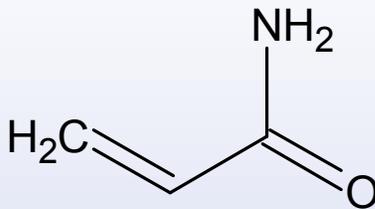


Acrylamide-related Research and Information Brought to OEHHA's Attention



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Sources of Information

- **Public submissions to OEHHA**
- **U.S. Food and Drug Administration (FDA)**
 - **compiled internet links for FDA activities and information**
- **World Health Organization and the Food and Agriculture Organization (WHO/FAO) Infonet**
- **European Commission Database of Activities**
- **Published literature**



Acrylamide Levels in Foods

- **FDA - extensive testing of U.S. food supply**
 - 2 interim reports to date, JIFSAN contract for private lab testing, Total Diet Study planned (hundreds of samples)
- **Environmental World Watch, Inc – California foods**
- **Measurements in foods from other countries:**
 - Sweden, UK, Germany, Canada, Norway, Switzerland, Japan, Jordan, Korea, Australia, Italy, Belgium, Finland, Ireland, Netherlands, Denmark, Austria, France
- **Extensive worldwide effort to develop and standardize methods of analysis**



Food stock, food storage and modulation of acrylamide through cooking practices and processes

- **FDA**
 - NCFST – acrylamide formation, including home cooking.
 - JIFSAN consortium-sponsored academic research
- **Private industry**
 - Procter and Gamble (mechanisms of formation)
 - Frito Lay (reaction variables in food preparation)
 - Nestle Research Center (Maillard reaction)



Acrylamide Formation and Reduction (continued)

- **Academic research**

- Univ. Madison-Wisconsin -- compilation of studies regarding asparagine levels in various food stocks and changes in asparagine levels from storage, irradiation, and other process variables (Env. World Watch submission).
- Univ. Madison-Wisconsin - mechanisms of formation, food engineering
- Univ. Reading, UK – Maillard reaction/acrylamide formation.
- Stockholm Univ. – acrylamide formation, reaction variables
- McGill Univ. -- asparagine conversion to acrylamide
- Univ. Arkansas - effect of frying on food quality and safety
- Instituto del Frio – reduce acrylamide in cooking and processing



Acrylamide Formation and Reduction (continued)

- **Ongoing research at other governmental organizations**
 - **Health Canada**
 - **Finland**
 - **Germany**
 - **Norway (several groups)**
 - **Sweden**
 - **U.K. (several projects)**



Food Consumption Amounts and Patterns (Dietary Assessment)

- **FDA**
 - CFSAN researchers estimating U.S. intake of acrylamide (distributional analyses, and by age)
 - Apply acrylamide residue data to existing food consumption databases developed by U.S. Department of Agriculture and others.
- **Intake assessments in other countries**
 - Norway
 - Sweden
 - Denmark
 - Ireland
 - Belgium (probabilistic exposure assessment)
 - France



Assessing Acrylamide Cancer Potency and Risk (e.g., bioavailability, sensitive populations, and biomarkers)

- **FDA – NCTR - NTP**

- extensive toxicology testing, including cancer studies in mice and rats, neonatal exposure cancer studies, mechanistic and toxicokinetic studies, bioavailability, DNA and protein adducts, developmental neurotox testing, *in vivo* mutagenicity, CYP2E1-knockout mouse studies.
- study of background acrylamide adducts in rats and humans – food, smoking
- human volunteer studies of acrylamide and glycidamide Hb-adduct formation
- investigating the feasibility of large epidemiological study using stored biological samples (i.e., nested case-control study).
- FDA risk assessment planned



Assessing Acrylamide Cancer Potency and Risk (continued)

- **U.S. Centers for Disease Control (CDC)**
 - NHANES – Hb adducts to be measured in U.S. pop.
 - Possible NIOSH worker study
- **Private Industry**
 - Research Triangle Institute -- Hb adducts, interspecies metabolism
 - SNF-Floerger --toxicokinetics and Hb adducts of acrylamide following ingested by human volunteers
 - CIIT -- PBPK model (rat) and CYP2E1 knockout mouse study
 - DNA adduct studies (cited by S. Olin, ILSI)
 - Mechanisms of acrylamide carcinogenicity (reviews: KS Crump, Inc, 1999a,b;2000a,b; SNF Flocare, 2001) (several studies ongoing, sponsored by SNF-Floerger).



Assessing Acrylamide Cancer Potency (continued)

- **Academia**

- **Cohort worker study** (Marsh et al., 1999)
- **Case-control dietary study** (Mucci et al. 2003)
- **Bioavailability, kinetics, and breastmilk and urinary levels among human volunteers** (Sorgel et al., 2002)
- **Bioavailability of acrylamide from food (rodents)** (Tareke et al., 2000).
- **Dose-response of *in vivo* micronuclei formation** (Paulsson et al., 2002; 2003; Abramsson-Zetterberg, 2003)
- **Mechanisms of acrylamide carcinogenicity or genotoxicity** (Segerback 1995; Damjanov and Friedman, 1998; Khan et al., 1999; Park et al., 2002, others).
- **Biomarker data from Germany, Sweden, Korea** (Schettgen, 2002; 2003; Perez, 1999; Hagmar 2001, Tareke 2000).
- **Metabolism and kinetics studies in humans** (Stockholm University)



Assessing Acrylamide Cancer Potency and Risk (continued)

- **Governmental organizations in other countries**
 - **evaluation of acrylamide toxicity** (Australia, 2002).
 - **bioavailability studies** (Netherlands, France, Germany, Sweden).
 - **transgenic mouse mutagenicity and carcinogenicity study planned** (Netherlands)
 - **low dose toxicology studies** (Germany)
 - **in vivo and in vitro DNA damage studies planned** (France)
 - **consumption habits of adolescents** (Germany).
 - **risk assessment** (Germany).



California's Current Cancer Potency Estimate for Acrylamide

- **Cancer potency: $4.5 \text{ (mg/kg-d)}^{-1}$**
- **NSRL (10^{-5} lifetime risk) = $0.2 \text{ } \mu\text{g per day}$**
- **FDA estimate of mean U.S. intake = $26 \text{ } \mu\text{g per day}$**

- **CA Potency estimate adopted in 1990**
 - Adopted a 1989 U.S. EPA assessment (IRIS)
 - Based on multiple acrylamide-responding sites in a 2-year drinking water study in female rats.

- **Considerable amount of new data since 1989**



Risk Communication

- **FDA and WHO/FAO**
 - multiple scientific and public meetings
 - posted informational items on Websites
 - dietary advisories (which say: eat a balanced diet, don't overcook food, don't undercook food).

