Priority Research Needs Identified by the Working Groups

1. Working Group 1: Formation of acrylamide in foods

    - Need database on the quantity of free asparagine on a dried-weight basis for various foods (database - variety, crop conditions, storage) and data on the quantity of glucose, fructose (and other sugars) and amino acids other than asparagine for various foods.
    - Time/temperature/pH/moisture/surface area-mass mapping and kinetics of asparagine/carbonyls reaction in various matrices. May include mathematical modeling. Process investigations and study of the kinetics/pathways of acrylamide formation versus browning and flavor forming reactions.
    - Define the direct correlation of asparagine to acrylamide production in foods.
    - What are the kinetics of acrylamide inhibition/destruction/scavenging under various reaction/process conditions?
        a. Mixed amino acids competitive reactions or scavenging.
        b. Ammonium ion as a possible competitive agent.
        c. Glutathione/cysteine to promote sulfhydryls-disulfide interchange to provide scavengers.
        d. Irradiation
        e. Pressure processing
        f. Fermentation (e.g. yeast)
        g. Hydrolyzed nucleic acids
        h. Asparaginase conversion of asparagine to aspartic acid.

2. Working Group 2: Analytical methodology

    - Establish proficiency testing program and materials
    - Need data on acrylamide content for more foods
    - Is there a need to investigate analytical methods for asparagine, and other possible precursors in food?
    - Is bound acrylamide bioactive and, if so, do current methods extract all acrylamide (including "bound" acrylamide)?

3. Working Group 3: Exposure and Biomarkers

    - Expand database of acrylamide levels in U.S. foods through a clearinghouse for data and through collection of additional data to fill gaps.
    - Establish relationship between biomarker (Hb adducts) and acrylamide in foodstuffs including completion of proposed CDC study of both acrylamide and glycidamide in an on-going human study assessing the relationship between oral administration of acrylamide and the levels of hemoglobin (Hb) adducts.

- Determine the bioavailability of acrylamide and glycidamide found in selected foods in an animal study (availability may be different in different foods).
- Determine glycidamide levels in foods that also contain high concentrations of acrylamide.

4. Working Group 4: Toxicology and Metabolic Consequences

- Metabolism and Kinetics
  - Collect metabolic fate and kinetic data in humans, including bioavailability from foods
  - Develop further information on the critical events and dose metrics related to the mode(s) of action at relevant doses for the key toxicities of acrylamide
- Genetic Toxicity
  - Investigate the formation of adducts of acrylamide or glycidamide with DNA and significant nuclear proteins (for example, protamine or chromosomal motor proteins), especially at critical target sites such as sites of tumor formation and male germ cells
- Reproductive and Developmental Toxicity
  - Develop dose-response data for germ cell toxicity that includes consideration of the relevant doses for acrylamide ingestion in food
  - Improve the weight-of-evidence regarding neurodevelopmental effects at doses relevant to those expected in food and establish a NOAEL for those effects
- Carcinogenicity
  - Convene an expert pathology working group to review the histology slides from existing carcinogenicity studies using updated diagnostic criteria
  - Investigate the mechanism of thyroid tumor induction by acrylamide
- Neurotoxicity
  - Evaluate the relationship between dose, duration, and effect-levels and onset of neurotoxicity in animal studies
- Epidemiology
  - Evaluate sperm chromosomal abnormalities (morphology and quality, if practical) in previously evaluated worker cohorts or other highly exposed populations

5. Working Group 5: Risk Communication

- Attitudinal research
- Information clearinghouse and evidence review
- Communication programs