) as a Direct Human Food Ingredient" when it meets the specifications of the Food Chemicals Codex based upon the following current good manufacturing conditions of use:

The ingredient is used as a formulation aid, pH control agent, a processing aid, or a stabilizer and thickener as defined in 170.3(o).

The ingredient is used in foods at levels not to exceed current good manufacturing practice as defined in 21 CFR 184.1(b).

21 CFR 173.315 Chemicals used in washing or to assist in the lye peeling of fruits and vegetables. (GRAS Referenced)

21 CFR 173.322 Chemicals used in delinting cottonseed. (GRAS Referenced)

21 CFR 173.340	Defoaming Agents (GRAS Referenced)
21 CFR 173.357	Materials used as fixing agents in the immobilization of enzyme preparation (GRAS Referenced)
21 CFR 184.1	Ingredients affirmed as GRAS in this part are also GRAS as indirect human food ingredients, subject to any limitations prescribed in parts 174, 175, 176, 177, 178 or §179.45 of this chapter or in part 186 of this chapter. The purity specifications in this part do not apply when the ingredient is used in indirect applications. However, when used in indirect applications, the ingredient must be of a purity suitable for its intended use in accordance with §170.30(h)(1) of this chapter.

Additional information is available from the Code of Federal Regulations on the FDA's website at HYPERLINK "http://www.fda.gov" www.fda.gov.

Principal Uses and Consumption of Caustic Potash

Caustic potash is one of very few chemicals finding almost universal application. Some of the principal products or processes in which caustic potash is used are

- Dehydrating agent for gases
- Lubricant in the extrusion pressing of high melting alloys
- Scavenger in a gasoline treating process (dual layer) for removing mercaptans
- Methylating agent
- Alkaline builder in detergent formulations
- In refining petroleum fractions
- In removing insulating coatings from wire
- In purifying olefin feedstock containing hydrocarbons prior to polymerization
- In stabilizing synthetic lubricants
- In removing napthenic acids from gas oils
- In fertilizers
- In descaling ferrous metals
- In sweetening sour petroleum fractions
- In a fused alkaline salt mixture used for metal cleaning
- In lye peeling
- In electrolytic stripping baths
- In chemical compounding
- In a molten bath for removing polyesters and polyurethanes from steel objects
- In an absorption cartridge for scavenging carbon dioxide
- Chemical desiccant
- Cleaner for eliminating scale from the surface of metal alloy
- Agent for lowering the sulfur content of coal
- In alkaline batteries
- Catalyst for biodiesel production

Attachment No. 6

Hazardous Substance Literature Review
for
Potassium Hydroxide
(As Registry Number 1310-58-3)

HSDB® - Hazardous Substances Data Bank

POTASSIUM HYDROXIDE

1310-58-3

Section 0 - Administrative Information

Hazardous Substances Databank Number: 1234

Last Revision Date

20050624

Review Date

Reviewed by SRP on 1/31/1999

Update History

Field Update on 2009-04-16, 2 fields added/edited/deleted
Field Update on 2008-08-15, 25 fields added/edited/deleted
Field Update on 2007-02-26, 1 fields added/edited/deleted
Complete Update on 2005-06-24, 1 fields added/edited/deleted
Field Update on 2005-01-27, 2 fields added/edited/deleted
Complete Update on 10/16/2002, 1 field added/edited/deleted.
Complete Update on 07/22/2002, 1 field added/edited/deleted
Complete Update on 02/13/2002, 1 field added/edited/deleted
Complete Update on 01/14/2002, 1 field added/edited/deleted.
Complete Update on 08/09/2001, 1 field added/edited/deleted
Complete Update on 05/16/2001, 1 field added/edited/deleted
Complete Update on 05/15/2001, 1 field added/edited/deleted
Complete Update on 06/12/2000, 1 field added/edited/deleted.
Complete Update on 03/28/2000, 1 field added/edited/deleted
Complete Update on 03/13/2000, 2 fields added/edited/deleted
Complete Update on 02/08/2000, 1 field added/edited/deleted
Complete Update on 11/18/1999, 1 field added/edited/deleted
Complete Update on 08/28/1999, 1 field added/edited/deleted
Complete Update on 07/27/1999, 4 fields added/edited/deleted.
Complete Update on 04/28/1999, 45 fields added/edited/deleted
Field Update on 01/29/1999, 1 field added/edited/deleted.
Field Update on 11/17/1998, 1 field added/edited/deleted
Complete Update on 06/02/1998, 1 field added/edited/deleted.
Complete Update on 03/18/1998, 3 fields added/edited/deleted
Field Update on 02/27/1998, 1 field added/edited/deleted.
Field Update on 10/20/1997, 1 field added/edited/deleted
Complete Update on 03/17/1997, 2 fields added/edited/deleted.
Complete Update on 02/27/1997, 1 field added/edited/deleted
Complete Update on 10/13/1996, 1 field added/edited/deleted.
Complete Update on 09/04/1996, 6 fields added/edited/deleted
Complete Update on 06/06/1996, 1 field added/edited/deleted
Complete Update on 01/21/1996, 1 field added/edited/deleted
Complete Update on 11/10/1995, 1 field added/edited/deleted
Complete Update on 01/24/1995, 1 field added/edited/deleted
Complete Update on 12/22/1994, 1 field added/edited/deleted.
Complete Update on 08/02/1994, 1 field added/edited/deleted
Complete Update on 05/05/1994, 1 field added/edited/deleted
Complete Update on 03/25/1994, 1 field added/edited/deleted.
Complete Update on 08/07/1993, 1 field added/edited/deleted
Field update on 12/19/1992, 1 field added/edited/deleted.
Complete Update on 01/23/1992, 1 field added/edited/deleted
Complete Update on 09/10/1991, 52 fields added/edited/deleted.
Field Update on 05/14/1990, 1 field added/edited/deleted
Field Update on 05/04/1990, 1 field added/edited/deleted.
Field Update on 01/15/1990, 1 field added/edited/deleted.
Complete Update on 01/11/1990, 3 fields added/edited/deleted
Field Update on 05/05/1989, 1 field added/edited/deleted.

Complete Update on 03/08/1988, 2 fields added/edited/deleted

Complete Update on 03/31/1986

Created 19830401 by GCF

Section 1 - Substance Identification

Name of Substance

POTASSIUM HYDROXIDE

CAS Registry Number

1310-58-3

Synonyms

CAUSTIC POTASH **PEER REVIEWED**

HYDROXYDE DE POTASSIUM (FRENCH)
U.S. Department of Health and Human Services, Public Health Service, Center for Disease Control National Institute for Occupational Safety Health Registry of Toxic Effects of Chemical Substances (RTECS) National Library of Medicine's current MEDLARS file, p 82/8201
Peer Reviewed

KALIUMHYDROXID (GERMAN)
U.S Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety Health Registry of Toxic Effects of Chemical Substances (RTECS). National Library of Medicine's current MEDLARS file . p 82/8201
Peer Reviewed

KALIUMHYDROXYDE (DUTCH)
U S. Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety Health Registry of Toxic Effects of Chemical Substances (RTECS). National Library of Medicine's current MEDLARS file., p 82/8201
Peer Reviewed

LYE
U.S Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety Health Registry of Toxic Effects of Chemical Substances (RTECS) National Library of Medicine's current MEDLARS file , p. 82/8201
Peer Reviewed

POTASSA
U.S Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety Health. Registry of Toxic Effects of Chemical Substances (RTECS) National Library of Medicine's current MEDLARS file , p 82/8201
Peer Reviewed

POTASSE CAUSTIQUE (FRENCH)
U.S. Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety Health Registry of Toxic Effects of Chemical Substances (RTECS) National Library of Medicine's current MEDLARS file , p 82/8201
Peer Reviewed

POTASSIO (IDROSSIDO DI) (ITALIAN)
U.S Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety Health Registry of Toxic Effects of Chemical Substances (RTECS) National Library of Medicine's current MEDLARS file., p. 82/8201
Peer Reviewed

POTASSIUM HYDRATE
U.S. Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety Health Registry of Toxic Effects of Chemical Substances (RTECS) National Library of Medicine's current MEDLARS file., p 82/8201
Peer Reviewed

POTASSIUM HYDROXIDE (K(OH)) **PEER REVIEWED**

POTASSIUM (HYDROXYDE DE) (FRENCH)
U.S. Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety Health Registry of Toxic Effects of Chemical Substances (RTECS) National Library of Medicine's current MEDLARS file., p 82/8201
Peer Reviewed

Molecular Formula

H-K-O **PEER REVIEWED**

Shipping Name/Number - DOT/UN/NA/IMO

UN 1813; Potassium hydroxide, dry, solid, flake, bead, or granular

UN 1814, Potassium hydroxide, liq or sol

IMO 8 0; Potassium hydroxide, solution or solid

STCC Number

49 352 25; Potassium hydroxide, dry solid flake, bead, or granular

49 352 30, Potassium hydroxide, liquid or solution

Section 2 - Manufacturing/Use Information

Methods of Manufacturing

Prepared industrially by electrolysis of potassium chloride. Faith, Keyes & Clark's Industrial Chemicals. F A. Lowenheim. M K Moran, Eds (Wiley-Interscience, New York 4th ed , 1975) pp 674-6
Budavari, S. (ed.) The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals Whitehouse Station, NJ. Merck and Co., Inc . 1996 , p. 1315
Peer Reviewed

Impurities

/Potential/ Impurities. sodium oxide, sodium carbonate, sodium chloride, sodium chlorate, ferrous oxide, mercury, sodium sulfate, silicon dioxide, aluminum oxide, calcium oxide, magnesium oxide, manganese, nickel, and copper
CONSIDINE. CHEMICAL AND PROCESS TECHNOL ENCYC 1974 p 229

Peer Reviewed

Formulations/Preparations

Grades. commercial, ground, flake, fused (88-92%). purified by alcohol (sticks, lumps & drops). reagent; highest purity, USP, liquid (45%); Food Chemicals Codex
Lewis, R.J., Sr (Ed.) Hawley's Condensed Chemical Dictionary 12th ed New York, NY Van Nostrand Rheinhold Co 1993, p. 954
Peer Reviewed

Available as 50%-Rayon, 50%-Commercial. 73%-Commercial, and Flake
CONSIDINE. CHEMICAL AND PROCESS TECHNOL ENCYC 1974 p 229
Peer Reviewed

Marketed as dehydrated solid (90-92% potassium hydroxide) and as a liquor (45-50% potassium hydroxide)
CONSIDINE CHEMICAL AND PROCESS TECHNOL ENCYC 1974 p.923
Peer Reviewed

2 Liquid grades sold rayon and commercial
CONSIDINE. CHEMICAL AND PROCESS TECHNOL ENCYC 1974 p 229
Peer Reviewed

POTASSIUM HYDROXIDE .. CONTAINS NOT LESS THAN 85 0% OF TOTAL ALKALI, CALCULATED AS POTASSIUM HYDROXIDE . & INCL NOT MORE THAN 3 5% OF POTASSIUM CARBONATE ..
Osol, A and J E Hoover, et al (eds.) Remington's Pharmaceutical Sciences 15th ed Easton, Pennsylvania Mack Publishing Co., 1975., p. 723
Peer Reviewed

Manufacturers

ASHTA Chemicals Inc., 3509 Middle Road P.O Box 858, Ashtabula, OH (216) 997-5221
SRI. 1997 Directory of Chemical Producers -United States of America Menlo Park, CA: SRI International 1997., p 860
Peer Reviewed

Occidental Chemical Corporation, 5005 LBJ Freeway, Dallas, TX 75244, (214) 404-3800 Basic Chemicals Group, Electrochemicals, Hq Production sites. Delaware City, DE 19706, Mobile, AL 36614; Muscle Shoals. AL 35661
SRI. 1997 Directory of Chemical Producers -United States of America. Menlo Park, CA SRI International 1997 , p 860
Peer Reviewed

Vulcan Materials Co. Hq, PO Box 530390, Birmingham, AL 35253, (205) 877-3000 Vulcan Chemicals Group, PO Box 7689, Birmingham, AL 35253. Production site. Port Edwards, WI 54469
SRI 1997 Directory of Chemical Producers -United States of America Menlo Park CA SRI International 1997., p 860
Peer Reviewed

Other Manufacturing Information

PRESENT COST OF PRODN LIMITS ITS USE AS INTERMEDIATE IN LIQUID FERTILIZERS WHERE ITS HIGH SOLUBILITY PERMITS PRODN OF SUCH GRADES AS 0-25-25 6-18-18, 8-24-8, & 11-11-11.
Farm Chemicals Handbook 1989. Willoughby, OH Meister Publishing Co , 1989 , p. B-49
Peer Reviewed

Production capacities for some plants can vary, as the cells used to make potassium hydroxide can also make caustic soda
CHEMICAL PROFILE: Caustic Potash, 1985
Peer Reviewed

Major Uses

The active ingredient is no longer contained in any registered pesticide products "cancelled"
USEPA/OPP, Status of Pesticides in Registration, Reregistration and Special Review p 325 (Spring, 1998) EPA 738-R-98-002
QC Reviewed

MISCELLANEOUS &/OR GENERAL-PURPOSE FOOD ADDITIVE.
Furia, T E. (ed.). CRC Handbook of Food Additives. 2nd ed Cleveland The Chemical Rubber Co , 1972., p. 925
Peer Reviewed

Electroplating; photoengraving & lithography; printing inks, in analytical chemistry & in org synth, mfr liq soap. pharmaceutical aid (as alkalizing agent): mordant for woods; absorbing carbon dioxide, mercerizing cotton; paint & varnish removers
Budavari, S (ed) The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ Merck and Co., Inc , 1990 , p 1315
Peer Reviewed

Electrolyte in alkaline storage batteries & some fuel cells; absorbent for hydrogen sulfide
Lewis, R.J., Sr (Ed.) Hawley's Condensed Chemical Dictionary. 12th ed. New York, NY Van Nostrand Rheinhold Co., 1993. p 954
Peer Reviewed

Used in petroleum refining.
CHEMCYCLOPEDIA 1986 p.169
Peer Reviewed

Principle uses of KOH include chemicals, particularly the production of potassium carbonate and potassium permanganate. pesticides. fertilizers, and other agricultural products soaps and detergents; scrubbing and cleaning operations, e.g , industrial gases, dyes and colorants, and rubber chemicals
Kirk-Othmer Encyclopedia of Chemical Technology 4th ed. Volumes 1. New York, NY John Wiley and Sons. 1991-Present , p. V19 1084
Peer Reviewed

MEDICATION (VET) **PEER REVIEWED**

Consumption Patterns

29% AS A CHEM INT FOR POTASSIUM CARBONATE, 19% AS A CHEM INT FOR SOAPS; 19% AS A CHEM INT FOR TETRAPOTASSIUM PYROPHOSPHATE, 10% AS A CHEM INT FOR OTHER INORG POTASSIUM CHEMICALS, 8% AS A CHEM INT FOR LIQUID FERTILIZERS, 5% IN MFR OF DYESTUFFS, 4% IN MFR OF HERBICIDES; 6% FOR MISC USES (1975) **PEER REVIEWED**

Potassium Carbonate, 25%, Liquid Fertilizers, 15%; Soap, 10%; Potassium Phosphates, 9%. Synthetic Rubber, 5%. Pesticides, 3%. Potassium Permanganate, 2%. Exports, 5%. Other Chemicals and Misc uses, 26% (1984)
CHEMICAL PROFILE: Caustic Potash, 1984
Peer Reviewed

Potassium carbonate, 25%; potassium phosphates (including TKPP), 10%; liquid fertilizers, 8%. soaps, 7%, potassium chemicals (including potassium silicate, permaganate and cyanide), 30%, miscellaneous (including oil and gas, metal treatment, batteries and water treatment), 18%, exports, 2%.
Kavaler AR; CHEMICAL PROFILE: Caustic potash Chemical Marketing Reporter 231 (20) 50 (1987)
Peer Reviewed

Potassium chemicals (including potassium acetate cyanide, permanganate and silicate), 35%. potassium carbonate 25%. liquid fertilizer, 12%, soaps, 12%, potassium phosphates (including tetrapotassium pyrophosphate), 7%, miscellaneous, 9%
Kavaler AR; Chemical Profile: Caustic Potash Chemical Marketing Reporter, Jan 22, 1996
Peer Reviewed

U.S Production

(1972) 1.54X10+11 GRAMS "PEER REVIEWED"

(1975) 1.91X10+11 GRAMS "PEER REVIEWED"

(1984) 2.25X10+11 G /88 to 92% POTASSIUM HYDROXIDE - LIQUID/
BUREAU OF THE CENSUS CURRENT INDUSTRIAL REPORTS INORGANIC CHEMICALS 1984 p 2
Peer Reviewed

Demand: 1986: 245,000 tons, 1987: 250,000 tons; 1991 /projected/ 270,000 tons. (Includes imports, 16,000 tons were imported in 1986.)
Kavaler AR: CHEMICAL PROFILE. Caustic potash. Chemical Marketing Reporter 231 (20): 50 (1987)
Peer Reviewed

Production capacity estimate as of 4/1/97: 532 thousand short tons
SRI 1997 Directory of Chemical Producers -United States of America Menlo Park, CA. SRI International 1997 , p 860
Peer Reviewed

Demand, 1995 440,000 tons; 1996 450,000 tons (includes exports which were 60,000 tons in 1994, but not imports, which were 55,000 tons).
Kavaler AR, Chemical Profile: Caustic Potash Chemical Marketing Reporter, Jan 22, 1996
Peer Reviewed

U.S Imports

(1972) 1.45X10+9 GRAMS "PEER REVIEWED"

(1975) 6.53X10+9 GRAMS "PEER REVIEWED"

(1984) 1.60X10+10 g
BUREAU OF THE CENSUS U.S IMPORTS FOR CONSUMPTION AND GENERAL IMPORTS 1984 p 1-350
Peer Reviewed

(1994) 55,000 tons
Kavaler AR, Chemical Profile. Caustic Potash. Chemical Marketing Reporter Jan 22, 1996
Peer Reviewed

U.S. Exports

(1972) 6.36X10+9 GRAMS "PEER REVIEWED"

(1975) 8.35X10+9 GRAMS "PEER REVIEWED"

(1984) 8.99X10+9 g
BUREAU OF THE CENSUS U.S. EXPORTS. SCHEDULE E. 1984 p 2-02
Peer Reviewed

(1994) 60,000 tons
Kavaler AR, Chemical Profile: Caustic Potash. Chemical Marketing Reporter, Jan. 22, 1996
Peer Reviewed

Section 3 - Chemical and Physical Properties

Color/Form

White or slightly yellow lumps, rods, pellets
Budavari, S. (ed.) The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals Whitehouse Station, NJ Merck and Co , Inc , 1996., p 1315
Peer Reviewed

White rhombic crystals
Lide, D.R (ed) CRC Handbook of Chemistry and Physics 76th ed, Boca Raton, FL CRC Press Inc 1995-1996 , p 4-78
Peer Reviewed

Odor

Odorless
NIOSH NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No 94-116 Washington, D C U S Government Printing Office, June 1994 , p 262
Peer Reviewed

Boiling Point

1327 deg C
Lide, D R (ed.) CRC Handbook of Chemistry and Physics 76th ed Boca Raton, FL CRC Press Inc , 1995-1996 , p. 4-78
Peer Reviewed

Melting Point

380 deg C
Budavari, S. (ed.) The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals Whitehouse Station, NJ Merck and Co , Inc , 1996., p. 1315
Peer Reviewed

Molecular Weight

56 11
Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co. Inc , 1996 , p 1315
Peer Reviewed

Density/Specific Gravity

2 044 g/cu cm
Lide, D R. (ed). CRC Handbook of Chemistry and Physics 76th ed Boca Raton, FL: CRC Press Inc , 1995-1996 , p 4-78
Peer Reviewed

pH

13 5 (0.1 Molar aq soln)
Budavari, S (ed.) The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc , 1996., p 1315

Peer Reviewed

Solubilities

INSOL IN ETHER, AMMONIA
Weast, R C (ed) Handbook of Chemistry and Physics 69th ed. Boca Raton, FL CRC Press Inc , 1988-1989., p B-118
Peer Reviewed

100 g/375 ml ethanol @ 25 deg C
Clayton, G D. and F. E Clayton (eds.). Patty's Industrial Hygiene and Toxicology Volume 2A, 2B, 2C. Toxicology 3rd ed New York John Wiley Sons, 1981-1982 , p 3055
Peer Reviewed

Sol in 0 9 part water, about 0 6 part boiling water, 3 parts alcohol, 2.5 parts glycerol.
Budavari S (ed.) The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ Merck and Co , Inc 1996 , p 1315
Peer Reviewed

Solubility in water (g KOH/100 g H2O): 97 at 0 deg C, 103 @ 10 deg C, 112 @ 20 deg C, 126 @ 30 deg C, 178 @ 100 deg C
Gerhartz, W. (exec ed). Ullmann's Encyclopedia of Industrial Chemistry. 5th ed Vol A1 Deerfield Beach, FL VCH Publishers. 1985 to Present., p VA22 94
Peer Reviewed

Vapor Pressure

1 MM HG @ 714 DEG C
Sax, N.I Dangerous Properties of Industrial Materials 6th ed New York, NY Van Nostrand Reinhold, 1984 , p. 1047
Peer Reviewed

Other Chemical/Physical Properties

When dissolved in water or alcohol or when the soln is treated with acid much heat is generated
Budavari, S (ed.) The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals Whitehouse Station, NJ Merck and Co Inc , 1996 , p 1315
Peer Reviewed

HARD & BRITTLE & SHOWS CRYSTALLINE FRACTURE; STRONGLY ALKALINE
Osol, A. and J.E Hoover, et al. (eds). Remington's Pharmaceutical Sciences 15th ed Easton, Pennsylvania. Mack Publishing Co., 1975 , p 724
Peer Reviewed

Readily absorbs moisture & carbon dioxide from air & deliquesces
Budavari, S (ed.) The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals Whitehouse Station, NJ Merck and Co., Inc , 1996 , p 1315
Peer Reviewed

Melting point: 406 deg C
Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics 76th ed. Boca Raton, FL: CRC Press Inc., 1995-1996., p 4-78
Peer Reviewed

Heat of solution: 53 51 kJ/mol (in water)
Gerhartz, W (exec ed.) Ullmann's Encyclopedia of Industrial Chemistry 5th ed Vol A1 Deerfield Beach FL VCH Publishers 1985 to Present., p VA22 94
Peer Reviewed

Heat of fusion: 7.5 kJ/mol
Gerhartz, W. (exec ed) Ullmann's Encyclopedia of Industrial Chemistry 5th ed.Vol A1. Deerfield Beach, FL. VCH Publishers, 1985 to Present., p VA22 94
Peer Reviewed

Density (g/cu cm) of aqueous solutions: 10 wt % 1 092, 20 wt % 1 188; 30 wt %: 1 291, 40 wt % 1.395; 50 wt %: 1 514
Gerhartz, W (exec ed) Ullmann's Encyclopedia of Industrial Chemistry 5th ed Vol A1 Deerfield Beach FL: VCH Publishers, 1985 to Present. p VA22 94
Peer Reviewed

Melting point ca 250 deg C. Heat of fusion ca 6 7 kJ/mol /Technical caustic potash (90-92% KOH)/
Gerhartz, W (exec ed). Ullmann's Encyclopedia of Industrial Chemistry 5th ed Vol A1 Deerfield Beach, FL. VCH Publishers, 1985 to Present., p VA22 94
Peer Reviewed

Section 4 - Safety and Handling

DOT Emergency Guidelines

/GUIDE 154 SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE)/ Health: TOXIC, inhalation, ingestion, or skin contact with material may cause severe injury or death Contact with molten substance may cause severe burns to skin and eyes Avoid any skin contact Effects of contact or inhalation may be delayed Fire may produce irritating, corrosive and/or toxic gases Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution /Potassium hydroxide, dry, solid; Potassium hydroxide, flake, Potassium hydroxide, solid, Potassium hydroxide, solution/

U.S. Department of Transportation. 2004 Emergency Response Guidebook . A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D C 2004
QC Reviewed

/GUIDE 154. SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE)/ Fire or Explosion Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Some are oxidizers and may ignite combustibles (wood, paper, oil, clothing, etc). Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated /Potassium hydroxide, dry, solid; Potassium hydroxide, flake; Potassium hydroxide, solid, Potassium hydroxide, solution/

U.S. Department of Transportation. 2004 Emergency Response Guidebook . A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D C 2004
QC Reviewed

/GUIDE 154 SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE)/ Public Safety CALL Emergency Response Telephone Number . As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids Keep unauthorized personnel away Stay upwind. Keep out of low areas. Ventilate enclosed areas /Potassium hydroxide, dry, solid, Potassium hydroxide, flake, Potassium hydroxide, solid, Potassium hydroxide, solution/

U S. Department of Transportation 2004 Emergency Response Guidebook . A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C 2004
QC Reviewed

/GUIDE 154 SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE)/ Protective Clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible /Potassium hydroxide, dry, solid; Potassium hydroxide, flake; Potassium hydroxide, solid; Potassium hydroxide, solution/

U.S Department of Transportation. 2004 Emergency Response Guidebook . A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D C. 2004
QC Reviewed

/GUIDE 154. SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE)/ Evacuation. .. Fire. If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions: also, consider initial evacuation for 800 meters (1/2 mile) in all directions /Potassium hydroxide, dry, solid; Potassium hydroxide, flake; Potassium hydroxide, solid; Potassium hydroxide, solution/

U S Department of Transportation 2004 Emergency Response Guidebook . A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D C 2004
QC Reviewed

/GUIDE 154. SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE)/ Fire. Small fires: Dry chemical, CO2 or water spray. Large fires: Dry chemical, CO2, alcohol-resistant foam or water spray. Move containers from fire area if you can do it without risk. Dike fire control water for later disposal, do not scatter the material. Fire involving tanks or car/trailer loads: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. /Potassium hydroxide, dry, solid; Potassium hydroxide, flake; Potassium hydroxide, solid; Potassium hydroxide, solution/

U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004
QC Reviewed

/GUIDE 154: SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE)/ Spill or Leak. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. DO NOT GET WATER INSIDE CONTAINERS. /Potassium hydroxide, dry, solid; Potassium hydroxide, flake; Potassium hydroxide, solid; Potassium hydroxide, solution/

U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004
QC Reviewed

/GUIDE 154: SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE)/ First Aid. Move victim to fresh air. Call 911 or emergency medical service. Give artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. For minor skin contact, avoid spreading material on unaffected skin. Keep victim warm and quiet. Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. /Potassium hydroxide, dry, solid; Potassium hydroxide, flake; Potassium hydroxide, solid; Potassium hydroxide, solution/

U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004
QC Reviewed

Fire Potential

WHEN WET, ATTACKS METALS SUCH AS ALUMINUM, TIN, LEAD & ZINC TO PRODUCE FLAMMABLE HYDROGEN GAS.
U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.
Peer Reviewed

NFPA Hazard Classification

Health: 3. 3= Materials that, on short exposure, could cause serious temporary or residual injury, including those requiring protection from all bodily contact. Fire fighters may enter the area only if they are protected from all contact with the material. Full protective clothing, including self-contained breathing apparatus, coat, pants, gloves, boots and bands around legs, arms, and waist, should be provided. No skin surface should be exposed.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 49-110
Peer Reviewed

Flammability: 0. 0= This degree includes any material that will not burn.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 49-110
Peer Reviewed

Reactivity: 1. 1= This degree includes materials that are normally stable, but may become unstable at elevated temperatures and pressures and materials that will react with water with some release of energy, but not violently. Fires involving these materials should be approached with caution.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 49-110
Peer Reviewed

Fire Fighting Procedures

Extinguish fire using agent suitable for type of surrounding fire. Use water spray to keep fire-exposed containers cool. Use flooding quantities of water.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 49-110
Peer Reviewed

Reactivities and Incompatibilities

Acids, water, metals (when wet), halogenated hydrocarbons, maleic anhydride. [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 262]
Note: Heat is generated if KOH comes in contact with water & carbon dioxide from the air.
QC Reviewed

Above 84 deg C it reacts with reducing sugars to form poisonous carbon monoxide gas. Violent, exothermic reaction with water. Potentially explosive reaction with bromoform + crown ethers, chlorine dioxide, nitrobenzene, nitromethane, nitrogen trichloride, peroxidized tetrahydrofuran, 2,4,6-trinitrotoluene. Reaction with ammonium hexachloroplatinate(2-) + heat forms a heat-sensitive explosive product. Violent reaction or ignition under the appropriate conditions with acids, alcohols, p-bis(1,3-dibromoethyl)benzene, cyclopentadiene, germanium, hyponitrous acid, maleic anhydride, nitroalkanes, 2-nitrophenol, potassium peroxodisulfate, sugars, 2,2,3,3-tetrafluoropropanol, thorium dicarbide.
Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 2764
Peer Reviewed

MOLTEN ORTHO NITROPHENOL REACTS VIOLENTLY WITH POTASSIUM HYDROXIDE (COMMERCIAL 85% PELLETS). WHEN POTASSIUM HYDROXIDE & TETRACHLOROETHANE ARE HEATED, A SPONTANEOUSLY FLAMMABLE GAS, CHLOROACETYLENE, IS FORMED.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 491-160
Peer Reviewed

1,2-DICHLOROETHYLENE & POTASSIUM HYDROXIDE REACTION PRODUCES CHLOROACETYLENE, WHICH IS SPONTANEOUSLY FLAMMABLE IN AIR.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 491-160
Peer Reviewed

WHEN PHOSPHORUS IS BOILED WITH SOLN OF . . POTASSIUM HYDROXIDE, PHOSPHINE GAS IS EVOLVED WHICH IS SPONTANEOUSLY FLAMMABLE.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 491-148
Peer Reviewed

POTASSIUM PERSULFATE PLUS A LITTLE POTASSIUM HYDROXIDE & WATER IGNITED A POLYTHENE (POLYETHYLENE) LINER OF A CONTAINER BY SIMULTANEOUS RELEASE OF HEAT & OXYGEN.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 491-163
Peer Reviewed

A PIECE OF POTASSIUM HYDROXIDE CAUSES LIQUID CHLORINE DIOXIDE TO EXPLODE. A REACTION BETWEEN N-NITROSOMETHYLUREA & POTASSIUM HYDROXIDE IN N-BUTYL ETHER RESULTED IN AN EXPLOSION DUE TO FORMATION OF DIAZOMETHANE.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 491-160
Peer Reviewed

WHEN MOIST CHLORINE WAS PASSED OVER CALCIUM CARBIDE & POTASSIUM HYDROXIDE, A SOLN OF 58% DICHLORACETYLENE WAS COLLECTED IN ETHER. SOLN BURNED SPONTANEOUSLY & FILLED LAB WITH PHOSGENE. WHEN HEAD ... REMOVED FROM STEEL BOMB USED FOR 1 OF EXPT CONTACT WITH AIR CAUSED AN EXPLOSION.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 491-71
Peer Reviewed

1,2-DICHLOROETHYLENE & POTASSIUM HYDROXIDE REACTION PRODUCES CHLOROACETYLENE, WHICH IS EXPLOSIVE.
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 491-160

Peer Reviewed

ALKALI & OTHER ALKALINE EARTH CMPD SUCH AS POTASSIUM .. WILL CAUSE EXPLOSIVE DECOMP OF MALEIC ANHYDRIDE
Fire Protection Guide to Hazardous Materials 12 ed. Quincy, MA National Fire Protection Association, 1997., p. 491-180
Peer Reviewed

DIAZOMETHANE WAS BEING PREPD BY PORTION-WISE ADDN OF N-METHYL-N-NITROSO UREA TO A FLASK CONTAINING 40% POTASSIUM HYDROXIDE & METHYLENE CHLORIDE. AT THE 4TH ADDN A LOUD DETONATION OCCURRED.
Fire Protection Guide to Hazardous Materials 12 ed Quincy, MA. National Fire Protection Association. 1997 p 491-121
Peer Reviewed

THE NITROPARAFFINS /SUCH AS NITROETHANE, NITROMETHANE OR NITROPROPANE/, IN PRESENCE OF WATER, FORM SALTS WITH INORGANIC BASES THE DRY SALTS ARE EXPLOSIVE.
Fire Protection Guide to Hazardous Materials 12 ed Quincy, MA National Fire Protection Association, 1997 , p 491-41
Peer Reviewed

NITROGEN TRICHLORIDE EXPLODES ON CONTACT WITH CONCN POTASSIUM HYDROXIDE
Fire Protection Guide to Hazardous Materials. 12 ed Quincy, MA National Fire Protection Association, 1997 p 491-130
Peer Reviewed

USING POTASSIUM HYDROXIDE TO DRY IMPURE TETRAHYDROFURAN, WHICH CAN CONTAIN PEROXIDES, IS HAZARDOUS SERIOUS EXPLOSIONS CAN OCCUR
Fire Protection Guide to Hazardous Materials 12 ed Quincy, MA National Fire Protection Association, 1997 , p 491-194
Peer Reviewed

WHEN HEATED, TRICHLOROETHYLENE & . POTASSIUM HYDROXIDE FORM EXPLOSIVE MIXT OF DICHLOROACETYLENE.
Fire Protection Guide to Hazardous Materials 12 ed Quincy, MA: National Fire Protection Association, 1997., p 491-180
Peer Reviewed

Decomposition

When heated to decomposition it emits toxic fumes of K2O.
Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed Volumes 1-3 New York, NY Van Nostrand Reinhold, 1996 , p 2784
Peer Reviewed

Skin, Eye, and Respiratory Irritations

DUST OR MIST /IS/ IRRITATING TO EYES, NOSE & THROAT
U.S. Coast Guard, Department of Transportation CHRIS - Hazardous Chemical Data Volume II Washington, D C U S. Government Printing Office, 1984-5
Peer Reviewed

Protective Equipment and Clothing

WATER BUBBLER EYE FOUNTAINS & SHOWERS MUST BE AVAILABLE WHERE SKIN OR EYE CONTACT WITH ALKALIES IS POSSIBLE TIGHT-FITTING GOGGLES, RUBBER APRONS & RUBBER GLOVES MUST BE WORN WHEN HANDLING ALKALIES IN CONCENTRATED SOLN EMPLOYEES MUST BE DRILLED IN CONSTANT USE OF SAFETY EQUIPMENT
International Labour Office. Encyclopedia of Occupational Health and Safety Vols I&II Geneva, Switzerland: International Labour Office, 1983., p 202
Peer Reviewed

WORKERS EXPOSED TO DUSTS OR MISTS SHOULD WEAR APPROPRIATE RESP PROTECTIVE EQUIPMENT WORKERS WHO MUST ENTER PLACES IN WHICH HIGH OR UNKNOWN CONCN OF POTASSIUM HYDROXIDE MIST OR DUST MAY BE PRESENT SHOULD WEAR SAFETY BELT & LIFELINE WITH ATTENDANT POSTED TO HELP IN CASE OF EMERGENCY
International Labour Office. Encyclopedia of Occupational Health and Safety Vols I&II Geneva, Switzerland International Labour Office, 1983., p 78
Peer Reviewed

Wear appropriate personal protective clothing to prevent skin contact
NIOSH NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No 97-140 Washington, D C U.S Government Printing Office. 1997., p. 263
QC Reviewed

Wear appropriate eye protection to prevent eye contact
NIOSH NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U S. Government Printing Office, 1997 , p 263
QC Reviewed

Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance, this is irrespective of the recommendation involving the wearing of eye protection.
NIOSH NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140 Washington, D C U.S Government Printing Office, 1997 , p 263
QC Reviewed

Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure [NIOSH. NIOSH Pocket Guide to Chemical Hazards DHHS (NIOSH) Publication No 97-140 Washington, D.C U S Government Printing Office, 1997 , p. 263]
Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate
QC Reviewed

Other Preventative Measures

EXERCISE GREAT CARE IN HANDLING POTASSIUM HYDROXIDE, AS IT RAPIDLY DESTROYS TISSUE. DO NOT HANDLE WITH BARE HAND
Osol, A. and J E Hoover, et al. (eds.). Remington's Pharmaceutical Sciences. 15th ed Easton, Pennsylvania, Mack Publishing Co 1975 , p 723
Peer Reviewed

SRP The scientific literature for the use of contact lenses in industry is conflicting The benefit or detrimental effects of wearing contact lenses depend not only upon the substance, but also on factors including the form of the substance, characteristics and duration of the exposure, the uses of other eye protection equipment, and the hygiene of the lenses. However, there may be individual substances whose irritating or corrosive properties are such that the wearing of contact lenses would be harmful to the eye In those specific cases, contact lenses should not be worn In any event, the usual eye protection equipment should be worn even when contact lenses are in place **PEER REVIEWED**

Causes and emergency treatment of chemical eye injuries were described. Alkali injuries have resulted from splashes with potassium hydroxide. Emergency care calls for copious irrigation of the external eye, keeping the eye open as much as possible during this process. A portable eye wash system should be available which will provide a continuous flushing of the eye during transport to an emergency care facility The pH of the eye must return to normal before stopping the irrigation process.
Burns FR; Paterson CA, Occupational Health and Safety 58 (4) 33-6 (1989)
Peer Reviewed

The worker should immediately wash the skin when it becomes contaminated.
NIOSH NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No 97-140 Washington, D.C U S Government Printing Office. 1997., p 263
QC Reviewed

Work clothing that becomes wet or significantly contaminated should be removed and replaced
NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U S Government Printing Office, 1997 , p. 263
QC Reviewed

Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises
NIOSH NIOSH Pocket Guide to Chemical Hazards DHHS (NIOSH) Publication No 97-140 Washington, D C U.S. Government Printing Office, 1997 , p 263
QC Reviewed

Shipment Methods and Regulations

No person may /transport,/ offer or accept a hazardous material for transportation in commerce unless that person is registered in conformance and the hazardous material is properly classed, described, packaged, marked, labeled, and in condition for shipment as required or authorized by . /the hazardous materials regulations (49 CFR 171-177)/
49 CFR 171.2 (7/1/96)
Peer Reviewed

The International Air Transport Association (IATA) Dangerous Goods Regulations are published by the IATA Dangerous Goods Board pursuant to IATA Resolutions 618 and 619 and constitute a manual of industry carrier regulations to be followed by all IATA Member airlines when transporting hazardous materials
IATA. Dangerous Goods Regulations 38th ed. Montreal, Canada and Geneva, Switzerland: International Air Transport Association, Dangerous Goods Board, January, 1997 , p 201
Peer Reviewed

The International Maritime Dangerous Goods Code lays down basic principles for transporting hazardous chemicals Detailed recommendations for individual substances and a number of recommendations for good practice are included in the classes dealing with such substances. A general index of technical names has also been compiled This index should always be consulted when attempting to locate the appropriate procedures to be used when shipping any substance or article
IMDG, International Maritime Dangerous Goods Code, International Maritime Organization p.8204 (1988)
Peer Reviewed

Storage Conditions

POTASSIUM HYDROXIDE SHOULD BE STORED IN COOL, VENTILATED PLACE & KEPT DRY CONTAINERS SHOULD BE KEPT CLOSED & PLAINLY LABELLED
International Labour Office Encyclopedia of Occupational Health and Safety. Volumes I and II. New York. McGraw-Hill Book Co , 1971., p. 78
Peer Reviewed

Store in a cool, dry, well-ventilated location. Separate from water, acids, and metals
Fire Protection Guide to Hazardous Materials 12 ed. Quincy, MA. National Fire Protection Association, 1997 , p 49-110
Peer Reviewed

Cleanup Methods

SPILLED MATERIAL SHOULD BE FLUSHED AWAY QUICKLY & NEVER BE LEFT UNATTENDED IF MATERIAL IS SOLID, IT CAN BE SHOVELED AWAY & ANY REMAINING TRACES NEUTRALIZED WITH DILUTE ACETIC ACID
International Labour Office. Encyclopedia of Occupational Health and Safety. Volumes I and II. New York McGraw-Hill Book Co., 1971 , p 78
Peer Reviewed

Keep water away from release Prompt cleanup and removal are necessary Control runoff and isolate discharged material for proper disposal
Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA. National Fire Protection Association, 1997 , p. 110
Peer Reviewed

Disposal Methods

SRP: At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance on acceptable disposal practices. **PEER REVIEWED**

Neutralization & discharge to sewer: Carefully dissolve in water and neutralize with dilute acetic acid Flush to sewer with lots of water, regulations permitting or dispose of through a licensed contractor. Consider use of waste caustic for neutralizing plant acid wastes
United Nations. Treatment and Disposal Methods for Waste Chemicals (IRPTC File) Data Profile Series No 5 Geneva, Switzerland. United Nations Environmental Programme, Dec. 1985., p 266
Peer Reviewed

Section 5 - Toxicity/Biomedical Effects

Antidote and Emergency Treatment

Basic treatment. Establish a patent airway Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if necessary Administer oxygen by nonrebreather mask at 6 to 12 L/min Monitor for pulmonary edema and treat if necessary . Monitor for shock and treat if necessary . . For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport Do not use emetics For ingestion, rinse mouth and administer 5 mL/kg up to 200 mL of water for dilution if the patient can swallow, has a strong gag reflex and does not drool . . Do not attempt to neutralize. Cover skin burns with dry sterile dressings after decontamination . . /Inorganic bases/alkaline corrosives and related cmpds/
Bronstein, A.C , P.L. Currance; Emergency Care for Hazardous Materials Exposure. 2nd ed St. Louis, MO Mosby Lifeline 1994 , p 165
Peer Reviewed

Advanced treatment. Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or in respiratory arrest. Early intubation, at the first signs of upper airway obstruction, may be necessary Positive-pressure ventilation techniques with a bag-valve-mask device may be beneficial. Monitor cardiac rhythm and treat arrhythmias as necessary . . Start an IV of D5W TKO /SRP: "To keep open", minimal flow rate/ Use lactated Ringer's if signs of hypovolemia are present. Watch for signs of pulmonary edema For hypotension with signs of hypovolemia, administer fluid cautiously Watch for signs of fluid overload Consider drug therapy for pulmonary edema . . Use proparacaine hydrochloride to assist eye irrigation . . /Inorganic bases/alkaline corrosives and related cmpds/
Bronstein, A C , P.L. Currance, Emergency Care for Hazardous Materials Exposure 2nd ed. St. Louis, MO Mosby Lifeline 1994., p 166
Peer Reviewed

Human Toxicity Excerpts

ACUTE POISONING: . . INGESTION OF ALKALI IS FOLLOWED BY SEVERE PAIN, VOMITING, DIARRHEA, & COLLAPSE. THE VOMITUS CONTAINS BLOOD AND DESQUAMATED MUCOSAL LINING. IF DEATH DOES NOT OCCUR IN THE FIRST 24 HOURS, THE PATIENT MAY IMPROVE FOR 2-4 DAYS AND THEN HAVE A SUDDEN ONSET OF SEVERE ABDOMINAL PAIN, BOARDLIKE ABDOMINAL RIGIDITY, AND RAPID FALL OF BLOOD PRESSURE INDICATING DELAYED GASTRIC OR ESOPHAGEAL PERFORATION. . ESOPHAGEAL STRICTURE CAN OCCUR WEEKS, MONTHS, OR EVEN YEARS LATER TO MAKE SWALLOWING DIFFICULT CARCINOMA IS A RISK IN LATER LIFE. /ALKALIES/
Dreisbach, R.H. Handbook of Poisoning. 12th ed Norwalk, CT Appleton and Lange, 1987., p 211
Peer Reviewed

ACUTE POISONING. .. ALKALIES PENETRATE SKIN SLOWLY EXTENT OF DAMAGE DEPENDS ON DURATION OF CONTACT. CHRONIC POISONING. (FROM SKIN CONTACT) A CHRONIC DERMATITIS MAY FOLLOW REPEATED CONTACT WITH ALKALIES /ALKALIES/
Dreisbach, R.H. Handbook of Poisoning. 12th ed Norwalk, CT Appleton and Lange, 1987., p 211
Peer Reviewed

INGESTION MAY PRODUCE VIOLENT PAIN IN THROAT AND EPIGASTRIUM, HEMATEMESIS, COLLAPSE. IF NOT IMMEDIATELY FATAL, STRICTURE OF ESOPHAGUS MAY DEVELOP
Budavari, S. (ed) The Merck Index - Encyclopedia of Chemicals, Drugs and Biologicals. Rahway, NJ: Merck and Co., Inc., 1989 , p 1215
Peer Reviewed

EYE CONTACT WITH CONCENTRATED ALKALI CAUSES CONJUNCTIVAL EDEMA & CORNEAL DESTRUCTION /ALKALIES/
Dreisbach, R.H. Handbook of Poisoning. 12th ed, Norwalk, CT Appleton and Lange, 1987 , p 212
Peer Reviewed

/ALKALIES, SUCH AS POTASSIUM HYDROXIDE/ CAN GELATINIZE TISSUE BY SAPONIFICATION OF LIPID AND LOCAL DEHYDRATION TO SOLUBILIZE PROTEINS AND COLLAGEN WHICH MAY RESULT IN DEEP AND PAINFUL LESIONS ("LIQUEFACTION NECROSIS"). EXPOSURE TO DUST OR MIST MAY CAUSE IRRITATION OF EYES & RESP TRACT & LESIONS OF NASAL SEPTUM
American Conference of Governmental Industrial Hygienists. Inc Documentation of the Threshold Limit Values and Biological Exposure Indices 6th ed Volumes I, II, III Cincinnati, OH: ACGIH, 1991 , p 1284
Peer Reviewed

IN 2 SASKATCHEWAN POTASH MINES ATMOSPHERIC DUST LEVELS OF MINING CREW & SCREENING OPERATORS WERE ABOVE 8-HR TLV (TLV-AVG) RESP SYMPTOMS INDICATED BY FORCED EXPIRATORY LUNG FUNCTION TESTS WERE GRADE I PHLEGM PRODN, MILD SHORTNESS OF BREATH & CHRONIC COUGH
MARKHAM JW ET AL, AM IND HYG ASSOC J 42 (9) 671 (1981)
Peer Reviewed

WHEN INHALED IN ANY FORM, /IT/ IS STRONGLY IRRITATING TO UPPER RESP TRACT. SEVERE INJURY IS USUALLY AVOIDED BY SELF-LIMITING SNEEZING, COUGHING & DISCOMFORT WHEN EXPOSED TO AIR THE BICARBONATE & CARBONATE /ARE FORMED/ SINCE THEY ARE LESS ALKALINE IN AQ SOLN THEY MAY BE LESS IRRITANT OR CORROSIVE
Clayton, G.D. F.E. Clayton (eds.) Patty's Industrial Hygiene and Toxicology. Volumes 2A, 2B, 2C, 2D, 2E, 2F Toxicology 4th ed New York, NY John Wiley & Sons Inc , 1993-1994 , p 767
Peer Reviewed

DUST OR MIST /IS/ IRRITATING TO EYES, NOSE & THROAT SOLID OR LIQUID WILL BURN SKIN & EYES
U S. Coast Guard, Department of Transportation CHRIS - Hazardous Chemical Data Volume II Washington, D C U S. Government Printing Office, 1984-5
Peer Reviewed

Swallowing caustic alkalies /potassium hydroxide/ causes immediate burning pain in the mouth, throat, and stomach, and the lining membranes become swollen and detached. Vomiting and purging may occur, the vomitus having a brown color from altered blood There is intense pain and shock. Stricture of the esophagus can develop In severe cases, circulatory failure, esophageal perforation and peritonitis, or pneumonia may occur
Reynolds, J E.F , Prasad, A.B. (eds.) Martindale-The Extra Pharmacopoeia. 28th ed London The Pharmaceutical Press, 1982 , p. 44
Peer Reviewed

Potassium hydroxide (caustic potash) is one of the strongest alkalies It is extremely corrosive, and many reports have been made of devastating damage of the eye from contact with either the solid or solutions of potassium hydroxide. The type of injury is essentially the same as that produced by sodium hydroxide and other strong alkalies
Grant, W.M. Toxicology of the Eye 3rd ed. Springfield, IL Charles C Thomas Publisher, 1986., p 756
Peer Reviewed

"Button" batteries, which contain concentrated solutions of sodium or potassium hydroxide, represent a serious risk for leakage, corrosion, and perforation when lodged in the esophagus.
Klaassen, C.D , M O Amdur, Doull J. (eds.) Casarett and Doull's Toxicology The Basic Science of Poisons 5th ed New York, NY: McGraw-Hill, 1995 , p 976
Peer Reviewed

Non-Human Toxicity Excerpts

INGESTION . LEADS TO CORROSION OF MUCOUS MEMBRANES OF UPPER PART OF DIGESTIVE TRACT. VOMITION, COLIC, & PURGATION MAY FOLLOW WITH PROSTRATION & DEATH FROM ACUTE SHOCK /CAUSTICS/
Garner's Veterinary Toxicology. 3rd ed., rev. by E.G.C. Clarke and M.L. Clarke. Baltimore. Williams and Wilkins. 1967 , p 38
Peer Reviewed

FREQUENT APPLICATIONS OF AQ SOLN (3-6%) TO SKIN OF MICE FOR 46 WK PRODUCED TUMORS IDENTICAL TO THOSE FROM COAL TAR
Clayton, G D , F.E. Clayton (eds.) Patty's Industrial Hygiene and Toxicology Volumes 2A, 2B, 2C, 2D, 2E, 2F Toxicology 4th ed New York, NY John Wiley & Sons Inc., 1993-1994 , p 767
Peer Reviewed

Non-Human Toxicity Values

LD50 Rat oral 1 23 g/kg
Budavari, S. (ed) The Merck Index - Encyclopedia of Chemicals, Drugs and Biologicals. Rahway, NJ. Merck and Co., Inc , 1989., p. 1215
Peer Reviewed

LD50 Rat oral 273 mg/kg
Lewis, R.J. Sax's Dangerous Properties of Industrial Materials 9th ed Volumes 1-3. New York, NY. Van Nostrand Reinhold. 1996., p 2764
Peer Reviewed

Ecotoxicity Values

TLm Mosquito fish 80 ppm/24 hr fresh water /Conditions of bioassay not specified/
U.S Coast Guard. Department of Transportation CHRIS - Hazardous Chemical Data Volume II. Washington, D C U S Government Printing Office, 1984-5
Peer Reviewed

Absorption, Distribution and Excretion

ALKALIES PENETRATE SKIN SLOWLY /ALKALIES/
Dreisbach, R.H. Handbook of Poisoning. 12th ed. Norwalk, CT Appleton and Lange, 1987 , p 213
Peer Reviewed

Ammonium hydroxide penetrates fastest, followed by sodium hydroxide, potassium hydroxide, and finally calcium hydroxide
Sullivan, J B Jr , G R Krieger (eds.) Hazardous Materials Toxicology-Clinical Principles of Environmental Health Baltimore MD Williams and Wilkins, 1992., p. 433
Peer Reviewed

Section 6 - Pharmacology

Theraputic Uses

Potassium hydroxide is a powerful caustic which has been used to remove warts /Former use/
Reynolds, J.E F., Prasad, A B (eds) Martindale-The Extra Pharmacopoeia. 28th ed. London The Pharmaceutical Press, 1982., p 44
Peer Reviewed

A 2.5% solution in glycerol may be used as a cuticle solvent.
Reynolds, J E F , Prasad, A.B (eds) Martindale-The Extra Pharmacopoeia. 28th ed London: The Pharmaceutical Press, 1982 , p 44
Peer Reviewed

Therap cat (Vet) Caustic. In disbudding calves' horns In aq solution to dissolve scales and hair in skin scrapings
Budavari, S. (ed). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ Merck and Co , Inc., 1996 , p 1315
Peer Reviewed

Section 8 - Exposure Standards and Regulations

Allowable Tolerances

Residues of potassium hydroxide are exempted from the requirement of a tolerance when used as a neutralizer in accordance with good agricultural practices as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest.
40 CFR 180.1001(c) (7/1/97)
Peer Reviewed

Potassium hydroxide meeting Food Chemicals Codex specifications is exempted from the requirement of a tolerance when used as a neutralizer in accordance with good agricultural practice as inert (or occasionally active) ingredients in pesticide formulations applied to animals
40 CFR 180.1001(e) (7/1/97)

Peer Reviewed

OSHA Standards

Vacated 1989 OSHA PEL TWA 2 mg/cu m is still enforced in some states.
NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 370
QC Reviewed

NIOSH Recommendations

Recommended Exposure Limit: 10 Hr Time-Weighted Avg: 2 mg/cu m.
NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 262
QC Reviewed

Threshold Limit Values

Ceiling Limit: 2 mg/cu m
American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2008, p. 49
QC Reviewed

Clean Water Act Requirements

Designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance.
40 CFR 116.4 (7/1/88)
QC Reviewed

CERCLA Reportable Quantities

Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 1000 lb or 454 kg. The toll free number of the NRC is (800) 424-8802; in the Washington D.C. metropolitan area (202) 426-2675. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV. D.3.b).
40 CFR 302.4 (7/1/97)
Peer Reviewed

FIFRA Requirements

Residues of potassium hydroxide are exempted from the requirement of a tolerance when used as a neutralizer in accordance with good agricultural practices as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest.
40 CFR 180.1001(c) (7/1/97)
Peer Reviewed

Potassium hydroxide meeting Food Chemicals Codex specifications is exempted from the requirement of a tolerance when used as a neutralizer in accordance with good agricultural practice as inert (or occasionally active) ingredients in pesticide formulations applied to animals.
40 CFR 180.1001(e) (7/1/97)
Peer Reviewed

As the federal pesticide law FIFRA directs, EPA is conducting a comprehensive review of older pesticides to consider their health and environmental effects and make decisions about their future use. Under this pesticide reregistration program, EPA examines health and safety data for pesticide active ingredients initially registered before November 1, 1984 and determines whether they are eligible for reregistration. In addition, all pesticides must meet the new safety standard of the Food Quality Protection Act of 1996. Pesticides for which EPA had not issued Registration Standards prior to the effective date of FIFRA, as amended in 1988, were divided into three lists based upon their potential for human exposure and other factors, with List B containing pesticides of greater concern and List D pesticides of less concern. Potassium hydroxide is found on List D. Case No: 4065; Pesticide type: fungicide, herbicide, antimicrobial; Case Status: RED Approved 09/92; OPP has made a decision that some/all uses of the pesticide are eligible for reregistration, as reflected in a Reregistration Eligibility Decision (RED) document.; Active Ingredient (AI): Potassium hydroxide; AI Status: The active ingredient is no longer contained in any registered pesticide products ... "cancelled."

USEPA/OPP; Status of Pesticides in Registration, Reregistration and Special Review p.325 (Spring, 1998) EPA 738-R-98-002
QC Reviewed

FDA Requirements

Substance added directly to human food affirmed as generally recognized as safe (GRAS) when used in food at levels not to exceed current good manufacturing practice.
21 CFR 184.1631 (4/1/97)
Peer Reviewed

Potassium hydroxide used as a general purpose food additive in animal drugs, feeds, and related products is generally recognized as safe when used in accordance with good manufacturing or feeding practice.
21 CFR 582.1631 (4/1/97
Peer Reviewed

Section 9 - Monitoring and Analysis Methods

Sampling Procedures

Analyte: Hydroxide ion; Matrix: air; Sampler: filter; flow rate: 1 to 4 liter per minute; Sample size: 70 to 1000 liters; interferences: non identified; sample stability: at least 7 days at 25 deg C
U.S. Department of Health and Human Services, Public Health Service. Centers for Disease Control, National Institute for Occupational Safety and Health. NIOSH Manual of Analytical Methods, 3rd ed. Volumes 1 and 2 with 1985 supplement, and revisions. Washington, DC: U.S. Government Printing Office, February 1984., p. 7401
Peer Reviewed

Attachment No. 7

City of Lodi, CA

Soil and Groundwater Investigation
Existing Conditions Report

2.3.2 Biosolids Treatment Process Modifications

In conjunction with Improvements Project 2007, the City is also planning to construct a new return activated sludge (RAS) pump station and a fourth anaerobic digester. Additionally, the City is planning to redirect the biosolids lagoon supernatant flows to a location upstream of the municipal treatment system aerations basins. This modification would result in nitrogen removal from the supernatant flows and result in a reduction in the nitrogen load applied to the existing irrigation reuse facilities.

2.3.3 Industrial Process Modifications

The City is currently considering requests for additional discharges to the industrial sewer line. The following loading scenarios are currently being evaluated with respect to available storage capacity, additional treatment requirements, and impacts to irrigation water quality:

1. Current base case flows/loadings + 10 wineries each with flows equivalent to the existing discharge from the Van Ruiten Winery (1.1 million gallons per year).
2. Current base case flows/loadings + additional 60,000 gallons per day (gpd) from PCP during the non-irrigation season (November through March).
3. Current base case flows/loadings + doubling the flows from the PCP during the irrigation season (current PCP summer flows are approximately 100 million gallons per year).
4. Current base case flows/loadings + additional 60,000 gallons per day (gpd) from PCP during the non-irrigation season (November through March) + doubling the flows from the PCP during the irrigation season.

To accommodate such loads, the City is evaluating the benefits of constructing an aeration basin that would provide treatment for a portion of the increased loads. This facility would also likely need to be lined with geomembrane liner such as to avoid the potential for these high strength flows to cause groundwater degradation.

The PCP cannery currently uses sodium hydroxide in their canning process as a caustic material for peeling fruit. This practice is of concern for land application on the City's property due to the undesirable sodium content in the land-applied wastewater (high sodium content can be toxic to certain plants and disrupt the calcium nutrition of the plant). Therefore, the PCP cannery is planning to change their existing process to use potassium hydroxide in lieu of sodium hydroxide. Potassium hydroxide would be considered an environmentally superior source of caustic since the wastewater would add an essential plant nutrient to the cropland.

6.5.3 General Chemistry

Consideration of the dissolved constituents contributing to EC can also be used to help resolve whether the land application on the City's property has had a significant effect on water chemistry in the monitoring wells. As discussed in Section 5.5.2, the general chemistry in the onsite monitoring wells appears to be strongly influenced by regional conditions, particularly in the western half of the City's property.

Another complicating factor in this assessment is the fact that the vast majority of flow applied to the City's property is municipal effluent, which is originally derived as a local groundwater source. Therefore it would be expected that the general chemistry of the applied flows would be characteristic of the regional groundwater conditions located east of the WPCF. Therefore, it will likely be difficult to distinguish the potential impacts associated with land application from the regional influences.

The City has collected some initial general chemistry data for the various sources of irrigation flow. The data collected for the municipal effluent, the industrial line flows during the canning season, and combined irrigation flow during the canning season been used to develop Stiff Diagrams, which are provided in Appendix G.

The primary cation contributing to the salinity in both the municipal effluent and the industrial flows is sodium, followed by lower concentrations of magnesium and calcium. However, the sodium levels in the industrial discharge during the canning season are very high. This is largely to the fact that the PCP cannery relies on sodium hydroxide in their canning process to help remove the skins from the fruits and vegetables prior to canning. As discussed in Section 2.3.3, the PCP cannery is planning to change their existing process to use potassium hydroxide in lieu of sodium hydroxide. This will result in a significant decrease in the sodium loadings on the City's properties. Further, potassium is a beneficial nutrient to crops and will generally be assimilated into the plant material that is removed from the field areas.

The major anion concentrations are from chloride in the industrial influent during canning season and bicarbonate in the municipal flows; however, chloride is also prominent in this source.

A comparison of the sodium and chloride concentrations in these two major sources of irrigation water in comparison to the combined flow during the PCP canning season is provided in Table 6-7.

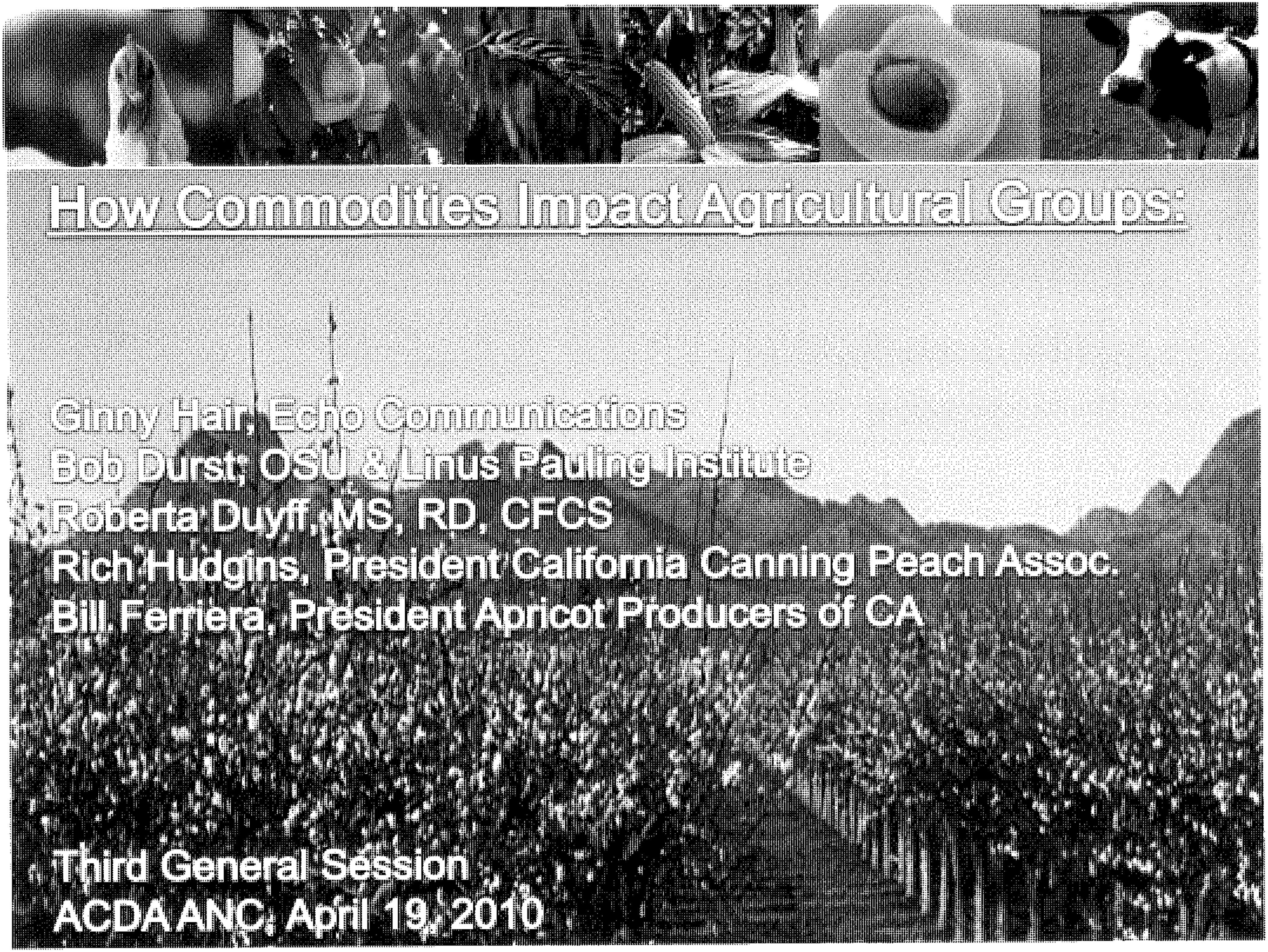
Table 6-7. Irrigation Source Water Sodium and Chloride Concentrations

Constituent	Irrigation Water During PCP Canning Season[(a)]	Municipal Effluent[(b)]	Industrial Flows During PCP Canning Season[(a)]
Sodium, mg/L	107	75	315
Chloride, mg/L	77	64	145

(a) August – September, 2005
(b) August 2005 – February 2006

Attachment No. 8

How Commodities Impact Agricultural Groups
Canned and Frozen Cling Peach Study


How Commodities Impact Agricultural Groups:
Ginny Hair, Echo Communications
Bob Durst, OSU & Linus Pauling Institute
Roberta Duyff, MS, RD, CFCS
Rich Hudgins, President California Canning Peach Assoc.
Bill Ferriera, President Apricot Producers of CA
Third General Session
ACDA ANC, April 19, 2010

Canned and Frozen Cling Peach Study

Bob Durst
Linus Pauling Institute
Bob.Durst@OregonState.edu

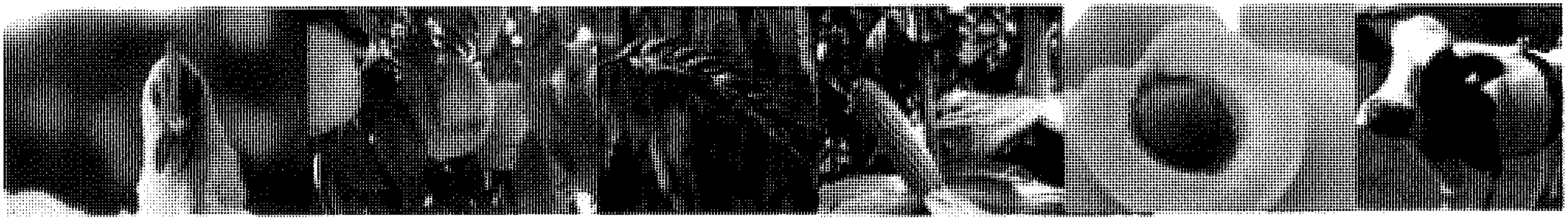
Linus Pauling Institute Mission Statement

- Determine the function and role of vitamins and essential minerals (micronutrients) and chemicals from plants (phytochemicals) in promoting optimum health and preventing or treating disease.
- Determine the role of oxidative stress and inflammation in human health and disease, and the protective effects of dietary factors with anti-oxidant or anti-inflammatory properties.
- Help people everywhere achieve a healthy and productive life, full of vitality, with minimal suffering, and free of cancer and other debilitating diseases.

The Linus Pauling Institute
Oregon State University

LPI Prescription for Health

- Healthy Eating
  - 5 servings Fruits and Vegetables (9 is better)
  - Increase Omega-3 fatty acids
  - Reduce saturated and trans-fat
  - Avoid soft drinks, sugar-coated cereal, candy
- Healthy Lifestyle
  - Healthy bodyweight
  - 30 minutes moderate, daily exercise
- Supplements
  - Multi-vitamins, C, D, E, calcium



Fruits & Vegetables

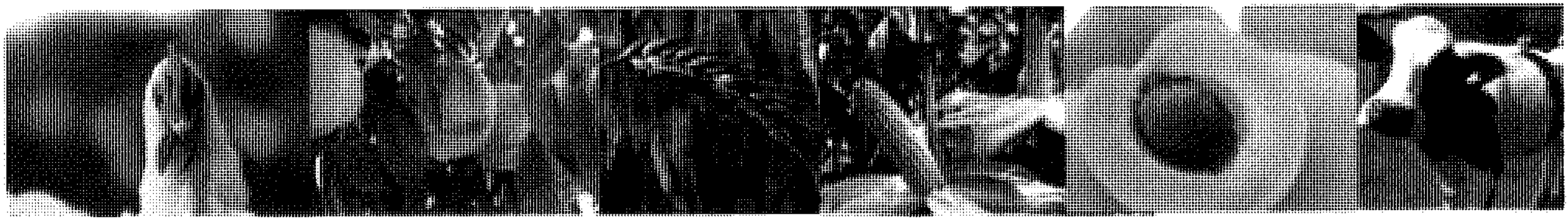
- Vitamins
- Essential Minerals
- Fiber
- Phytochemicals
  - Flavonoids/Polyphenols
  - Carotenoids
  - Chlorophyll
  - Etc.

Peach Storage Study

- California Cling Peach Board
- Nutrient content of peach products
- Comparing processed peaches to fresh?
- How does processing impact nutrients?
- How does storage affect nutrients?
- Promote healthy aspect of canned peaches

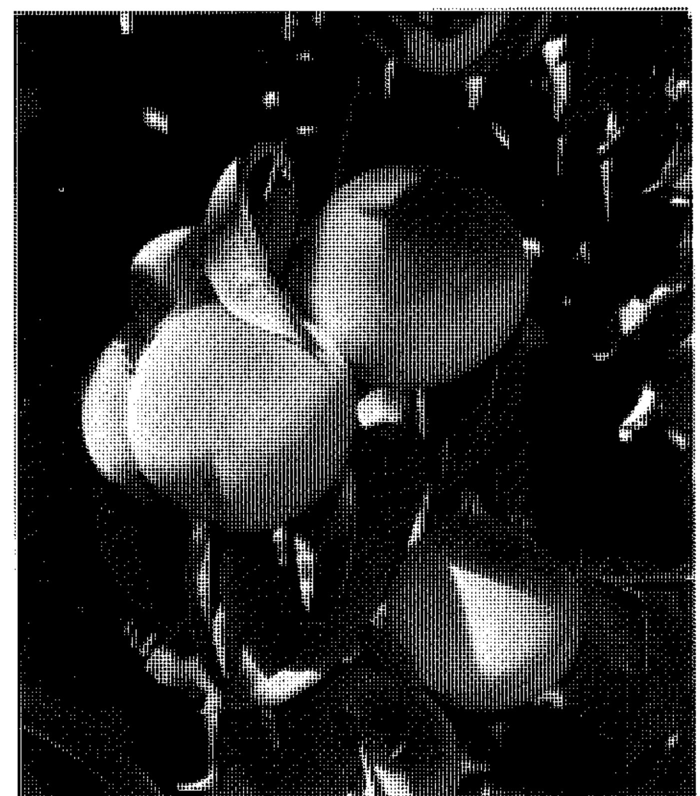
Peach Samples

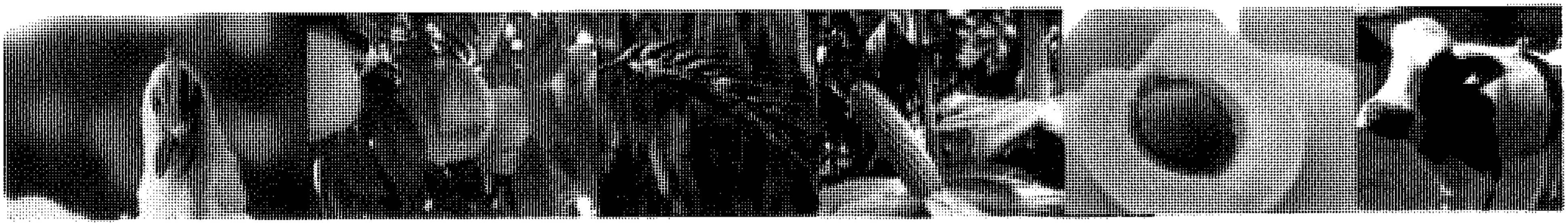
- Canned in syrup (CS)
- Canned in (pear) juice (CJ)
- Frozen (Frzn)
- Fresh (Fresh)
- Storage Time
  - 0, 3, 6 and 12 months
  - Fresh samples 2007 & 2008



Peach Samples

- Processed samples use Cling varieties
  - Bred for processed quality
  - Unsuitable for fresh
- Fresh samples use Freestone varieties
  - Bred for fresh quality
  - Unsuitable for processing

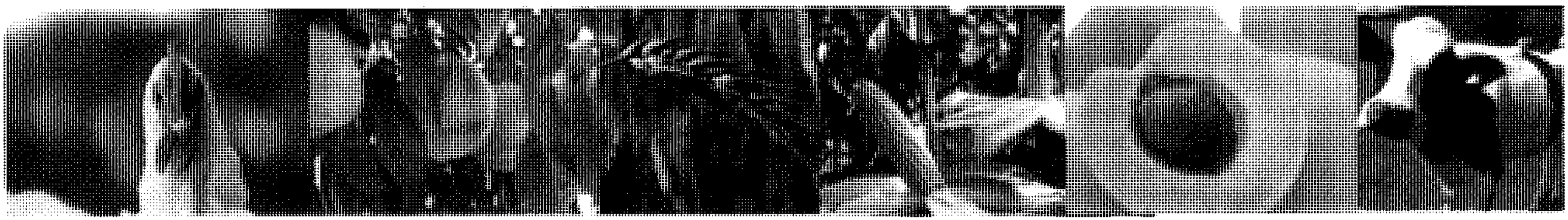




Analytes

NEW

- Vitamin A (Carotenoids)
- Vitamin E
- Antioxidants
  - Vitamin C
  - FRAP
- Phenolics
  - Profile
  - Total (F-C)
- Sugars
- Fiber

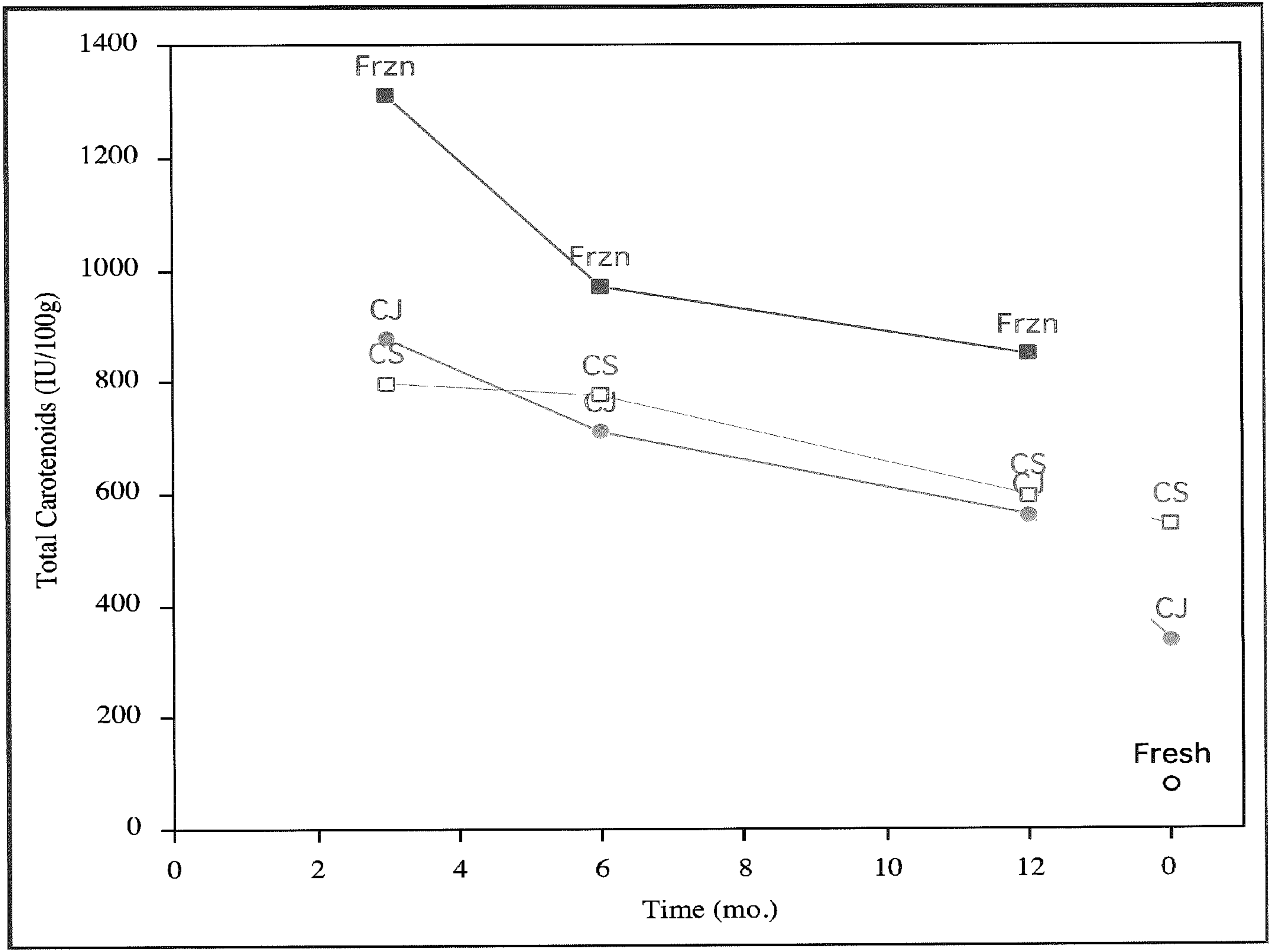


Carotenoids (Vitamin A)

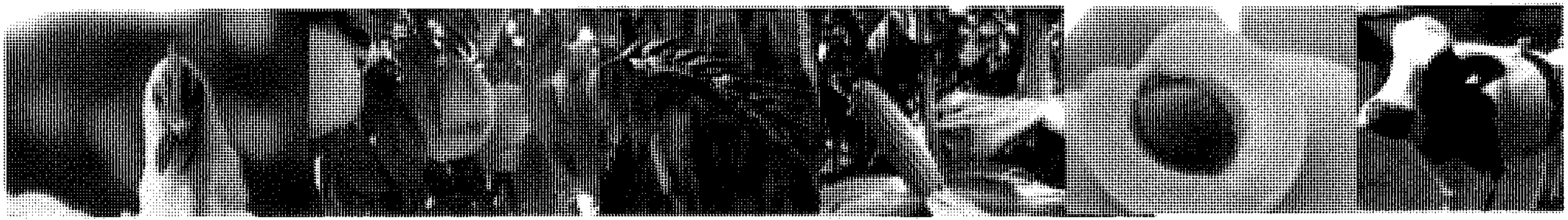
NEW

- Processing increases levels
  - Canned in juice **7x higher**
  - Canned in syrup **6.5x higher**
  - Frozen **10x higher**

- Retention during storage
  - Canned in juice retained 64%
  - Canned in syrup retained 75%
  - Frozen retained 65%
- 6-20% RDA (fresh 1%)



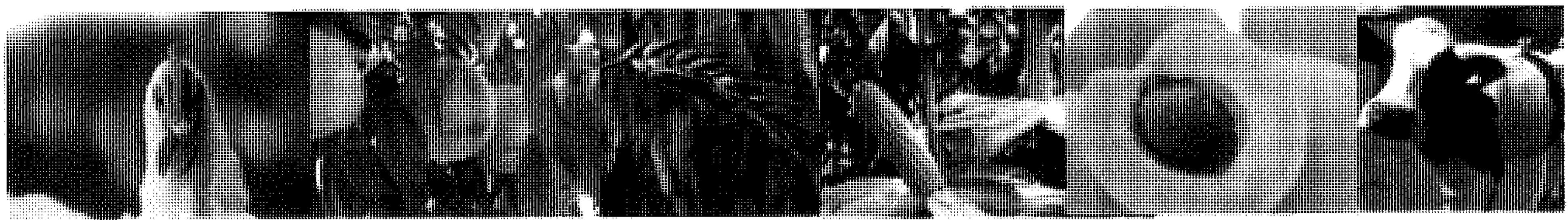
Total Carotenoids (IU/100g)
1400
1200
1000
800
600
400
200
0
Frzn
Frzn
Frzn
CJ
CS
CS
CJ
CS
CJ
CS
CJ
Fresh
0
2
4
6
8
10
12
0
Time (mo.)



Vitamin E

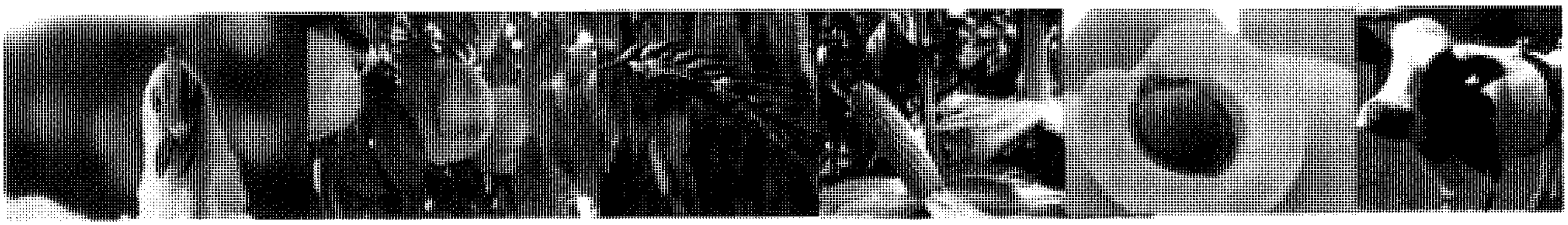
- Processing increases levels
  - Canned in juice **2x higher**
  - Canned in syrup **3x higher**
  - Frozen **4x higher**

- Retention during storage
  - Canned in juice retained 67%
  - Canned in syrup retained 50%
  - Frozen retained 73%
- 4-17% RDA (fresh 2-5%)



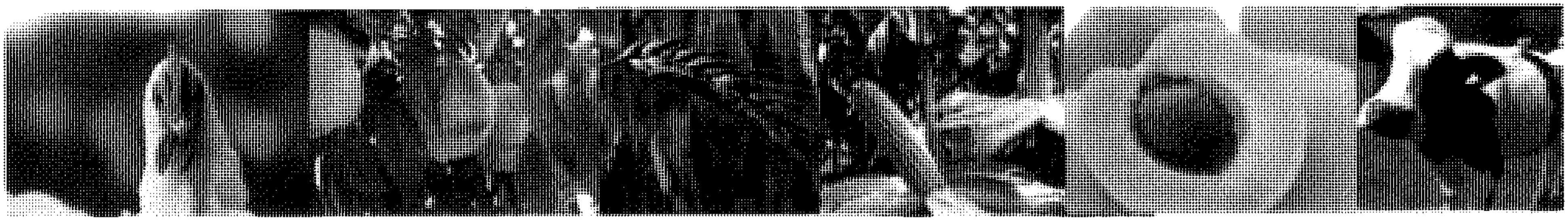
Vitamin C

- Retention during storage
  - CJ samples after 12 months storage retain over 70%
  - CS samples had 106%
  - Frozen sample had 90%
- Difference between canned & frozen
  - Frozen samples had added ascorbic acid (and citric acid)
  - Significant addition compared to what's naturally present
- Fresh had higher levels than processed
  - Losses occurred during canning process
    - Little change during storage
- 15-40% RDA (fresh 35-75%) (frozen 5-10x)



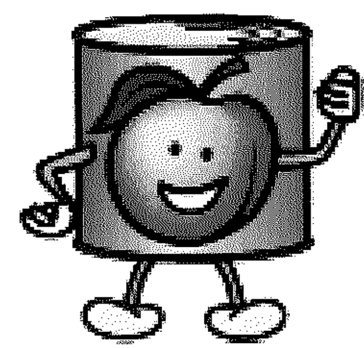
Antioxidants (FRAP)

- Range of values measured is quite large
- No change during storage in canned samples
  - CS is 24% greater than CJ
- Frozen samples significantly greater
  - Due to added ascorbic acid
  - >50% loss during storage
    - Not fully accounted for by decrease in ascorbic



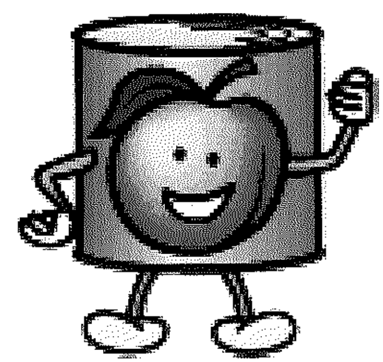
Phenolics

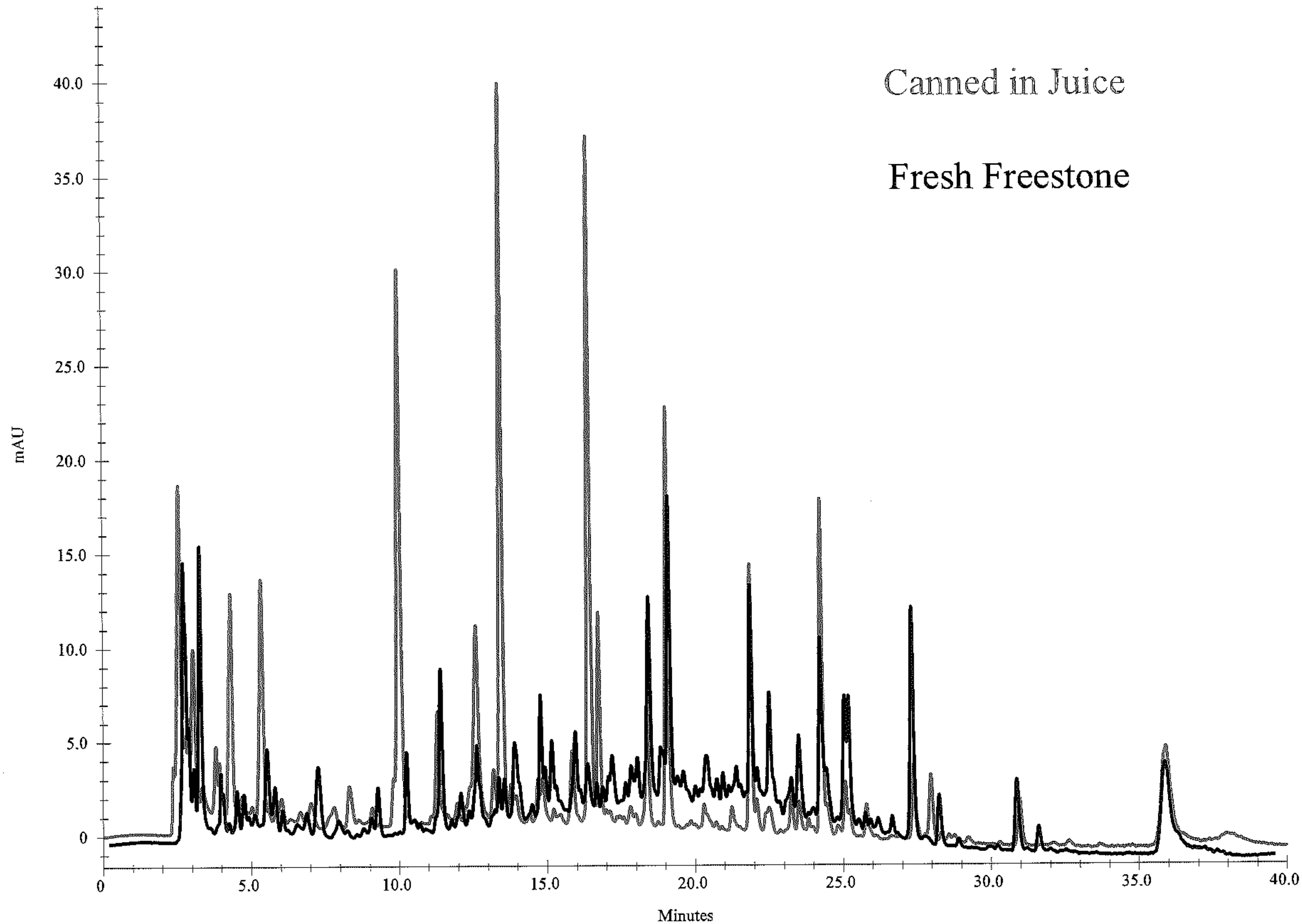
- No scientific proof that flavonoids exert physiologically relevant antioxidant effects in humans!
- Good scientific evidence that flavonoids exert (non-antioxidant) physiological effects, and have possible health benefits, in humans!



Phenolics in Peaches

- Phenolic fingerprint
  - Dozens of unique compounds
  - Changes with processing
    - Changes in profile and Increase in amounts
  - Minor changes with storage
- Total phenolics
  - Frozen is highest (?Vit C interference)
  - No changes with storage




Canned in Juice
Fresh Freestone
mAU
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
Minutes

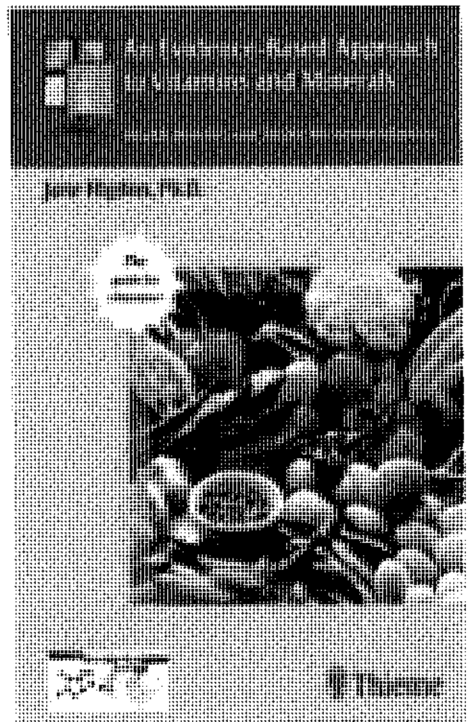
Conclusions

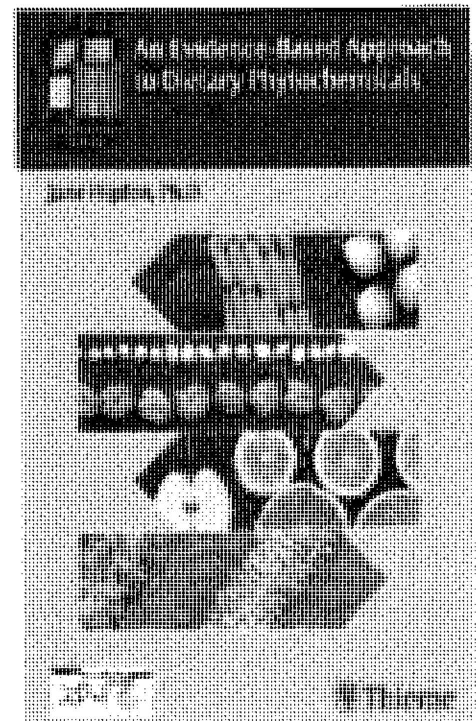
PROCESSING PRESERVES AND INCREASES NUTRIENTS!

Canned peaches are sources of (/100g)

- **Vitamin C**
  - **15-40% RDA (fresh 35-75%) (frozen 5-10x)**
- **Antioxidants**
  - No RDA
- **Carotenoids (Vitamin A)**
  - **6-20% RDA (fresh 1%); Canned in syrup 6.5x higher!**
- **Vitamin E**
  - **4-17% RDA (fresh 2-5%)**

http://LPI.OregonState.edu/infocenter





The Linus Pauling Institute
OREGON STATE UNIVERSITY

Micronutrient Information Center

Fruit & Vegetable Nutrition, Convenience, Affordability

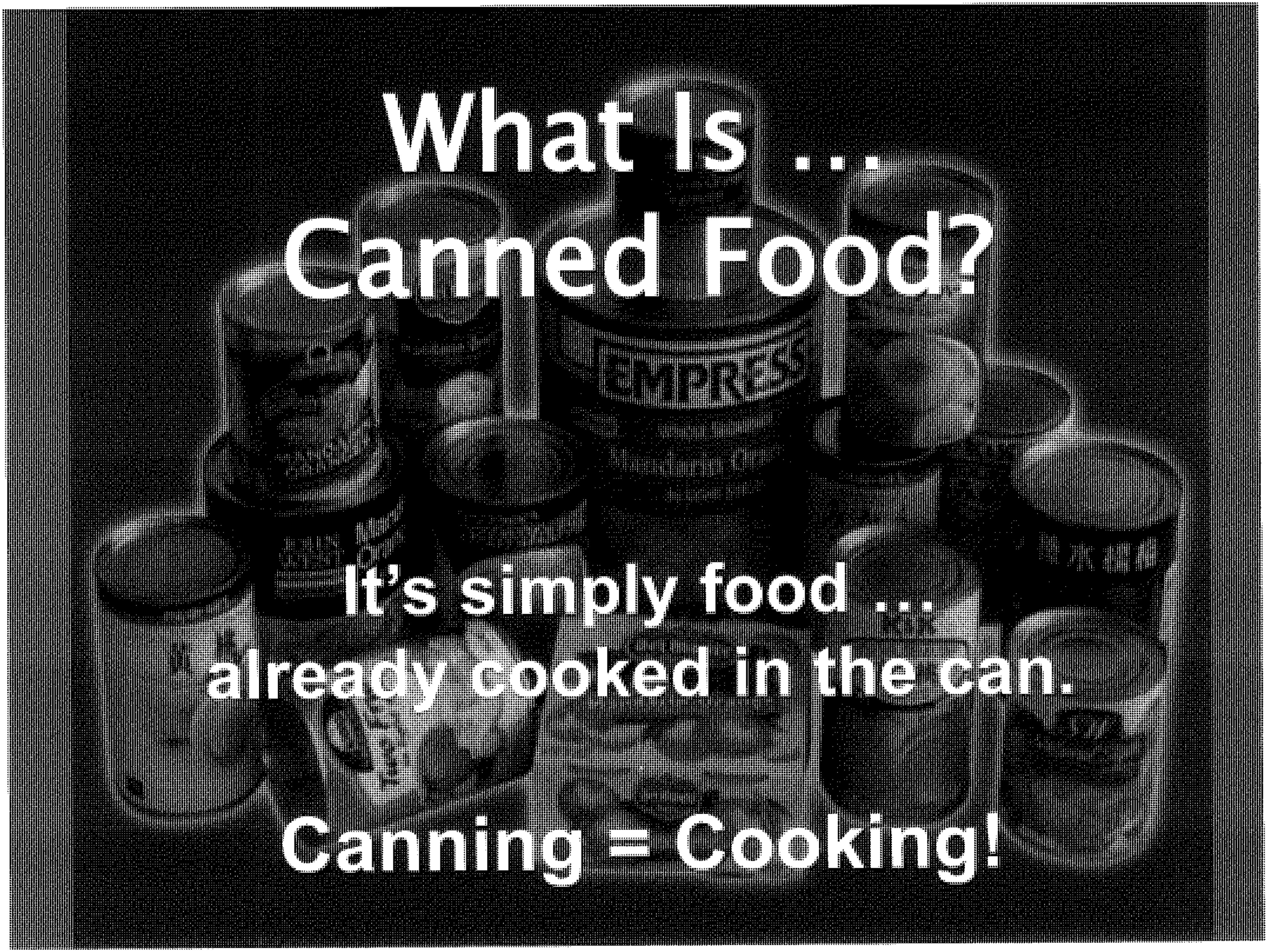
IT'S IN THE CAN!

Agriculture Commodity Distribution Association
April 19, 2010

Roberta L. Duyff, MS, RD, FADA, CFCS
Food and Nutrition Consultant/Author
Duyff Associates, St. Louis, MO

" If every individual could had the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health."

Hippocrates


What Is …
Canned Food?
It's simply food …
already cooked in the can.
Canning = Cooking!
EMPRESS

Food Safety and Preservation
Convenience and Food Availability
Saved Time and Effort
Lower Costs
Retained Nutrients and Food Quality
EMPRESS

Today's "Menu" ...

- Nutrient-rich benefits of fruits and vegetables
- Fruits and vegetables in today's nutrition guidance
- All forms (fresh, processed): smart options.
- Unique benefits of canned, frozen, dried fruits and vegetables

Fruits and Vegetables: Health Essentials

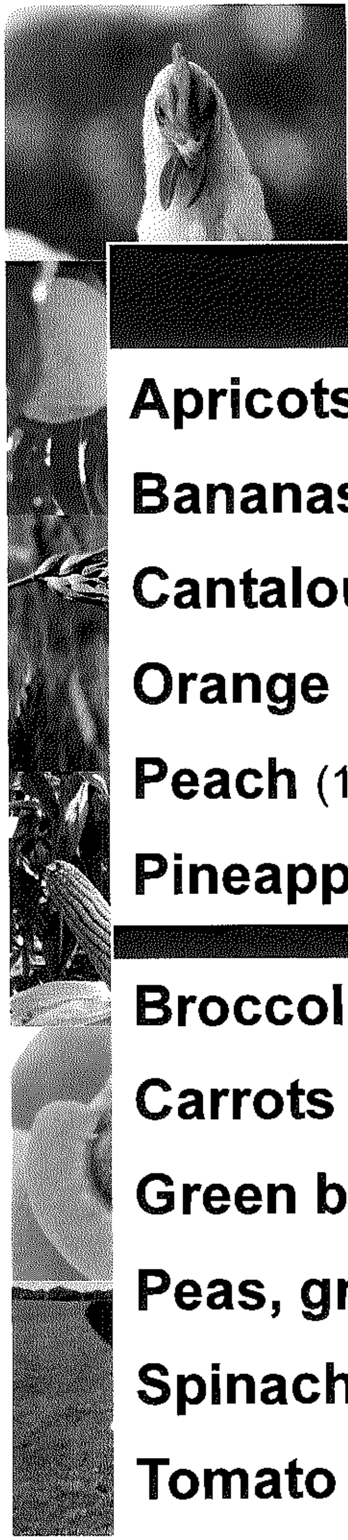
A Diet Rich in Fruits and Vegetables …

- Promotes overall good health.
- Reduces the risks for …
  - high blood pressure
  - heart disease
  - type 2 diabetes
  - certain types of cancer.
- Helps to maintain a healthy body weight.

Fruit, Vegetables Deliver Nutrients of Concern

- Vitamin A (as carotenoids)
- Vitamin C
- Potassium
- Magnesium
- Fiber
- Folate for adult women

(Source: 2005 Dietary Guidelines for Americans)



Fruit and Veggies: 10% Daily Value or More!

	Vitamin A	Vitamin C	Folate	Potassium	Fiber
Apricots (1/2 cup)	X	X		X	X
Bananas (1 medium)		X		X	X
Cantaloupe (1/2 cup)	X	X	X		
Orange (1medium)		X	X		X
Peach (1/2 cup)	X	X			
Pineapple (1/2 cup)		X			
Broccoli (1/2 cup)	X	X	X	X	X
Carrots (1/2 cup)	X	X			X
Green beans (1/2 cup)		X			X
Peas, green (1/2 cup)	X		X		X
Spinach, cked (1/2 cup)	X	X	X	X	X
Tomato (1 medium)	X	X		X	

Canned Fruit: Nature's Sweet Package

Nutrition Facts
Serving Size: 1/2 cup (124g)
Servings Per Container about 3-1/2

Amount Per Serving	
Calories 50	Calories From Fat 0
	% Daily Value*
Total Fat 0g	0%
Saturated Fat 0g	0%
Cholesterol 0mg	0%
Sodium 5mg	0%
Total Carbohydrate 12g	4%
Dietary Fiber 1g	4%
Sugars 11g	
Protein less than 1g	
Vitamin A 6%	Vitamin C 6%
Calcium 0%	Iron 2%

Cling Peaches in Fruit Juice

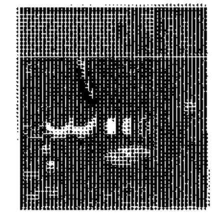
Nutrition Facts
Serving Size: 1/2 cup (130g)
Servings Per Container about 3-1/2

Amount Per Serving	
Calories 80	Calories From Fat 0
	% Daily Value*
Total Fat 0g	0%
Saturated Fat 0g	0%
Cholesterol 0mg	0%
Sodium 20mg	1%
Potassium 170mg	5%
Total Carbohydrate 20g	7%
Dietary Fiber 1g	4%
Sugars 19g	
Protein less than 1g	
Vitamin A 6%	Vitamin C 8%
Calcium 0%	Iron 2%

Cling Peaches in Light Syrup

Fruits and Vegetables: Today's Dietary Guidance

Fruits and Vegetables … For Overall Health



Dietary Guidelines for Americans 2005

"…all forms of fruit and vegetables, especially whole and cut-up, as healthful options"

2005 Dietary Guidelines:

2 cups fruits, 2½ cups vegetables daily

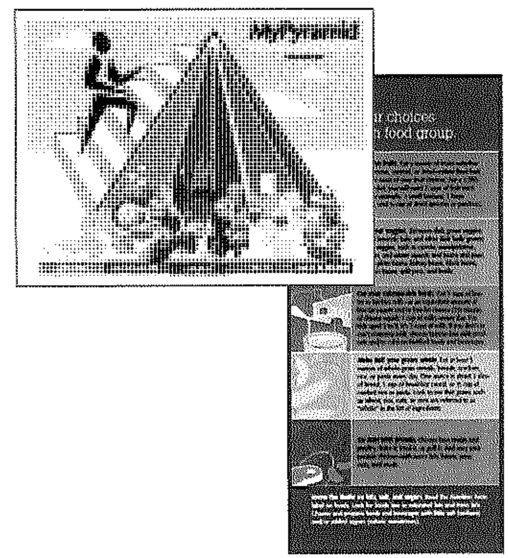
(2000 calorie daily diet)

- **Most women daily**: 2 cups fruit … 2½ to 3 cups vegetables
- **Most men daily:** 2 to 2 ½ cups fruit … 3 to 4 cups vegetables
- **Most teens daily**: 1½ to 2 ½ cups fruit … 2½ to 4 cups vegetables
- **Children (9-13 years) daily**: 1½ to 2½ cups fruit … 2 to 3 ½ cups vegetables

Fruits and Vegetables … Essentials in the Total Diet

- Food variety
  - More from fruit and vegetable groups than any other food group
  - Colors of health: all kinds of colorful fruits and vegetables

- Nutrient-dense foods
  - Calories that count
  - Nutrients that come up short
- Fruit and veggies with phytonutrients
  - Antioxidant power
  - Fiber



Fruits and Vegetables More Matters

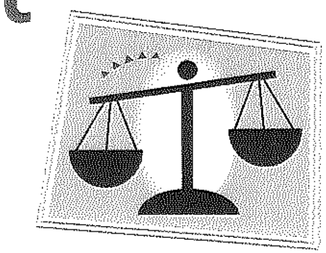
fruits & veggies more matters

"Fresh, frozen, canned, dried or 100% juice … When it comes to good nutrition, all forms of fruits and vegetables matter.

"And colors are important. Eat a colorful variety of fruits and vegetables every day!

"Fruits and veggies provide the unrivaled combination of great taste, nutrition, abundant variety and multiple product forms -- nature's perfect convenience food!"

Fruits and Vegetables … For Healthy Weight

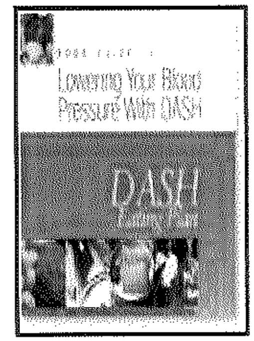


- Low in calories … compared to the same volume of other foods.
- Promote a feeling of fullness … due to higher water and fiber content
- Help you eat less … since take longer to chew.
- Replace “energy dense” foods. Fruits and veggies replace foods that are high in fat and sugar.

Fruits and Vegetables …
For Blood Pressure Control

Emphasizes fruit and vegetables,
as part of a taste-appealing strategy
to lower blood pressure …

DASH Diet, NHLBI/NIH



- Potassium, magnesium, fiber in many fruits and vegetables may help with blood pressure control.
- 4 to 5 servings fruit in a 2,000 calorie daily diet
- 4 to 5 servings vegetables in a 2,000 calorie daily diet

.

Fruits and Vegetables …
For Cardiovascular Health

"Consume a diet rich in vegetables and fruits…"

… American Heart Association

For heart health, fruit and vegetables are recognized for …

What they have …

- Fiber, which may help lower blood cholesterol levels,
- Antioxidant vitamins (beta carotene and vitamin C), which may be heart protective
- Nutrient-rich.

And what they don't have ...

- No cholesterol
- Essentially no solid fat
- Little sodium
- Few calories.

American Heart Association®

Learn and Live™

Fruits and Vegetables … To Reduce Cancer Risk

To protect against some cancers, a healthy diet emphasizes plant sources of food …

- "5 or more servings of fruits and vegetables daily to help prevent cancer"
- "Contain important vitamins, minerals, fiber, phytochemicals and antioxidants that appear to protect against some cancers"
- "Usually low in calories"
- "In general, fruits and vegetables with the most color -- green, red, yellow, and orange -- have the most nutrients." American Cancer Society

To Improve Nutrient Intake of School Kids and Teens

… USDA's National School Food Service Program provides guidelines for fruit and vegetables – in any form:

- school breakfast
- school lunch
- after-school snack program
- and more

Fruits and Vegetables: Do We Consume Enough?

Current food consumption patterns -- for all Americans -- fall significantly below fruit and vegetable recommendations for good health.

Food Groups of Concern

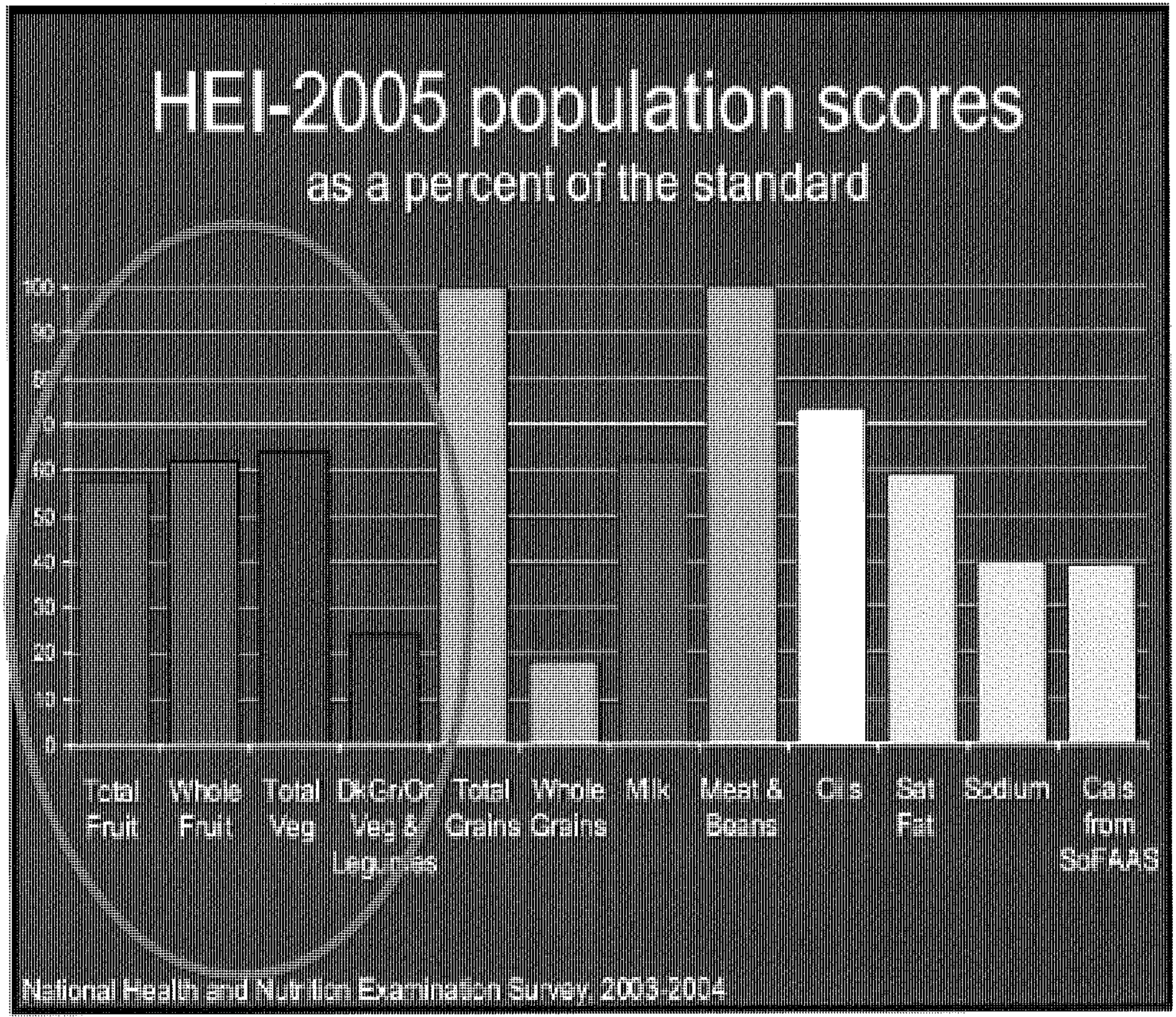
Draft Conclusion

Reported dietary intakes of the following food groups and dietary components are low enough to be of concern:

- For adults and children
  - Vegetables
  - Fruits
  - Whole grains
  - Fluid milk and milk products
  - Oils
- For adult women and adolescent girls
  - Meat, poultry, fish, eggs, soy products, nuts, and seeds

Nutrient Adequacy Subcommittee
2010 Dietary Guidelines Advisory Committee

Meeting 5, April 13-14, 2010


HEI-2005 population scores
as a percent of the standard
100
90
80
70
60
50
40
30
20
10
0
Total Fruit
Whole Fruit
Total Veg
DkGr/Or Veg & Legumes
Total Grains
Whole Grains
Milk
Meat & Beans
Oils
Sat Fat
Sodium
Cals from SoFAAS
National Health and Nutrition Examination Survey, 2003-2004

Food Groups of Concern

Findings—Fruit Group:

Food Group	Population Group	Median Intakes (cup or oz. equivalents)	Recommended Intakes across Calorie Ranges (cup or oz. equivalents)	Link to Shortfall Nutrients
Fruit	Males, 19+ y	0.8 cups	2.0 – 2.5 cups	Vitamin C
	Females, 19+ y	0.8 cups	1.5 – 2.0 cups	Magnesium
	Children, 9-18 y	0.6 – 0.8 cups	1.5 – 2.5 cups	Potassium
	Children, 4-8 y,	1.0 cups	1.0 – 2.0 cups	Fiber
	Children, 2-3 y,	1.4 cups	1.0 – 1.5 cups	
			[2000 kcal=2 cups]	

NCI, 2009

Food Groups of Concern

Findings—total vegetables:

Food Group	Population Group	Median Intakes (cup or oz. equivalents)	Recommended Intakes across Calorie Ranges (cup or oz. equivalents)	Link to Shortfall Nutrients
Total Vegetables, including dry beans and peas	Males, 19+ y Females, 19+ y Children, 9-18 y Children, 4-8 y Children, 2-3 y	1.8cups 1.5 cups 1.1–1.4 cups 0.9 cups 0.7 cups	2.5 – 4.0 cups 2.0 – 3.0 cups 2.0 – 2.5 cups 1.5 – 2.5 cups 1.0 – 1.5 cups [2000 kcal = 2.5 cups]	Potassium Fiber Magnesium Vitamins A,C,K (Folate, women of childbearing age)

NCI, 2009

Food Groups of Concern

Findings—vegetable subgroups:

Dark-green and leafy	Males, 19+ y Females, 19+ y Children, 9-18 y, m+f Children, 4-8 y, m+f Children, 2-3 y, m+f	0.05 cups 0.08 cups 0.01-0.03 cups 0.01 cups 0.01 cups	0.21-0.36 c/d (1.5-2.5 c/wk) 0.21-0.29 c/d (1.5-2.0 c/wk) 0.21-0.36 c/d (1.5-2.5 c/wk) 0.14-0.21 c/d (1.0-1.5 c/wk) 0.07-0.14 c/d (0.5-1.0 c/wk)	Potassium Calcium,Fiber, Magnesium Vitamins A,C K (Folate, women of childbearing age)
Red-Orange (tomatoes plus orange vegetables)	Males, 19+ y Females, 19+ y Children, 9-18 y, m+f Children, 4-8 y, m+f Children, 2-3 y, m+f	0.44 cups 0.34 cups 0.26-0.43 cups 0.24 cups 0.18 cups	0.79-1.07 c/d (5.5-7.5 c/wk) 0.57-0.86 c/d (4.0-6.0 c/wk) 0.57-1.07 c/d (4.0-7.5 c/wk) 0.43-0.79 c/d (3.0-5.5 c/wk) 0.36-0.43 c/d (2.5-3.0 c/wk)	Potassium Fiber Vitamins A,C K
Dry beans and pas	Males, 19+ y Females, 19+ y Children, 9-18 y, m+f Children, 4-8 y, m+f Children, 2-3 y, m+f	0.08 cups 0.05 cups 0.03-0.04 cups 0.03 cups 0.02 cups	0.21-0.43 c/d (1.5-3.0 c/wk) 0.14-0.29 c/d (1.0-2.0 c/wk) 0.14-0.43 c/d (1.0-3.0 c/wk) 0.07-0.21 c/d (0.5-1.5 c/wk) 0.07 c/d (0.5 c/wk)	Calcium, Fiber, Magnesium Potassium (Folate, women of childbearing age) (Phosphorus, teen and young adult women)
Potatoes plus other starchy vegetables	Males, 19+ y Females, 19+ y Children, 9-18 y, m+f Children, 4-8 y, m+f Children, 2-3 y, m+f	0.52 cups 0.36 cups 0.36-0.49 cups 0.31 cups 0.24 cups	0.71-1.14 c/d (5.0-8.0 c/wk) 0.57-0.86 c/d (4.0-6.0 c/wk) 0.57-1.14 c/d (4.0-8.0 c/wk) 0.50-0.71 c/d (3.5-5.0 c/wk) 0.29-0.50 c/d (2.0-3.5 c/wk)	Potassium Magnesium Fiber Vitamin C
Other vegetables	**Males, 19+ y** **Females, 19+ y** Children, 9-18 y, m+f Children, 4-8 y, m+f Children, 2-3 y, m+f	**0.59 cups** **0.51 cups** 0.25-0.35 cups 0.17 cups 0.12 cups	**0.57-1.00 c/d (4.0-7.0 c/wk)** **0.50-0.86 c/d (3.5-6.0 c/wk)** 0.50-1.00 c/d (3.5-7.0 c/wk) 0.36-0.57 c/d (2.5-4.0 c/wk) 0.21-0.36 c/d (1.5-2.5 c/wk)	Potassium Fiber Vitamin C

Nutrient Adequacy Subcommittee

2010 Dietary Guidelines Advisory Committee NCI, 2009

2010

Meeting 5, April 13-14, 2010

Canned, Fresh, Frozen, Dried: All Forms Fit

Canning Locks "Goodness" In

Canned, Fresh, Frozen: Nutritionally Similar

- Many fruits & vegetables: high in carotenoids, vitamin C, folate, potassium
- Canned, fresh, frozen: comparable in nutrients & fiber, as prepared for the table
- Canning: no effect on fiber content; may make fiber more soluble
- Canned foods: excellent alternatives to fresh and frozen, providing nutrients expected from their food group
- If a food is labeled as high in a nutrient, then the form (canned, frozen, or fresh) won't alter that.

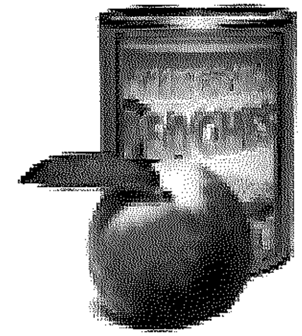
Source: "Nutrient Conservation in Canned, Frozen and Fresh Foods." University of Illinois, 1997. For a full report, www.mealtime.org

Canned, Fresh, Frozen: Nutritionally Similar

- A healthy eating pattern includes a variety of fruits and vegetables.
- All forms contribute good nutrition.
- For some nutrients, canned fruits/vegetables provide more than fresh.
- Exclusively recommending one form over another ignores the benefits of each and limits consumer choice.
- By the time food is consumed, all forms may be nutritionally similar.

Source: Rickman et al. "Nutritional Comparison of Fresh, Frozen and Canned Fruits and Vegetables," *Journal of the Science of Food and Agriculture,* March and April, 2007

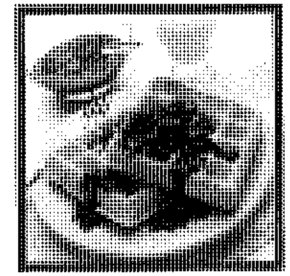
In the Can: "Phytos" Peach Nutrition Study



- Certain key nutrients increase with canning freezing.
- Carotenoid levels (carotene and lycopene) significantly increase with canning and freezing.
  - Canned peaches: 7x higher than in fresh
  - Frozen peaches: 10x higher than in fresh
- Vitamin E were higher after processing.
  - Canned peaches: 2.5x higher than in fresh
  - Frozen peaches: 3.7x higher than in fresh
- Picked at optimum nutrition, processing locks in key nutrients and retains them until served.

Source: Durst. Oregon State University, Linus Pauling Institute, 2009 (Reported in Hudgins, "Let's Can the Nutrition Misperceptions," *Cling Peach Review*, Fall/Winter 2009

In the Can: "Phytos" More Evidence



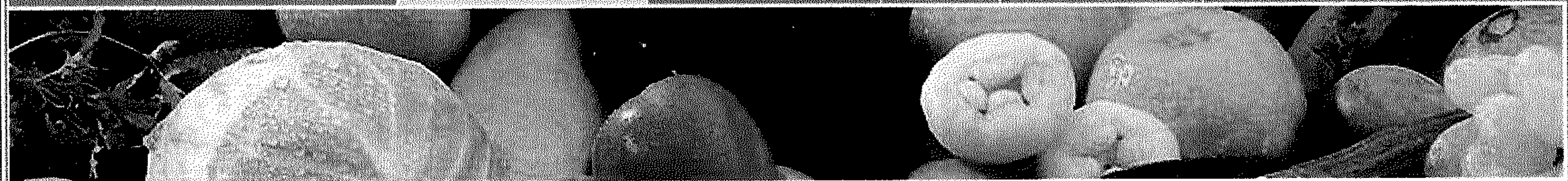
Flavonoids: canned, fresh and frozen blueberries

- Blueberries: antioxidant power, regardless of form
- Canning: no diminished levels of flavonoids measured
- Some flavonoid levels: canned blueberries slightly higher
- Juices in canned blueberries: deliver antioxidants

Implications:

- Canned blueberries: year-round source of antioxidants
- Unique research design: can apply to comparing phytonutrient levels in processed and fresh forms of other fruits/vegetables

Source: Oregon Health Sciences University Phytonutrient Study 2004, with analysis by U.S. Department of Agriculture



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Why Fruits & Veggies
Fruit & Vegetable Nutrition
Top 10 Reasons to Eat MORE Fruits & Vegetables
Fruit & Vegetable Storage 101
In the News: Fruits & Vegetables
Nut Nutrition Database
Diet & Exercise: The Role of Fruits & Vegetables
About Us

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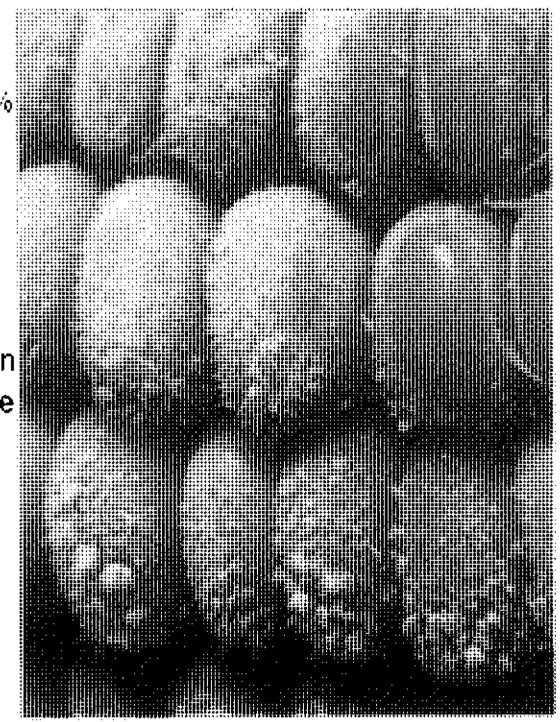
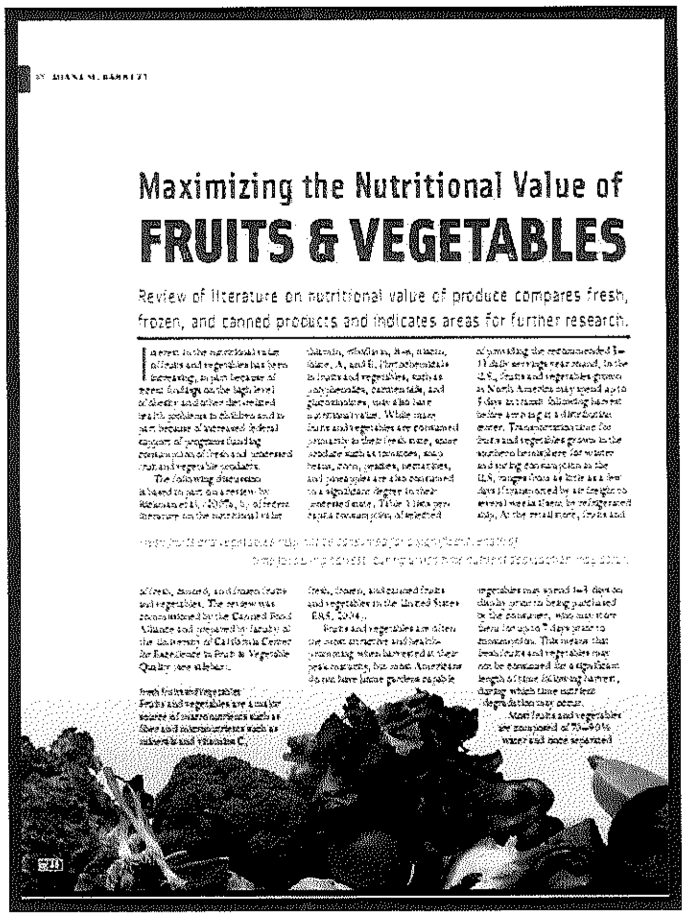
Shortcuts

Fresh, Frozen, Canned, Dried and 100% Juice: All Forms of Fruits & Vegetables Matter!



When it comes to good nutrition, **all forms of fruits and vegetables matter—fresh, frozen, canned, dried and 100% juice.** With 200+ options and a variety of convenient packaging to make fruits and vegetables easy to store and easy to serve, there's bound to be something to please everyone!

- Most **frozen and canned foods** are processed within hours of harvest, so their **flavor and nutritional value are preserved**.
- Studies show that recipes prepared with **canned foods** had similar nutritional values to those prepared with fresh or frozen ingredients.
- Canned foods are "cooked" prior to packaging, so they
are **recipe-ready**.
- **Frozen foods** also require little preparation—washing



Maximizing the Nutritional Value of

FRUITS & VEGETABLES

Review of literature on nutritional value of produce compares fresh, frozen, and canned products and indicates areas for further research.

Maximizing the Benefits

Taste Matters!

- Harvested and packed at peak quality
- Flavor is shelf stable
  - Unopened, retains peak flavor for about 2 years
- Great year round flavor
- Smart food prep skills retained canned foods' flavor and nutrition

Canned Foods: Deliver Flavor + Nutrition

Dishes made with canned, fresh and/or frozen ingredients:

- Similar nutrient profiles
- Similar flavor perception

Implications:

- Ingredients, not their form, determine a recipe's nutrient content
- Good preparation, not ingredient form, determines flavor qualities

Source: University of Massachusetts Nutrition Study 2000, 40 dishes made with fruits, vegetables, soups, chili, meats, fish and chicken

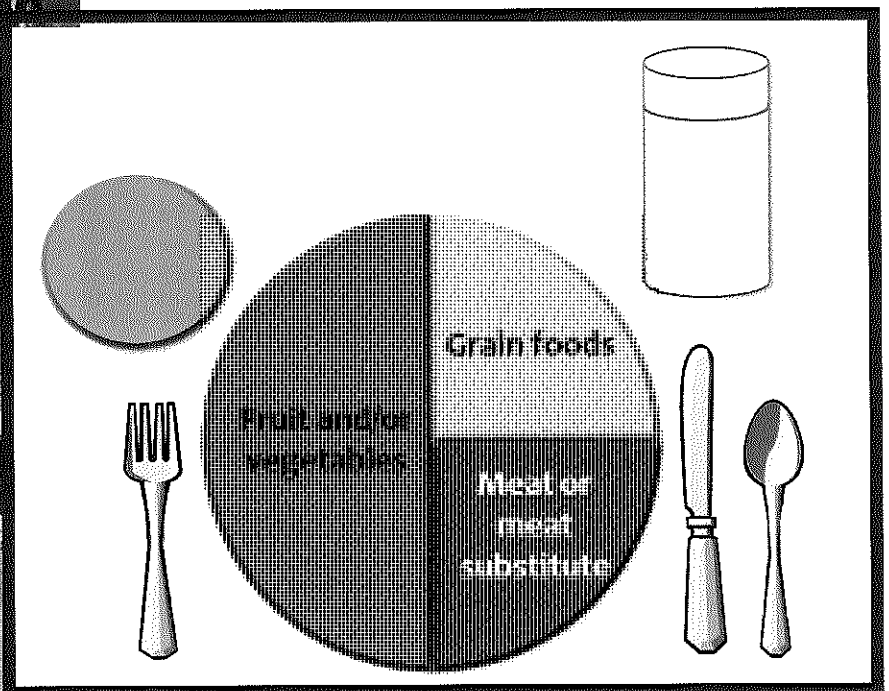
Processed Fruits/Vegetables: Convenient Nutrition

- Always available
- Many choices, nutrition-positioned
  - Packed in juice, light syrup, extra light fruit (fruit)
  - No-salt added, traditional (vegetables, broth, beans)
- Simple prep
  - Ready-to-eat and/or -heat solutions: fruits, veggies, beans

Canned Fruit and Vegetables: Safe to the Plate

- Sterile; free of micro-organisms
- No preservatives needed
- Tamper-proof containers
- Recyclable containers

Menu Planning: More Plant-Based Foods



A healthful plate is …

- ½ fruits and/or veggies
- ¼ lean protein food
- ¼ nutrient-rich "carb" food

Low-fat/fat-free dairy foods in a drink/salad/appetizer/dessert

Looks Like This!
More Plant–Based Foods

A healthful plate is ...

- ½ fruits and/or veggies
- ¼ lean protein food
- ¼ nutrient-rich “carb” food

Low-fat/fat-free dairy foods in a drink/salad/ appetizer/dessert

Image: Thai Curried Chicken with California Cling Peaches, California Cling Peach Board

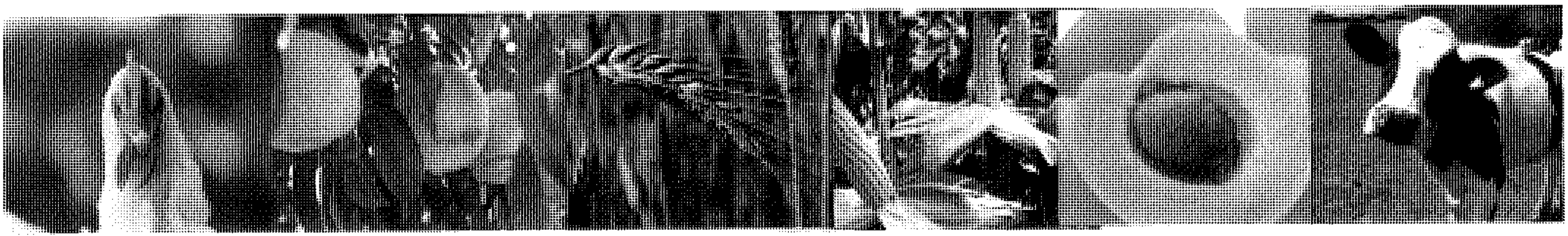
Bottom Line

- ✓ Fruits/ vegetables are health essentials.
  - ✓ Canned, frozen, fresh, dried: they're nutritionally comparable when served.
- ✓ Use the form that works for your food service.
- ✓ For nutrition, convenience, affordability, safety, and flavor, processed fruit fits for school/child nutrition.

✓ From farm to table, we're partners in promoting health and reducing health risks, including obesity, affecting our youth and adult consumers.

Valued Food Commodities

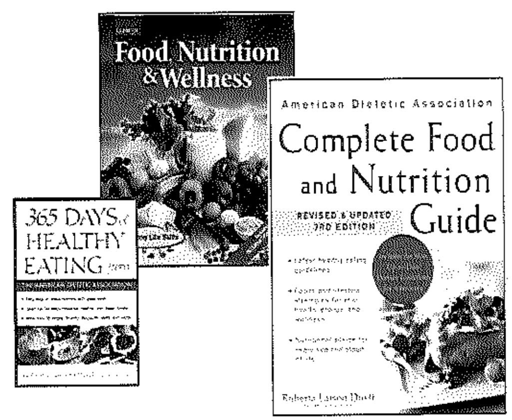
Fruit & Vegetable Nutrition, Convenience, Affordability



IT'S IN THE CAN!

Agriculture Commodity Distribution Association
April 19, 2010

Roberta L. Duyff, MS, RD, FADA, CFCS
Food and Nutrition Consultant/Author
Duyff Associates, St. Louis, MO
Duyff Associates, 2010



How Commodities Impact Agricultural Groups: The Grower's Perspective

Very brief overview of the following…

- Family farms and processors = "industry"
- "Know Your Farmer, Know Your Food"
- Income & food dollars
- Commodity program and recent peach Bonus Buy
- American agriculture's changing landscape
- Growing a better future together: USDA and family farmers

FAMILY FARMS + PROCESSORS = "INDUSTRY"

- Generations-old family farms
- Stewards of the land
- Commitment to sustainability
- Community-based processors and handlers

INDUSTRY + USDA = SCHOOL FEEDING PROGRAMS

HOW COMMODITIES IMPACT AGRICULTURAL GROUPS

Excerpts of Secretary Vilsack's Remarks
Agricultural Outlook Forum Feb 26, 2009

You will see USDA make a major effort to try to encourage Americans, particularly America's children, to consume more fruits, vegetables, nuts, and specialty crops.

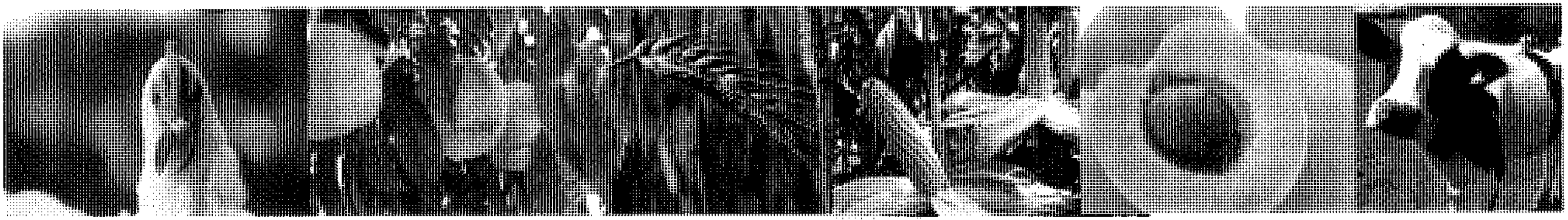
So you're going to see a major push from USDA to encourage, as we reauthorize the School Lunch Program and the School Breakfast Program, an embracing of fruits and vegetables and specialty crops, nutritious food, consistent with the President's direction, good for those small producers.

Excerpts of Secretary Vilsack's Remarks
at March 9, 2009 Press Conference

I think it is important for us to send a message that we are very interested in promoting fruits and vegetables in a variety of different forms to get more integrated into the school lunch, school breakfast, and school snack programs, as well as after-school programs, as well as in childcare facilities throughout the country.

There are multiple reasons why this is important. First and foremost, it's about improving the diets of young people. When 35 to 36 percent of our young people are at risk of being overweight or are in fact overweight, that creates a real problem today and well into the future with the onset of juvenile diabetes and what that can mean for those youngsters as they enter into adulthood. It is part of our health care crisis and part of a strategy for reducing health care costs in this country...

But I think it's very, very important for us to make a commitment to fruits and vegetables in a multitude of forms as part of the school lunch, school breakfast, and school snacks.



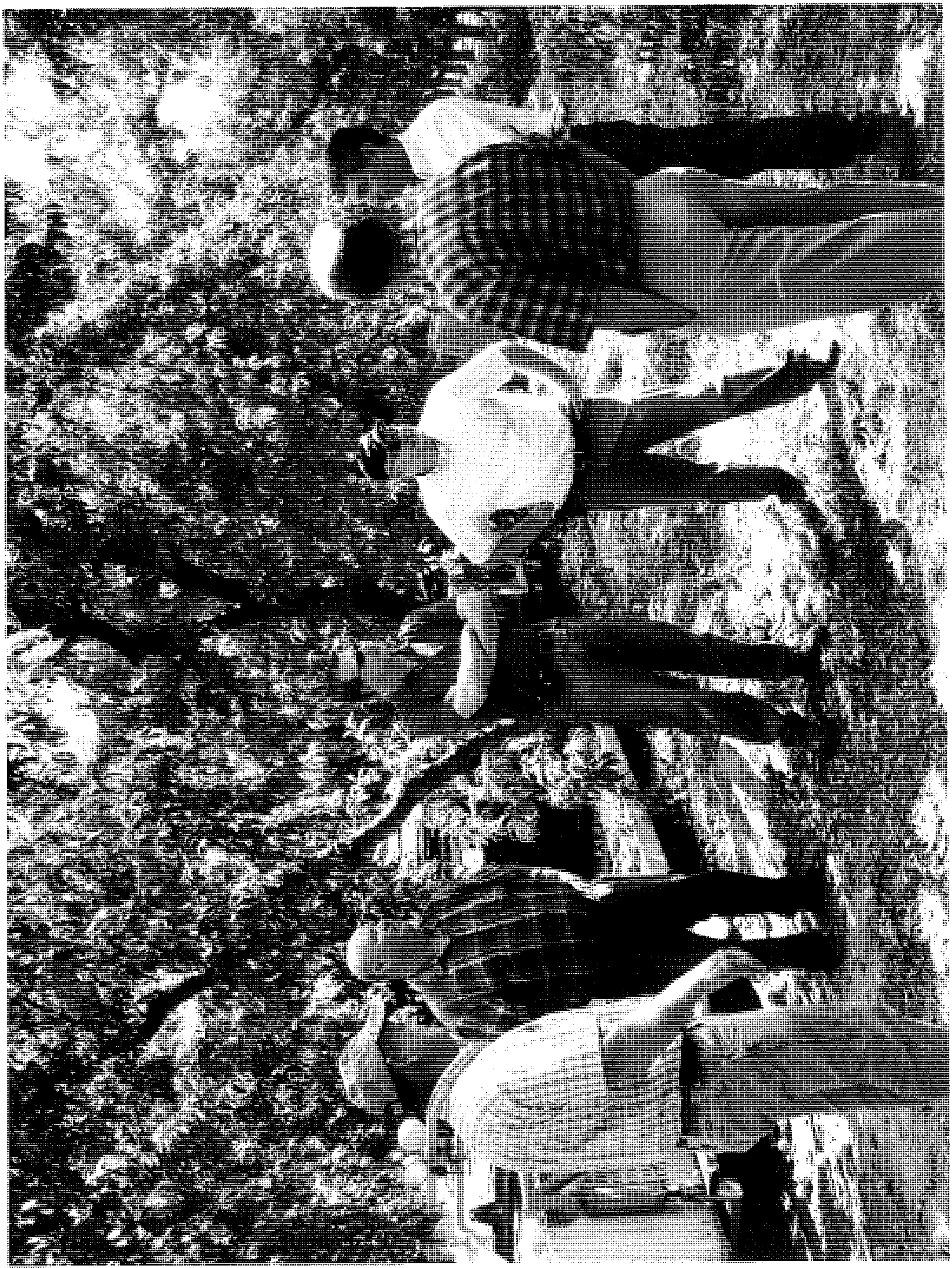
Excerpts of Interview with Deputy Secretary Kathleen Merrigan

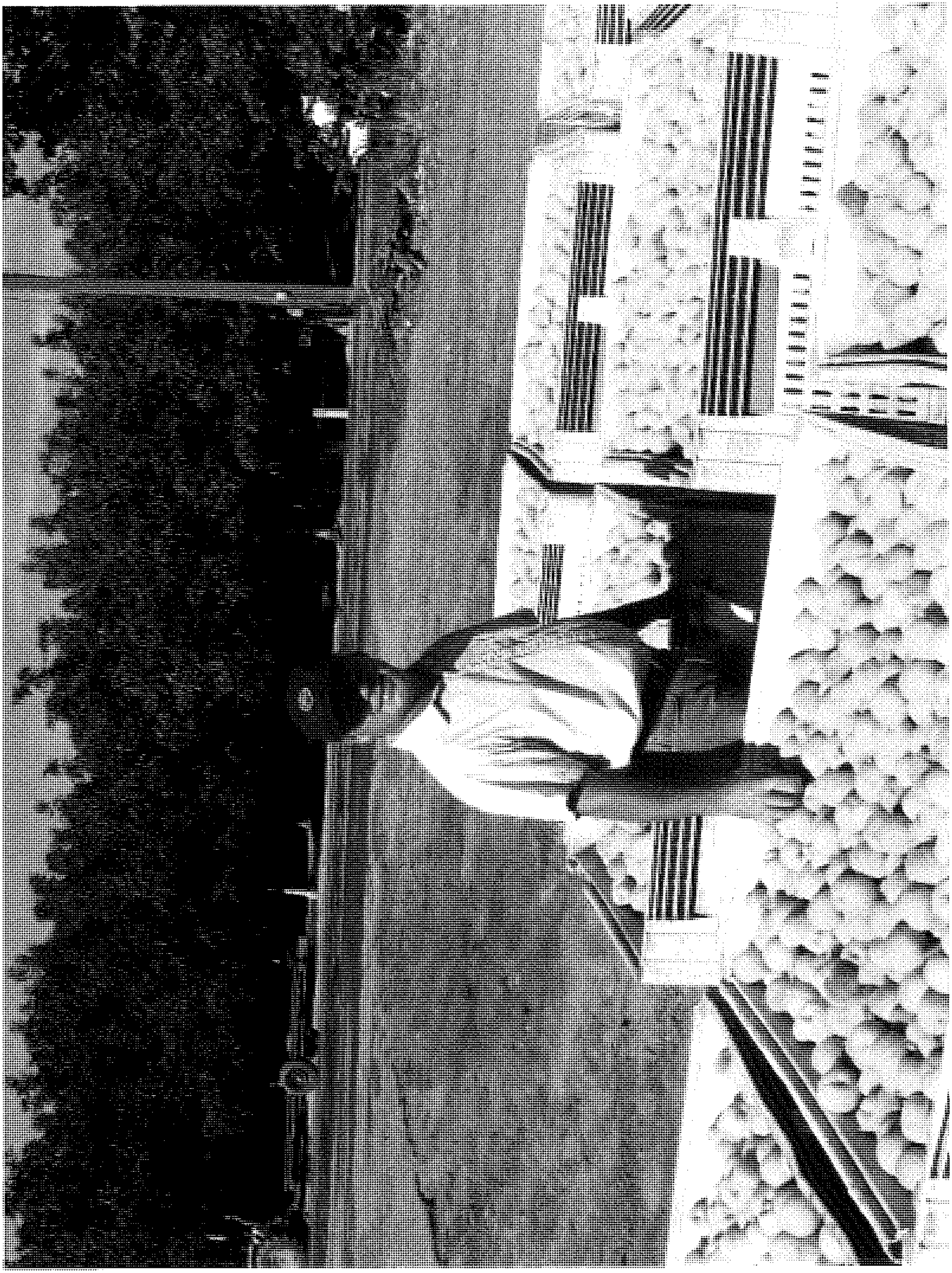
July 30, 2009

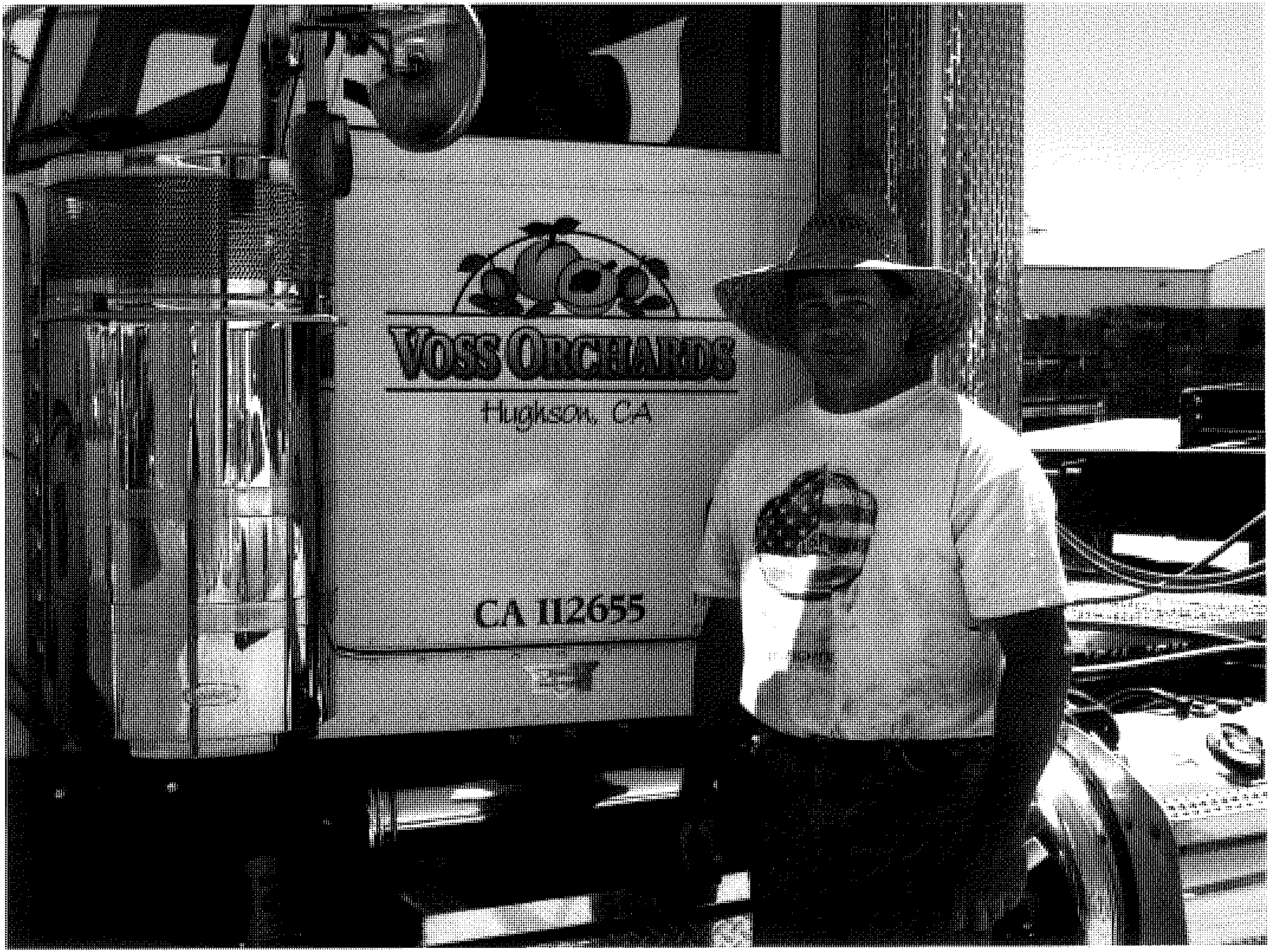
"Fruits and Vegetables need to have a bigger role in Americans' diets. We are going to be looking at all kinds of ways to make this happen.

We are looking for innovative ways to get more fruits and vegetables into our school lunch and breakfast programs... I can say with certainty that President Obama, Secretary Vilsack and I are really concerned about the small and medium-sized farming operations.

We are concerned about the health and vitality of the fruit and vegetable industry."



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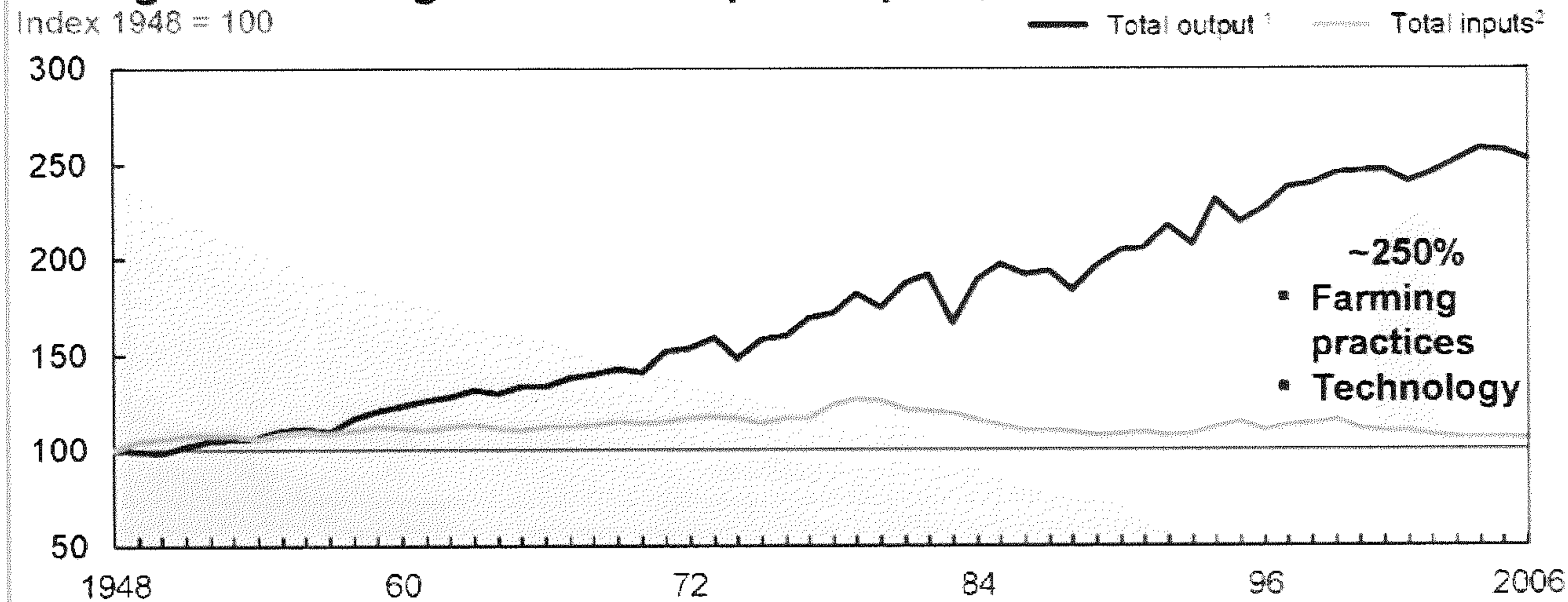
U.S. Agricultural Productivity Has Increased Nearly 250% Over The Last 60 Years

Changes in U.S. agricultural output / inputs, since 1948



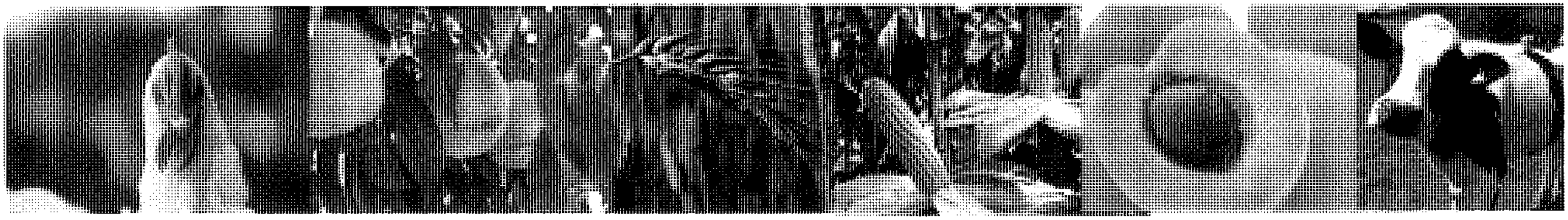
- In 1930, one farmer fed **10 people**
- Today, one farmer feeds **155 people**

- In 1930, agriculture employed **22% of the US workforce**
- Today, it employs **2%**

- In 1930, % of income spent on food was **25%**
- Today, % of income spent on food is **10%**[3]

1 Total output is an aggregation of crop and livestock commodities and related services
2 Total input is an aggregation of land, labor, capital and intermediate inputs like fertilizer, feed and seed
3 Disposable income spent on all food-related purchases, in and out of the home. This number falls to <6% when only home consumption is considered.

SOURCE: Productivity Growth in US Agriculture, USDA (2007); Economic Research Service, American Farm Bureau Federation



Commodity Program & Peach Bonus Buy

Example of What's Happening Now:

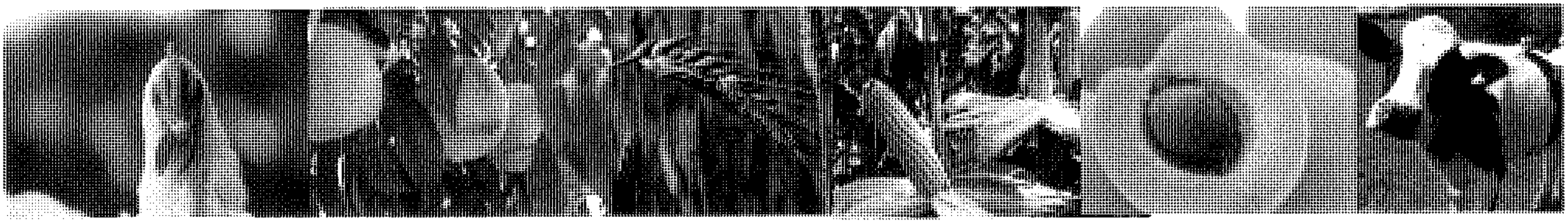
Productivity is a Double-Edged Sword:

- 2009 peach crop resulted in surplus
- Canned peach Bonus Buy was very important to address oversupply

The Importance of Timing in USDA Purchases

- The key is early timing for USDA purchase announcements and bid awards.
  - Processors no longer routinely pack entire crop.
  - Non-commercial pack sizes and packing mediums exacerbate supply problems and result in higher costs.
  - IDIQ issue for non-commercial items.

- Bids awarded prior to commencement of harvest and packing operations allows growers to sell surplus product which otherwise may not be harvested.



Importance of the School Feeding Programs

REMEMBER…NATIONAL SCHOOL LUNCH ACT'S DUAL MISSION:

- Strengthen the Nation's nutrition safety net by providing nutritious meals to school children
- Support American Agricultural markets by donating commodities for use in USDA feeding programs

THE FOUNDATION OF THE USDA'S COMMODITY PROGRAMS IS THE AMERICAN FARMER.

How Commodities Impact Agricultural Groups

Impact of USDA Feeding Programs on American Agriculture

- Economic challenges faced by farmers
- Stabilizes supplies and farmer pricing
- Provides a safety net while a commodity is developing new markets
- Keeps the “American” in agriculture

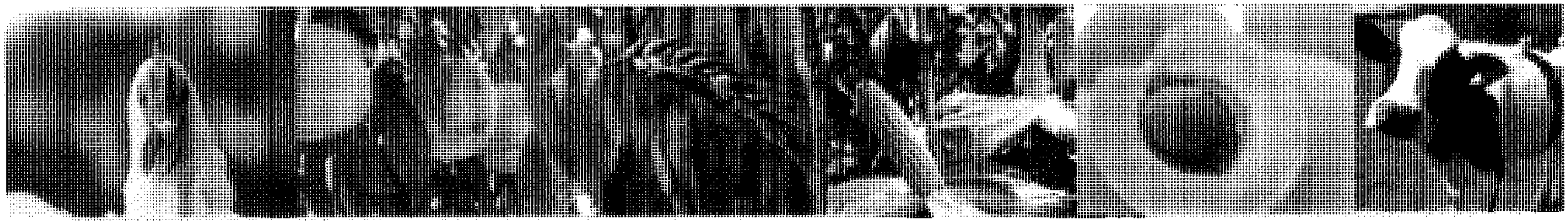
Inside the Life of a Farmer

Farm Income:

- Today: For every $1.00 spend on food; farmer receives 20 cents
- 30 Years Ago: farmer received 31 cents
- 50 Years Ago: farmer received 41 cents

What Impacts Farm Gate Pricing:

- Function of supply and demand
- Cannot control farm production like consumer products production
- All production has a fixed shelf life
- Fewer government support programs
- Weather, labor, water, transportation, imports, etc.



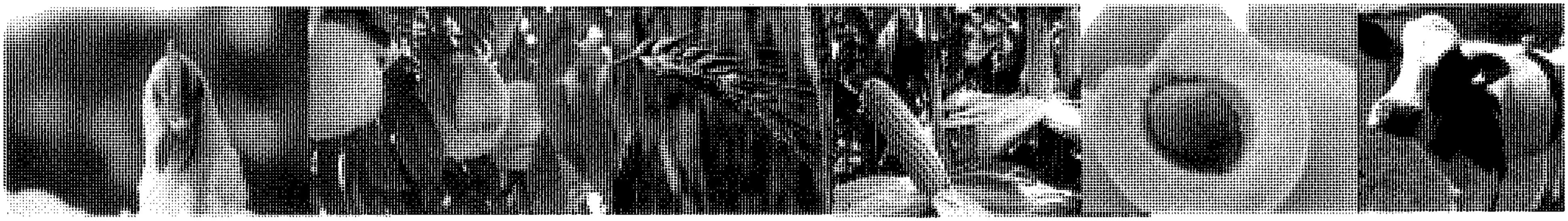
Income & Food Dollar$

Percentage of Income Spent on Food:

- "US: less than 10%
- High income countries: 16%
- Middle income countries: 35%
- Low income countries: 55%

Where the Food Dollar is Spent:

- Today: 50% is spent away from home
- 30 Years Ago: 34% spent away from home
- 50 Years Ago: 25% spent away from home



American Agriculture's Changing Landscape

What's Happened in the Last 40 Years…

- Numbers of producers and processors has reduced
- Peach/Apricot canning sector has gone from 26 processors 50 years ago to 3 today
- To ensure supply, USDA must make purchases earlier

- **Agriculture & USDA must do a better job of communicating**
- **Challenges of today demand a renewed partnership and commitment**

The Future of American Agriculture

Or…How Important is the Commodity Program to ALL of American Ag?

- Program has kept many fruits and vegetables in production
- With emphasis on increasing consumption, impact becomes greater
- Dairy farmers are facing greatest hardships in history; commodity program is key
- Livestock producers are facing smallest profit margins in history
- Grain producers are facing similar challenges

American Agriculture IS Worth the Investment.

In Summary…

USDA Commodity Program is Essential to the Survival of American Agriculture

Buying American Commodities IS Buying Local

All Forms Count: Canned, Frozen, Fresh, Dried & 100% Juice
ALL Offer Key Nutrients

THANK YOU!

QUESTIONS AND COMMENTS…

Attachment No. 9

Comparative pH Evaluation
of
Fresh Field Peaches
with
Potassium Hydroxide Lye Peeled Peaches

(1 Page Attached)

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Attachment No. 10

Potassium Levels
in
Raw and Processed Peaches
Conducted
at the National Food Lab

(2 Pages Attached)

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Attachment No. 10, pages 1 through 2 (of 2) have been CBI-deleted.