

US EPA ARCHIVE DOCUMENT

SCIENTIFIC ADVISORY PANEL (SAP)

OPEN MEETING

OCTOBER 24, 2001

VOLUME I

Located at: Sheraton Crystal City Hotel
1800 Jefferson Davis Highway
Arlington, VA 22202

Reported by: Frances M. Freeman

2

1

C O N T E N T S

2

3

Proceedings.....Page 3

3

1 DR. ROBERTS: I would like to open
2 this Wednesday, October 24th, meeting of the
3 Scientific Advisory Panel.

4 In case there are some members of
5 the audience who were not here yesterday, we
6 need to go through a few administrative things
7 to begin, and first of all, I would like to
8 ask our designated federal official for this
9 meeting, Ms. Olga Odiott, if she has any
10 announcements and instructions for the panel.

11 MS. ODIOTT: Thank you, Dr. Roberts.

12 Welcome, everybody. And by way of
13 background, the FIFRA SAP provides advice,
14 information and recommendations to the agency
15 on pesticides and pesticide-related issues
16 regarding the impact of regulatory actions on
17 health and the environment.

18 I would like to welcome the panel
19 members and I would like to thank the panel
20 members for agreeing to serve and for their
21 time and effort in preparing for this meeting.

4

1 I also want to say thank you for the
2 representatives from other federal agencies
3 for their support, their involvement and the
4 active role that they have played in preparing
5 for today's SAP meeting.

6 We have a full agenda for today and
7 tomorrow. And I just want to remind everybody
8 that the meeting times on the agenda are
9 approximate.

10 We have a significant number of public
11 commenters and the time is very limited. So
12 for members of the public requesting time to
13 provide oral comments, we request that they
14 limit their comments to five minutes as
15 indicated in the federal register notice
16 announcing the meeting.

17 Also, please direct your comments to
18 the subject matter relevant to this meeting.
19 This will allow adequate time for all public
20 commenters and an opportunity for them to
21 present to the FIFRA SAP.

5

1 We have asked the public to provide
2 written comments of the topics or issues that
3 are presented in advance of the meeting, and
4 these comments have been provided to the panel
5 for their review and their analyses.

6 All the background materials, all the
7 question posed to the panel by the agency and
8 all other document that are related to this
9 SAP meeting are available in the OPP dockets.
10 The overheads will be available in a few days.
11 And the background documents are also
12 available on the EPA web site. The agenda
13 lists the contact information for such
14 documents.

15 As a designated federal official, I
16 work with the appropriate agency officials to
17 ensure that all appropriate ethics regulations
18 are satisfied. In that capacity, panel
19 members are briefed with the provisions of the
20 federal conflict of interest laws.

21 Each participant has filed a standard

6

1 government ethics report and I, along with the
2 other deputy ethics officer for the Office of
3 Prevention, Pesticides and Toxic Substances,
4 and in consultation with the Office of the
5 General Counsel have reviewed the report to
6 ensure that all ethics requirements are met.

7 For press members that have questions
8 about today's meeting, Mr. David Deegan is
9 available to assist you. Mr. Deegan is right
10 here. Thank you.

11 And like we said yesterday at the
12 conclusion of the meeting, the panel will
13 prepare a written report that serves basically
14 as meeting minutes, and that report will be
15 available in approximately 30 days. Thank
16 you.

17 DR. ROBERTS: Before we get started
18 today, we need to introduce the panel members
19 again. So let me just ask the panel members,
20 beginning to my immediate right with
21 Dr. Freeman to just go around the table and

7

1 state your name, affiliation and, briefly,
2 your expertise relative to our topic.

3 DR. FREEMAN: My name is Natalie
4 Freeman. I'm at Robert Wood Johnson Medical
5 School and the Environmental and Occupational
6 Health Sciences Institute in Piscataway, New
7 Jersey. And my areas of research are
8 children's exposure to environmental
9 contaminants and the role of activity patterns
10 as they relate to exposure.

11 DR. MacDONALD: I'm Peter MacDonald,
12 professor mathematics and statistics at
13 McMaster University in Canada. And my
14 expertise is a general expertise in applied
15 statistics.

16 DR. KOSNETT: I'm Michael Kosnett.
17 I'm an associate clinical professor at the
18 University of Colorado Health Sciences Center.
19 And I'm a physician, specializing in
20 occupational and environment toxicology.

21 DR. GINSBERG: Gary Ginsberg with the

8

1 Connecticut Department of Public Health.
2 Teaching affiliations with Yale and the
3 University of Connecticut Health Center with
4 specialization in children's pharmacokinetics.

5 DR. KISSEL: I'm John Kissel. I'm in
6 the Department of Environmental Health at the
7 University of Washington in Seattle. And my
8 research area is human exposure assessment.

9 DR. GORDON: I'm Terri Gordon, NYU.

10 DR. LEES: Good morning. My name is
11 Peter Lees from Johns Hopkins University
12 School of Public Health. I am an industrial
13 hygienist with expertise in exposure
14 assessment, mostly chromium exposure
15 assessment, usually related to epidemiologic
16 studies.

17 DR. HOPENHAYN-RICH: I'm Claudia
18 Hopenhayn-Rich, an associate professor at the
19 University of Kentucky, Department of
20 Preventive Medicine and Environmental Health.
21 I'm an epidemiologist and my expertise

9

1 includes a number of epidemiologic studies of
2 arsenic exposure in drinking water.

3 DR. LEIDY: Good morning. I'm Ross
4 Leidy from the Pesticide Residue Research
5 Laboratory at North Carolina State University
6 in Raleigh, North Carolina.

7 We deal with non-food source exposures
8 following pesticide applications in and around
9 structures and are interested in the movement
10 of pesticides from urban and rural
11 environments into public drinking water
12 supplies.

13 DR. SOLO-GABRIELE: I'm Helena
14 Solo-Gabriele. I'm an associate professor at
15 the University of Miami. I'm a civil
16 environmental engineer. And my area of
17 expertise is in the environmental aspects or
18 impacts of CCA-treated wood.

19 DR. BATES: I'm Michael Bates. I'm
20 from the School of Public Health, University
21 of California at Berkeley. I'm an

10

1 epidemiologist with a background in
2 toxicology.

3 DR. STYBLO: I'm Miroslav Styblo. I'm
4 a research assistant professor with the
5 Department of Pediatrics School of Medicine
6 and Department of Nutrition, School of Public
7 Health at the University of North Carolina at
8 Chapel Hill. And I am involved in the
9 research of arsenic metabolism and the
10 mechanism of toxic and carcinogenic effects of
11 arsenic.

12 DR. STEINBERG: I'm J.J. Steinberg.
13 I'm a professor at the Albert Einstein College
14 of Medicine. I'm in the faculty of pathology.
15 I work on DNA toxicology and I am involved in
16 environmental public health.

17 DR. CHOU: I'm Karen Chou from
18 Michigan State University. I'm in the
19 Department of Animal Science, Agriculture and
20 Natural Resources, and also with the Institute
21 for Environmental Toxicology and the Institute

11

1 of International Health in the College of
2 Osteopathic Medicine. I am an environmental
3 toxicologist.

4 DR. MUSHAK: I'm Paul Mushak. I'm a
5 toxicologist and health risk assessor. I
6 direct a tox practice and I'm also a visiting
7 professor of pediatrics at Einstein in the
8 Bronx.

9 My area of expertise over the last 35
10 years, I guess, is exposure assessment and
11 toxicokinetic aspects of exposures in children
12 and young animals.

13 DR. FRANCOIS: My name is Rony
14 Francois. I'm an occupational medicine
15 physician and an assistant professor at the
16 University of South Florida College of Public
17 Health in Tampa, Florida. My areas include
18 toxicology and exposure assessment.

19 DR. SMITH: My name is Andrew Smith.
20 I'm an environmental health scientist and a
21 risk assessor and director of the

12

1 environmental toxicology program within the
2 Maine Department of Human Services Bureau of
3 Health. And my office has had some
4 involvement in evaluating children's exposure
5 both to arsenic in water as well as
6 pressure-treated wood.

7 DR. SHI: I'm Xianglin Shi from
8 National Institute of Occupational Safety and
9 Health. I'm also adjunct professor at West
10 Virginia University.

11 My laboratory studies molecular
12 mechanism of metal toxicity and
13 carcinogenesis.

14 DR. MORRY: I'm David Morry. I am a
15 toxicologist and risk assessor for the State
16 of California, the California Environmental
17 Protection Agency.

18 I did the risk assessment for chromium
19 in drinking water for the State of California.
20 And I am currently involved in a project to
21 review all of our regulations to see how they

13

1 affect infants and children.

2 MR. CLEWELL: I'm Harvey Clewell. I
3 just recently became a principal with Environ,
4 but for a number of years I have been doing
5 pharmacokinetic and dose response modeling on
6 arsenic and chromium and, more recently,
7 pharmacokinetics in children.

8 DR. WARGO: John Wargo, Yale
9 University, professor of risk analysis and
10 environmental policy.

11 DR. HEERINGA: I'm Steve Heeringa, a
12 biostatistician with the Institute for Social
13 Research, University of Michigan, where I
14 direct research design and operations for that
15 institution.

16 DR. MATSUMURA: I am Fumio Matsumura
17 from the University of California at Davis.
18 My area of interest are pesticides,
19 biochemistry, molecular biology.

20 DR. THRALL: I'm Mary Anna Thrall.
21 I'm a veterinarian and a professor of

14

1 pathology at Colorado State University.

2 DR. ROBERTS: I'm Steve Roberts and
3 I'm a professor with joint appointments in the
4 Colleges of Medicine and Veterinary Medicine
5 at the University of Florida. I'm a
6 toxicologist and have research interests in
7 mechanisms of toxicity, pharmacokinetics and
8 research risk assessment -- rather,
9 methodology.

10 We have with us this morning
11 Dr. Vanessa Vu, who is director of the Office
12 of Science Coordination and Policy. We had a
13 pretty full and interesting day yesterday,
14 Dr. Vu, and I think we're probably going to
15 have another one today. Welcome.

16 DR. VU: Thank you, Dr. Roberts.

17 Indeed, we had a very full discussion
18 yesterday. And the agency is very
19 appreciative of all the comments, the very
20 insightful and thoughtful comments from panel
21 members. We also were very appreciative that

15

1 members of the public have presented their
2 scientific viewpoints on these issues
3 surrounding children's risk associated with
4 CCA-treated wood in the playground setting.

5 Yesterday's presentation, the agency
6 provided you a regulatory context from Mr. Jim
7 Jones, deputy director of Office of Pesticides
8 Program, and our scientific staff from the
9 antimicrobial division within EPA's Office of
10 Pesticide Programs, as well as our colleagues
11 from the Office of Water and region 8
12 scientists, surrounding both the overview of
13 the exposure and hazard issues as well as some
14 detailed questions on exposure.

15 Today we were hoping that our EPA
16 scientists will continue to provide you some
17 of the background on some of the exposure
18 scenario issues which you have heard quite a
19 bit from yesterday, discussion with all of
20 you, and hopefully we will continue to look
21 forward to look forward to hearing your

16

1 discussion and deliberation as we pose these
2 specific questions in front of you this
3 afternoon from the hazard as well as exposure
4 for the next days. Thank you.

5 DR. ROBERTS: Thank you, Dr. Vu. We
6 look forward to those presentations.

7 We were not able to get completely
8 through our public comments last night, and I
9 appreciate the indulgence of the public
10 commenters who had to wait to present this
11 morning, but we would like to give them the
12 opportunity to present their comments now.

13 I have three public commenters listed
14 as requesting to address the panel: Mr. John
15 Butala, Dr. Joyce Tsuji, and Scott Conklin.

16 I would each of those individuals in
17 that order to be prepared to make a
18 presentation.

19 Mr. Butala, welcome. Would you
20 introduce yourself to the panel, please.

21 MR. BUTALA: My name is John Butala.

17

1 I'm a toxicologist and I'm here on behalf of
2 the American Chemistry Council Arsenicals and
3 Wood Preservatives Task Force.

4 The task force would like to thank the
5 EPA for the opportunity to present comments to
6 the SAP. My comments will extend to about 15
7 minutes today, which is the amount of time I
8 understood I was allotted. And my overheads
9 will improve, as we go on, in legibility.

10 Yesterday, you heard Dr. Beck present
11 considerations for CCA-treated wood risk that
12 rely upon reduced bioavailability of CCA-wood
13 surface residue, and you heard Dr. Aposhian
14 present animal data to support that position.

15 You also heard Dr. Kamdem provide
16 chemical information about the differences
17 between arsenic and chromium in aqueous
18 solutions and in treated wood.

19 The biological and the chemical work
20 presented by these scientists is meaningful to
21 the risk assessment, and my purpose today is

18

1 to focus attention on an important data set
2 developed on CCA-treated wood in relevant
3 mammalian species that demonstrates the
4 manifestations of the physical and the
5 chemical aspects of CCA-treated wood, aspects
6 which you have been hearing about for the last
7 several days from Drs. Kamdem and Aposhian.

8 To equate risks from CCA-treated wood
9 with inorganic arsenic is inappropriate. The
10 form in which arsenic exists, the form to
11 which exposures occur influences physical
12 chemical properties, such as water solubility
13 and biological properties such as toxicity.
14 The trivalent form of arsenic in general is
15 taken to be more toxic than the pentavalent,
16 inorganic form, and these inorganic forms are
17 taken generally to be more toxic than the
18 organic arsenicals, although we now know there
19 is evidence that the valent state of arsenic
20 in the methylated derivatives may be a major
21 factor in toxicity.

1 We also know that the majority of the
2 acute toxicity data historically supports the
3 statement as I have read it to you, and that
4 it is in vitro data that support at moment
5 indications that methylated metabolites have
6 increased toxicity than heretofore expected.

7 We know that there is 3000fold
8 difference in mouse acute oral toxicity
9 between arsenic trioxide and arsine. In fact,
10 the most toxic form of arsenic is a gas,
11 arsine.

12 These differences have relevance to
13 the toxicity of arsenically treated wood.
14 When wood is pressure treated with CCA,
15 chemical reactions occur between the
16 components of the CCA preservative and the
17 wood.

18 The results are the reactions are
19 changes in the valence state of chromium and
20 the solubility of chromium, arsenic and copper
21 from CCA to yield stable complexes of the

20

1 metals with wood carboxylates, predominantly
2 in the wood cell wall. The overall reaction
3 process is termed fixation and is the process
4 that renders the CCA components strongly fixed
5 to the wood, thereby conferring the
6 preservative property of the wood. The
7 mechanism of these reactions has been the
8 subject of much research, recently summarized
9 by D.C. Bull, and we heard a little bit about
10 that yesterday.

11 And just to capture that, at least of
12 one of Bull's publications, the work
13 presented, as well as that of Kamdem yesterday
14 that we heard, demonstrates that once fixed
15 with wood cellulose, the chromium, the copper
16 and the arsenic metals of CCA exist
17 predominantly as water-insoluble complexes
18 with other organic and inorganic components.
19 This was specifically demonstrated for
20 CCA-wood surfaces by Kamdem in the x-ray
21 diffraction work that he presented, indicating

21

1 that CCA solution is different from samples of
2 the surface of treated wood as opposed to CCA
3 fixed on treated wood, and that CCA-treated
4 and untreated wood surfaces subjected to
5 scanning electron microscopy showed that
6 solids present on the wood surface were
7 amorphous complexes of oxygen, of carbon, of
8 calcium, chromium, copper and arsenic and
9 iron, and that the deposits on the CCA-treated
10 wood surface, once fixed, were amalgamation
11 complexes of those elements and that the solid
12 deposits did not contain arsenic pentoxide or
13 trioxide.

14 Finally, we know that the surface
15 residue on CCA-treated wood contains less than
16 half of a percent copper, arsenic or chromium.
17 And of that half a percent, only about 10
18 percent of the arsenic on the surface of the
19 treated wood is water-soluble. That computes
20 to about .05 percent of the residue on the
21 surface of treated wood to be water-soluble

22

1 arsenic.

2 It is inappropriate, as I indicate up
3 there, to equate risk from CCA-treated wood
4 with water-soluble hexavalent chromium, just
5 as it is inappropriate to equate it with
6 arsenate. The water-soluble hexavalent
7 chromium I'm speaking of, of course, is
8 equivalent to the test material that Dr. Tyl
9 used in her developmental toxicity studies in
10 rabbits and in mice. These would be the
11 studies that EPA has identified for hazard
12 assessment -- short-term hazard assessment of
13 chromium.

14 As stated above, when wood is treated
15 with CCA, a number of chemical reactions
16 occur, one of which is the change of
17 hexavalent chromium to trivalent chromium,
18 reduction. The reactions begin as soon as
19 wood is treated with CCA and continue until
20 essentially all of the chromium is fixed.
21 McNamara showed that fixation is time,

23

1 temperature, and moisture-dependent. In his
2 work on fixation, McNamara equated fixation
3 with a conversion of hexavalent chromium to
4 trivalent chromium and used squeezed solution
5 of CCA-treated wood as the medium to measure
6 the fixation.

7 In these studies -- and I do believe
8 copies of all of the studies that I'm
9 referencing and that I will reference have
10 been given to this panel; you should have
11 those, as well as the full bibliographic
12 citations for the studies I'm referencing, and
13 copies of the comments.

14 In McNamara's work, the term
15 "completely fixed" corresponded to greater
16 than 98 percent fixation, and also a negative
17 chromotropic acid fixation test result.

18 This early work comports very well
19 with what we heard yesterday from Dr. Kamdem,
20 that 98 to 99 percent of the chromium in
21 CCA-treated wood is reduced to trivalent

24

1 chromium. Accordingly, the Tyl study that I
2 mentioned a few moments ago is inappropriate
3 for risk assessment on CCA-treated wood in
4 that essentially no water-soluble hexavalent
5 chromate, or very little water-soluble
6 hexavalent chromate is present in treated
7 wood.

8 A limited but important body of
9 toxicology data demonstrate that the chemical
10 form of arsenic as it exists in treated
11 wood -- and I'm speaking of sawdust now -- and
12 on treated wood surface as the dislodgeable
13 residue is not equivalent to soluble arsenate
14 and arsenite. And when I say limited, the
15 limitations I'm referring to concern the
16 number of animals in the study. The study
17 designs were solid, the analytical chemistry
18 was solid, and I think the toxicology was
19 solid, but clearly the number of animals is
20 small.

21 Because of this, the chemical and

25

1 physical properties, the toxicological
2 properties of the arsenical compounds from
3 CCA-treated wood are different and distinct
4 from soluble arsenic species in water. A
5 demonstration of this can be found in the tox
6 studies I'm referring to. The first of these
7 were done by Drs. Peeples and Parker, working
8 with beagle dogs.

9 Peeples and Parker fed the animals
10 CCA-treated wood dust using southern pine
11 treated wood. The dogs' daily dose of wood
12 dust was approximately .15 grams per kilogram
13 for 13-kilogram dog. Peeples and Parker
14 measured the amount of arsenic the dogs
15 consumed on a daily basis as 6,000 micrograms
16 per day from treated wood, and an additional
17 135 micrograms per day from the standard lab
18 trial. So they were getting about 6.1
19 milligrams of arsenic per day.

20 Feedings continued for eight
21 consecutive days, for a total wood dust dose

26

1 of 1.2 grams per kilogram, equating to about
2 49 milligrams of arsenic as the element.

3 This dosing scheme equates to
4 approximately 0.47 milligrams per kilogram
5 arsenic -- 0.47 milligrams of arsenic per
6 kilogram per day or about 3.8 milligrams per
7 kilogram arsenic, total dose over the course
8 of the study. There were no adverse clinical
9 signs noted in the eight-day dosing period.
10 Urine analysis, germ analysis, hematology
11 values were unchanged as a result of dosing.

12 About 60 percent of the ingested
13 arsenic was found in the feces and 40 percent
14 of the ingested arsenic was excreted in the
15 urine, suggesting that the bioavailability of
16 arsenic from CCA-treated wood ingestion was
17 about 40 percent.

18 The majority of the urine arsenic was
19 dimethyl arsenic. No trimethyl arsenic was
20 detected. Again, this comports with what we
21 heard yesterday, albeit in a different

1 species.

2 Peeples also conducted a higher-dose
3 study in which he fed dogs ten grams of
4 CCA-treated wood dust daily for five days, to
5 yield a daily dose of 39 milligrams of
6 arsenic, or about 3 milligrams per kilogram
7 per day as the element.

8 The dogs demonstrated no signs of
9 toxicity during treatment. Fecal excretion
10 varied from day to day, ranging from 23 to 100
11 percent. The average amount of dosed arsenic
12 excreted in feces during dosing was
13 approximately 74 percent. The average amount
14 of arsenic excreted in urine was 16-1/2
15 percent, again, indicating a low
16 bioavailability of arsenic from ingesting
17 treated wood.

18 In this study, however, done in higher
19 doses, pentavalent arsenic was found in the
20 urine, along with dimethyl arsenic.

21 Now, this table helps, I think, to put

28

1 the studies that I've just talked about into
2 perspective. And what I'm getting at here is
3 Peoples fed dogs CCA-treated wood sawdust that
4 contained amounts of arsenic which, if given
5 in pure form, would likely to be lethal to the
6 dogs and, for that matter, to humans. The
7 health of the dogs, however, was unaffected,
8 and all of the arsenic was excreted in feces
9 or urine, essentially all. This was possible
10 because the forms of arsenic in the wood was
11 not soluble inorganic arsenic, thus reducing
12 the bioavailability of arsenic in the wood
13 dust.

14 Now, the utility of this study is not
15 to present an argument for which species is an
16 appropriate species to assess arsenic or
17 CCA-treated wood toxicity. The utility of
18 this particular table is to look at the
19 intra-species differences between arsenic
20 pentoxide toxicity and CCA-treated wood within
21 a species.

1 Dr. Peeples also investigated the
2 potential for trans-dermal absorption of
3 arsenic from CCA-treated wood dust in contact
4 with skin. In this study, beagle dogs had 1.5
5 grams of wood dust, which is about 45
6 milligrams of arsenic, applied under a patch
7 to clipped skin, applied continuously for two
8 days. Peeples was able to detect background
9 levels of dimethyl arsenic in the urine prior
10 to wood dust application -- that would be
11 dietary arsenic -- and found no increase in
12 urinary excretion of inorganic arsenic during
13 the application period or for two days after
14 the application period.

15 The University of Alabama study, which
16 used pregnant rabbits exposed dermally to CCA
17 sawdust for days 7 to 20 of pregnancy
18 similarly provided no evidence of any
19 treatment-related effect in the rabbits. The
20 pregnant animals received 26 grams of
21 CCA-treated wood dust on days 7, 11 and 15

30

1 through gestation. The test material remained
2 on the skin under vinyl plastic film until
3 gestation day 20.

4 Maternal response to dermal dosing
5 stress was equivalent in treated and control
6 groups. According to the author of the study,
7 there were no differences between the treated
8 and control groups in gross, skeletal or
9 visceral malformations, indicating that
10 extended dermal exposure to CCA-treated wood
11 dust is not teratogenic or phytotoxic.

12 Hood also tested pregnant mice with
13 dietary exposure to 10 percent CCA-treated
14 wood dust and untreated wood dust and a second
15 control group was employed that received lab
16 trial and no wood dust.

17 Maternal arsenic exposure via dietary
18 admixture of CCA wood dust throughout
19 pregnancy, gestation 1 to 18 days, produced no
20 effect on maternal weight gain, no effect on
21 fetal parameters, including fetal toxicity,

31

1 and no skeletal or visceral malformations when
2 compared to untreated wood dust control or to
3 no wood dust control.

4 In vivo cytogenetic studies have been
5 completed in mice receiving dietary exposure
6 to CCA wood dust for up to 21 consecutive
7 days. 50 metaphase plates at a minimum of a
8 thousand mitotic figures, were scored for each
9 animal. No changes were observed in
10 chromosome number or structure. And in the
11 same study, blood cell parameters, which were
12 via red cell count, white cell count and
13 differential as well as hemoglobin and
14 hematocrit, were examined and found to be
15 unaffected by 21 days of oral dosing by gavage
16 of 2500 milligrams per kilogram per day. And
17 I think this table summarizes those.

18 Incidentally, the asterisk, if you can
19 see it, indicates my assumptions on
20 calculating the dose levels from dietary
21 admixture which I can explain later, if you

32

1 like.

2 In a study to be published in an
3 upcoming edition of Toxicological Sciences,
4 Gordon, et al. -- and that would be one of
5 your panel members here, Dr. Terri Gordon --
6 showed that in vitro exposure of V79 hamster,
7 Chinese hamster, along fiberglass cells to
8 respirable-size particles of CCA-treated wood
9 dust produced greater cytotoxicity than
10 equivalent exposure to untreated wood dust.
11 Gordon also showed that increased cytotoxicity
12 with CCA wood dust occurred in an
13 arsenic-resistant cell line, suggesting that
14 arsenic was not responsible for the
15 cytotoxicity.

16 Tagacytosis (ph) of the particles
17 appeared to be necessary to induce
18 cytotoxicity.

19 Metalothioneine (ph) induction due to
20 copper was the only effect reported as a
21 result of cell exposure to particle-free

1 extracts of the treated wood.

2 Aged samples from treated wood were
3 less potent than fresh samples. At
4 approximately equal molar concentrations, the
5 cytotoxicity of the treated wood was less than
6 30 percent of the cytotoxicity of the
7 inorganic arsenate or hexavalent chromate when
8 tested as the aqueous solutions.

9 As illustrated by this collection of
10 studies presented here and when matched by
11 test animal species and endpoint, it's
12 possible to observe a marked reduction in
13 general toxicity and specific toxicological
14 endpoints for CCA-treated wood versus
15 inorganic arsenic and chromium. This is
16 possible because the metals in CCA-treated
17 wood are not equivalent to inorganic
18 water-soluble arsenic and chromate and because
19 the bioavailability of these metals in
20 CCA-treated wood is reduced.

21 So in summary, the evaluation of

1 CCA-treated wood in a manner that is more
2 relevant to the physical chemical and
3 toxicological properties of CCA-treated wood
4 must be part of considerations by the SAP.

5 The interpretation of exposure data
6 for CCA-treated wood has been and continues to
7 be based on inorganic arsenic toxicity
8 information, which, in turn, these
9 informations are based on controversial low
10 dose extrapolations of cancer and non-cancer
11 endpoints from high-exposure inorganic arsenic
12 drinking water studies. And this is
13 inappropriate for hazard assessment and risk
14 assessment for CCA-treated wood.

15 The oral bioavailability of arsenic
16 from treated wood particles is far less than
17 100 percent. I think we now have several
18 demonstrations of that. And a proper risk
19 assessment for CCA-treated wood must integrate
20 exposure assessment, bioavailability and
21 toxicology data derived from studies of

35

1 treated wood.

2 Those are my comments. Thank you very
3 much for your attention.

4 DR. ROBERTS: Thank you, Dr. Butala.
5 We have a number of questions for you.

6 Dr. Mushak and then Dr. Shi.

7 DR. MUSHAK: Two quick questions and a
8 cautionary comment.

9 The first question: The aging factor
10 in dusts. Did Peeples' study use
11 freshly-generated dust?

12 MR. BUTALA: The Peeples' study did
13 use freshly-generated dust.

14 DR. MUSHAK: And they did not, as I
15 recall, look at the effect of aging of dust on
16 release. So I think we have to be careful
17 about --

18 MR. BUTALA: You are right. They did
19 not.

20 DR. MUSHAK: The second one is, since
21 we don't know exactly what's in the medium

36

1 that Professor Aposhian used for his hamster
2 studies, I think -- are you comfortable
3 assuming that, since apparently you are big on
4 form of arsenic and form of chromium, that we
5 have to be careful about the form going into
6 the hamsters?

7 MR. BUTALA: I am big on the forms of
8 the metals.

9 DR. MUSHAK: Okay. Right. But
10 consistency --

11 MR. BUTALA: Now, as far as what
12 Dr. Aposhian has done, based on his
13 presentation yesterday, which was my first
14 chance to see the data and hear his
15 explanation, no, we don't know the form.

16 But I understand, and it's my
17 understanding we probably need to verify
18 this -- I understand that Dr. Kamdem's lab,
19 who prepared that extract -- I believe that's
20 the case -- also has retained samples and
21 either has done or is doing analytical

37

1 chemistry assessments of the solutions that
2 were used for dosing.

3 So it's my expectation that we will
4 get some analytical chemistry insight into
5 what the animals received.

6 DR. MUSHAK: That would be chemical
7 structural, not just simply bulk analysis,
8 right?

9 MR. BUTALA: Well, that's my
10 impression, yes.

11 DR. MUSHAK: The comment goes to the
12 issue of trivalent versus pentavalent arsenic
13 differential toxicity. I mean, that's from
14 the old literature of acute high dosings in
15 mice and rabbits, et cetera.

16 I think, with the range of exposures
17 we're talking about with these kids -- and
18 Dr. Aposhian essentially verified this
19 yesterday -- one ought not to belabor this
20 trivalent-pentavalent differential toxicity
21 business. It's a bit misleading.

1 DR. ROBERTS: Dr. Shi?

2 DR. SHI: I have several questions or
3 comments -- or clarification, actually. The
4 first one is you stated that when the wood are
5 treated and the chemical reaction occurred --
6 which kind of chemical reaction are you
7 talking about here?

8 MR. BUTALA: These reactions are --
9 there are a series of reactions, and
10 collectively they are called fixation, and I
11 think that one of the final public commenters
12 today will address that at some level.

13 The fixation reactions have been the
14 subject of a lot of study. And, again, I
15 think we heard that yesterday. I'm talking
16 about the chemistry of it now. And there have
17 been reviews published on those. Probably the
18 most recent review and perhaps the most
19 insightful is the one cited in my presentation
20 by D.C. Bull and others.

21 And I can't really provide you with a

1 thorough description of it at this point
2 except to say that, in essence, the important
3 aspects of fixation are that the CCA-treating
4 solution, the registered pesticide, is an
5 aqueous solution of arsenic acid, chromic acid
6 and copper oxide. And the acid forms are the
7 oxide. So it's arsenic pentoxide, chromic
8 oxide and copper oxide. Pentavalent arsenic,
9 hexavalent water-soluble chromium and copper
10 oxide.

11 When in contact with the wood, the
12 first thing that seems to happen are oxidation
13 reduction reactions with the chromium that
14 change the valent state from hexavalent to
15 trivalent, which then cause subsequent
16 reactions which change the water solubility of
17 the arsenic and the copper through the bonding
18 of, I think, the sugar moieties in the
19 cellulose wall of the wood cells in the wood.

20 Now, that's not a very sophisticated
21 chemical explanation of fixation, but that's

40

1 essentially what occurs such that, in the end,
2 when fixation is complete, the chromium has
3 undergone a valent state change. The other
4 elements do not undergo a valent state change,
5 but all three elements undergo solubility
6 changes. And that then confers -- well, the
7 term "fixation" then relates back to that end
8 product which then confers preservative
9 characteristics to the wood itself.

10 Fixation is typically measured by the
11 amount of chromium that remains in the
12 hexavalent state. Any amount that remains in
13 hexavalent state is an indication of the
14 absence of fixation.

15 DR. SHI: How about arsenate? You
16 talk about the chromium -- from Chromium 6 to
17 Chromium 3 meaning completion of a fixation.
18 How about arsenate?

19 MR. BUTALA: Again, we may hear about
20 this a little later, but chromium is
21 essentially the rate-limiting component of the

41

1 fixation reactions.

2 So that -- I'm sorry. It's not the
3 rate-limiting components. The other two are.
4 Probably, arsenic is. So that arsenic
5 undergoes the solubility change and copper
6 undergoes the solubility change as chromium is
7 being reduced.

8 And those changes occur either
9 simultaneously and those reactions occur --
10 are finished prior to the complete reduction
11 of chromium.

12 So that chromium is what is measured
13 as the endpoint of fixation. And it's the
14 reduction of chromium from hexavalent to
15 trivalent.

16 DR. SHI: Second question. You said
17 -- you identified some compound. Because
18 your presentation contained a lot of
19 information, I don't exactly understand what's
20 the compound you identified.

21 Did you use that compound exactly the

42

1 same -- use that to evaluate the toxicity or
2 carcinogenesis?

3 MR. BUTALA: The compounds I
4 identified, that reference came from the work
5 of Dr. Kamdem that was presented yesterday.
6 And that was analyses that he performed by
7 several methods, several physical methods on
8 the residue of CCA-treated wood.

9 The toxicological data that I
10 presented was done on sawdust, you know,
11 ground-up wood.

12 There was no attempt made in the
13 preparation of the sawdust to remove surface
14 residue, so that was present as well.

15 Now, if you are asking me was the type
16 of analysis that Dr. Kamdem performed to
17 identify these inorganic arsenic and organic
18 complexes, was that kind of analyses performed
19 on the dosing -- on the material that was
20 dosed to the dogs and to the rabbits in the
21 studies I described? The answer is no. The

43

1 analyses done there were just elemental
2 analysis by atomic absorption.

3 DR. SHI: Another question. This is
4 Number three.

5 The experiments are performed in the
6 laboratory, as actually most experiments do.

7 And recently there are several
8 studies, and one is from NYU. And Dr. Terri
9 Gordon is also familiar with that.

10 Another study is from the University
11 of Minnesota.

12 In the last two or three years, the
13 studies show, when you do the toxicity
14 carcinogenicity study in the laboratory, it
15 may be very different than in a field study
16 because of UV of the sunlight, particularly in
17 a playground. Children play in the sunlight.
18 The sunlight or UV enhances the arsenic
19 toxicity and carcinogenicities.

20 Do you have any comment about that?
21 Do you consider that factor in your toxicity

1 study?

2 MR. BUTALA: The comment I have -- I'm
3 not familiar with Minnesota work, but I am
4 familiar slightly with work that Toby Rossman
5 has done at New York University where she
6 first demonstrated that inorganic arsenic,
7 anyways, could be co-mutagenic or at least
8 co-genotoxic in the presence of ultraviolet
9 radiation. And I think the end point of her
10 genetic toxicity was chromosome damage as
11 opposed to point mutation. Again, I did
12 present some data here that indicated that
13 CCA-treated wood sawdust did not cause any
14 sort of chromosome damage in vivo.

15 Then I think Dr. Rossman extended
16 those studies very recently in a publication
17 where she indicated that inorganic arsenic can
18 be a cocarcinogen in a mouse model in the
19 presence of UV light, and I think that's what
20 you are referring to.

21 So those endpoints, genotoxicity,

45

1 specifically chromosome damage, and
2 carcinogenicity, are the two endpoints that
3 have been associated with ultraviolet light
4 co-activation, for lack of a better term.

5 We have evaluated one of those here,
6 the classgenicity (ph). I'm not aware of
7 anybody -- of any work that has been done on
8 carcinogenicity in an animal model,
9 particularly the one that Dr. Rossman has
10 developed, that uses sunlight exposure as
11 well.

12 DR. SHI: And everybody talks about in
13 the treated wood about arsenic and chromium
14 together. And you also talk about a possible
15 interaction. And most likely, they can form a
16 cluster of some kind of compound together.
17 The two questions -- two points here.

18 One is in the arsenic and chromium
19 compound, if together, that's a new compound.
20 It's one. Secondly, the synergistic effect.
21 Did you consider these two factors? One is

46

1 the compound together, the new compound.
2 Second, is the synergistic effect about the
3 two compounds.

4 MR. BUTALA: The first part of your
5 question as far as considering that complex,
6 it's my position that the complex was present
7 in the material dose to the rodents. So I
8 think it's fair to say, yes, it was considered
9 in the toxicology evaluation.

10 The second part of your question, were
11 you asking about synergistic effects?

12 DR. SHI: Yes.

13 MR. BUTALA: Well, again, my answer
14 would be the same in that the material of
15 concern, in this case the complex, and
16 certainly the complex representing all three
17 of the elements in whatever form, was the
18 material tested. That was really the point I
19 was trying to make, that the relevant test
20 material for evaluation of CCA-treated wood
21 hazard should be CCA-treated wood, as opposed

47

1 to this one step beyond extrapolation of what
2 is known about arsenate or arsenite, what is
3 known about chromate, chromium. And then
4 trying to synthesize those together and then
5 having to deal with the uncertainties of
6 interactions and different test systems.

7 It seems to me if you want to know
8 about the hazard of CCA-treated wood, that's
9 what you should test.

10 And that's what I described.

11 DR. SHI: Last question. For the
12 cigarette smoking, for example. That took
13 about 10 years or 20 years for the cancer to
14 develop, and the cancer take a long time. How
15 about CCA-treated wood? How long do you study
16 and how long do we need it to getting your
17 conclusion? It's not that bad. How about the
18 long-term effect to make --

19 MR. BUTALA: We do not have long-term
20 toxicology studies on CCA-treated wood. You
21 are correct.

1 DR. SHI: In your study, how long your
2 study will evaluate? You have some evidence
3 to show another toxic -- what's the time frame
4 of that study?

5 MR. BUTALA: The time frame of the
6 study? The longest dosing period was 21 or 22
7 days. So you are correct. These are -- these
8 can be characterized as single dose or, at
9 best, repeated dose studies. That's what I
10 presented.

11 DR. ROBERTS: Dr. Ginsberg.

12 DR. GINSBERG: I wasn't aware -- well,
13 I was aware of the Peeples study. I hadn't
14 read it, though, so I appreciate you bringing
15 that to our attention. I would just like to
16 understand it a little bit better.

17 You said that under one dosing
18 scenario, there was something on the order of
19 40 percent excretion in urine. So at least,
20 as a minimum, 40 percent bioavailability of
21 the arsenic that was in the wood dust. And

49

1 then, with a higher dose gavaged of the wood
2 dust, there was 16 -- so a minimum of 16
3 percent bioavailability.

4 So I would like your comments on two
5 things. One is, how much of the material --
6 what was the difference in dose between the 40
7 percent minimum bioavailability study versus
8 the 16 percent? What were those amounts of
9 wood dust going down the hatch, so to speak?

10 And then the other is your opinion, I
11 guess, on if that was dislodgeable residue
12 rather than wood -- actual bulk wood dust
13 going down, do you think that we would have
14 seen more bioavailability in that study.

15 MR. BUTALA: The difference between
16 the two -- you are right. I mean, you have
17 put your finger right on it. Both were -- no,
18 I'm sorry. I think it would be more -- the
19 first study was, in fact, a dietary study so
20 it was a dietary admixture. And the second
21 study, I think, was more of a bolus dose to

50

1 get -the ten equivalent of 10 grams of wood
2 per kilogram down into the animal.

3 I think that alone could explain the
4 differences in bioavailability and absorption,
5 really. So that's the first part.

6 And the second part you asked me?

7 DR. GINSBERG: In your opinion, do you
8 think that the -- if the way the material was
9 dosed was as dislodgeable residue rather than
10 the arsenic contained in bulk wood dust, would
11 there have been any difference in the amount
12 we would have seen in urine?

13 MR. BUTALA: That's very difficult to
14 say. When Peoples did his work, there was not
15 attention focused on surface dislodgeable
16 residue.

17 Now, there was nothing special done to
18 the wood that would have removed the
19 dislodgeable residue, particularly the type of
20 treatments of the wood that we heard and saw
21 described yesterday.

51

1 The really -- the big difference, I
2 think, that has to be accounted for is the
3 increase in surface area of the treated wood
4 when it's made into sawdust. A tremendous
5 increase on a weight basis of the surface --
6 the particles that I think probably adds an
7 element of conservatism to toxicology hazard
8 assessment of CCA-treated wood on the one hand
9 because, on a weight basis, the increase in
10 surface area of the particles versus not
11 increase in surface --

12 DR. GINSBERG: But when comparing that
13 to the dislodgeable residue that we don't have
14 that extraction step, aren't we dealing with
15 different matrix for bioavailability? I know
16 the arguments you are describing in terms of
17 the complexation and that the arsenic may be
18 in a form that's not sodium arsenate in terms
19 of bioavailability. That's a separate issue.
20 But when we're talking about what's in wood --
21 I know it's not solid; it's ground-up wood

52

1 dust compared to dislodgeable.

2 I just wanted to see, in your mind, if
3 you thought they were equivalent
4 bioavailability or do we know what the
5 difference in -- has anybody done that
6 bioavailability test dislodgeable residue
7 versus ground-up wood?

8 MR. BUTALA: They are not equivalent.
9 They cannot be equivalent. All I'm prepared
10 to say is that the wood dust that was
11 administered to the animals had whatever
12 surface residue is typically present on that
13 wood still on it as wood dust and the animals
14 received it. The endpoints of the study,
15 which would be the reduced toxicity, systemic
16 toxicity, which was measured, and the apparent
17 reduced bioavailability -- blood levels
18 weren't taken in these studies, but excreta
19 were measured for the elements, so there is
20 pretty good evidence for reduced
21 bioavailability.

1 Some component of that was the residue,
2 and that's as far as I'm willing to --

3 DR. GINSBERG: And one final question.
4 Do you know what the pH of the dog's stomach
5 is?

6 MR. BUTALA: No, I don't.

7 DR. GINSBERG: It is pretty acidic.

8 MR. BUTALA: But just to circle back
9 to that, remember what I said. I did not
10 present any of these data as an argument for
11 appropriate species for toxicology hazard
12 assessment to people. It's not an
13 inter-species exercise that I was going
14 through. It's an intra-species. It's dog
15 arsenate versus dog CCA-treated wood. So
16 whatever the pH of their stomach was, it's not
17 important to me because I'm not trying to say
18 that the dog was a surrogate for a human. I'm
19 just saying that than animal model behaved
20 differently in terms of how it responded to
21 aqueous arsenate versus CCA-treated wood.

1 DR. ROBERTS: Dr. Clewell and then
2 Dr. Styblo, Steinberg and Mushak.

3 DR. CLEWELL: My question has already
4 been answered. Thanks.

5 DR. ROBERTS: Dr. Styblo?

6 DR. STYBLO. I have one or two short
7 comments.

8 We repeatedly discussed the question
9 of bioavailability here based, basically, on
10 comparison of urinary excretion and total,
11 urinary plus fetal excretion. Remember, we
12 are talking arsenic here.

13 We have clear data from experiments in
14 animals that say that arsenic is excreted in
15 bile, not just inorganic arsenic, but also
16 metabolites of arsenic.

17 Considering this fact, I'm not sure
18 it's a good idea to use this ordinary formula
19 urinary compared with total excretion for
20 assessment of bioavailability. In fact, what
21 is in bile are most toxic arsenic metabolites,

55

1 including carconite in complex with
2 glutathione, and MA3, which is the most toxic
3 one, in complex with glutathione.

4 There is evidence for that. So for
5 me, the fact that significant part of arsenic
6 is excreted in feces doesn't mean that this
7 arsenic has not been absorbed in intestine.

8 To make it even more complicated, we
9 know that intestinal microflora can methylate
10 arsenic to forms that may be reabsorbed in the
11 organism. So this is a very complicated issue
12 and there is great level of uncertainty.

13 Second thing. You seem to downplay a
14 little bit cytotoxicity studies done with
15 methylated arsenicals compared with in vivo
16 studies. I would like to clarify this thing.

17 You are right. Methylated arsenicals
18 in trivalent forms were tested mainly in
19 cultured cells as compared with other previous
20 studies done in animals. I would like to
21 balance the advantages and limitations here.

1 The cells were, in part, primary human
2 cell lines, primary human cell lines derived
3 from target tissues and tissues that methylate
4 arsenic: Liver, skin, bladder and bronchs
5 (ph), which seems to be very relevant
6 material. So that's the advantage.

7 The limitation is the fact that we are
8 working not in vitro, but ex-vivo conditions,
9 which are not completely comparable with
10 in vivo.

11 While in animal studies, we are
12 working with animals in vivo. However, we
13 know that we don't have at this time a good
14 animal model for either human methylation or
15 metabolism or toxic effects of arsenic.

16 So that would be a balanced view of
17 the toxicology of arsenic.

18 MR. BUTALA: And I appreciate the
19 balance. I'm just pointing out that, you
20 know, at the level of the in vitro studies, we
21 lack the pharmacokinetic component of the

57

1 in vivo study, which I'm sure will come.

2 DR. ROBERTS: Dr. Steinberg. Then
3 Dr. Mushak.

4 DR. STEINBERG: Mr. Butala, the
5 amiable presentation of Dr. Aposhian really
6 was a pilot study. It was five animals.
7 There was no genetic information. It would --
8 it was not a peer-review article. It clearly
9 did not make a scientific standard as opposed
10 to just a little brief bite of information.
11 So it's hard to use that information in any
12 decision, and I think we can all pretty much
13 agree to that.

14 Regarding Dr. Kamdem, again, in a non
15 peer-review paper that we received, his little
16 report that we received, the x-ray diffraction
17 is, by his own admission, semi-quantitative,
18 which he fully admitted to, and, of course,
19 had never been correlated with the gold
20 standard of atomic absorption or anything
21 else.

1 So, again, that really doesn't quite
2 make the scientific standard that anyone can
3 really use for any type of information.

4 Regarding your genetic toxicology, you
5 didn't notice, or maybe you didn't mention
6 that there were micro-nuclear damage that was
7 caused by arsenic. And, of course, many of
8 those studies are now -- this is a rapidly
9 changing field. They are now old studies.
10 Dr. Abernathy, who has worked on this, has
11 presented the newer data of Mesa, which looks
12 like arsenic as a very good -- a very good,
13 directly toxic agent on DNA, which, of course,
14 would strongly support its carcinogenicity,
15 which, of course, the EPA, the NAS, the ATSDR
16 and everyone agrees upon.

17 The Peeples data without a reference,
18 and much of the other data that you give us is
19 hard really to comment. We haven't received
20 any of that data.

21 So -- and, also, in the Beck report,

59

1 in both her introduction on page 3 and on
2 page 55, there was even a question raised
3 about whether arsenic was carcinogenic, which
4 I was a little concerned about.

5 So much of that information that you
6 bring forward is very hard to use, based on
7 it's either early form -- and, therefore, to
8 use the term "inappropriate," I would deem is
9 a little harsh.

10 MR. BUTALA: Well, I think
11 Dr. Aposhian has indicated he is extending his
12 work and, yes, this is an early phase. He
13 wanted to be able to present -- to give this
14 panel the benefit of what he was doing and
15 where he was going.

16 With regard to Dr. Kamdem's work, I
17 think he does have plans to present it to a
18 journal, but, again, wanted to give the panel
19 the benefit of information. And we may need
20 to get clarification on a point, but I thought
21 yesterday he said that he did tie his work

60

1 back into a qualified standard -- to a
2 certified standard through atomic absorption
3 or other means.

4 DR. STEINBERG: Not in the report --
5 and, again, I underscore report -- on his own
6 stationery which did not appear in a
7 peer-reviewed paper and, again, underscored a
8 semi-quantifiable, which means not completely
9 quantifiable. It means not linear. That's
10 what semi-quantifiable means.

11 MR. BUTALA: And as to the rest of the
12 work that I presented, I think I did provide
13 this group copies of all of those papers.
14 It's my understanding you have them, so you
15 can look at them.

16 DR. STEINBERG: If I have them, I read
17 them. So someone will have to show me those
18 papers in detail because there ain't nothing
19 that I received that I didn't read. So I will
20 have to take a look at many of those
21 references from '79 and, you know, those kind

61

1 of older references in genetic toxicology.

2 I look forward to seeing that
3 historical, ancient data. And, again, I'm
4 much more interested in something a little
5 more recent.

6 DR. ROBERTS: Let's take a couple more
7 questions quickly. And we can move --

8 MR. BUTALA: And just finally, to
9 respond to the last point, yes, I am aware of
10 more recent data that indicates that
11 arsenic -- again, in the inorganic form, can
12 be shown to interact with genetic material.

13 The point I was making is not to deny
14 that in any way, but to say that when present
15 in the wood, dose that -- essentially heroic
16 doses, we didn't see that. That's the key.

17 DR. ROBERTS: Questions from
18 Dr. Mushak and Dr. Gordon, and then let's --

19 DR. MUSHAK: Quick questions.

20 The reason I brought up this whole
21 business of new dust versus aging dust is

62

1 really focused on the potential for generating
2 over time more dislodgeable residues as these
3 dusts age.

4 Now, would you agree that, as these
5 dusts age, they are apt to reduce more
6 material rather than keep them intact?

7 MR. BUTALA: I couldn't comment on
8 that. My only experiences with new dust and
9 aged dust have to do with chemical changes on
10 just elemental aspects of the dust, lead,
11 zinc, you know, those kinds of fumes that age,
12 and we know there are toxicological
13 differences there.

14 But whether or not those translate to
15 structural differences on these complexes, I
16 don't know.

17 DR. MUSHAK: So in point of fact, one
18 can't rule out that aged dust would have
19 dislodgeable residues.

20 The business of bolus feeding versus
21 how children ingest materials in the course of

63

1 a day, the Peeples study with the 16 percent
2 is a problem because it's a bolus dose, and we
3 know that anytime you look at bolus dosing --
4 this is Mike Ruby's study with rabbits; it's
5 also the studies with -- Jerry Freeman's
6 studies with rats -- you find that these don't
7 simulate real-life conditions for children.

8 And there is a big difference in the
9 biochemical and biophysical milieux of the
10 stomach when you whack the gut with a big dose
11 of something and competes with the biochemical
12 apparatus versus how a child can, you know,
13 keep this thing going.

14 So you agree that the bolus artifact
15 may, in fact, impair a direct translation to,
16 say, child uptake rates?

17 MR. BUTALA: No. I agree with you. I
18 think that the dietary studies are the better
19 of the two. And I would also point out that
20 the Tyl study on hexavalent chromium was a
21 bolus dose study.

1 DR. ROBERTS: Dr. Gordon?

2 DR. GORDON: In the Peeples study, you
3 said they did a dermal absorption with the
4 sawdust?

5 MR. BUTALA: Yes.

6 DR. GORDON: And there was very little
7 arsenic absorbed, right?

8 MR. BUTALA: Yes, very little.

9 DR. GORDON: But then in the physical
10 form, wood dust -- having worked with it, it's
11 dry, has to be compressed -- do you think
12 there would be a difference in absorption
13 between wood dust put back on the animal
14 versus soil on the hands of a child or an
15 adult?

16 MR. BUTALA: I think -- you know, the
17 difference may well be not only in the matrix
18 but in the degree of hydration. And these
19 were not occluded dermal applications; they
20 were only semi-occluded, meaning gauze, so
21 there wasn't really a high level of hydration.

65

1 And I think that would be probably be a bigger
2 factor than the medium.

3 DR. ROBERTS: Thank you, Dr. Butala,
4 for your comments -- I'm sorry.
5 Dr. Matsumura?

6 DR. MATSUMURA: I'm interested in your
7 statement that the CCA appears to be less
8 toxic than the arsenic, arsenate, arsenite in
9 the same species, right?

10 Now, when you are giving those doses,
11 when you say 150 milligrams of the dust, you
12 are not expressing that in the form of
13 arsenate or arsenite. You are comparing total
14 weight of dust versus the inorganic arsenic?

15 MR. BUTALA: In the actual -- in the
16 actual study reports, in some instances, the
17 investigator does not express dose beyond the
18 amount of wood dust given in a standard dosing
19 metric, milligrams or grams per kilogram.

20 What I did in my presentation, which,
21 again, I believe that copies have been

66

1 distributed to you all, written copies, but if
2 not, we can certainly take care of that -- I
3 did those calculations you talked about. I
4 think that's why maybe the presentation was a
5 little bit dense because I did try to express
6 wood as a function of dose and then the
7 element as a function of dose.

8 So that's how did it and that's how I
9 constructed the tables.

10 DR. MATSUMURA: So you compared
11 milligrams to milligrams of the arsenic
12 equivalent in the same species to make that
13 conclusion or not?

14 MR. BUTALA: Yes. I did that.

15 DR. MATSUMURA: I would like to look
16 at that. So I can look at my own calculation
17 to see how equivalent they are.

18 MR. BUTALA: Of course.

19 DR. ROBERTS: Thank you.

20 Dr. Smith, a quick one.

21 DR. SMITH: Thank you for your

1 indulgence.

2 I only have the abstract for the
3 Peeples study, but I'm curious. They sort of
4 discuss in one of the studies they are giving
5 ten gram of this 60-mesh sawdust. And they
6 talk about the arsenic content of it, so I can
7 imagine how you might get your estimate of
8 arsenic dose.

9 They also say, though, that the
10 arsenic was fully extractable in one normal
11 HCL. Can you talk to me a little bit more
12 about what they actually did there. I assume
13 this is before giving the animal -- they did
14 some sort of experiment --

15 MR. BUTALA: This is a separate study.

16 DR. SMITH: A separate study. Are you
17 familiar with --

18 MR. BUTALA: A separate demonstration
19 on their part where they took the sawdust --
20 you know, the idea is that, is fixation
21 reversible under acidic conditions, low pH

68

1 conditions? And they took some of the sawdust
2 and simply put it in HCL and found that,
3 indeed, at -- I believe it was -- was it one
4 normal that he used?

5 DR. SMITH: I think that's what --

6 MR. BUTALA: At one normal HCL,
7 indeed, the fixation reactions could be fairly
8 well reversed and free metal released.

9 So that then really added impetus,
10 given what we know about the pH of the
11 stomach, to look into whether or not that
12 occurs in vivo.

13 And for reasons that have yet to be
14 elucidated, it does not occur in vivo, at
15 least the way it did in the HCL study.

16 And there is really no additional
17 information, I believe, beyond what I've just
18 provided to you in the actual reports.

19 DR. ROBERTS: Thank you, Mr. Butala.
20 I appreciate your presentation and answering
21 our many questions.

1 MR. BUTALA: And thank you for the
2 opportunity.

3 DR. ROBERTS: Our next public
4 commenter is Dr. Joyce Tsuji from Exponent.

5 Welcome. And could you please
6 introduce yourself for the panel, please.

7 DR. TSUJI: Thank you. I'm Joyce
8 Tsuji. I'm a toxicologist with Exponent. And
9 I was asked to review EPA's evaluation by the
10 American Forest and Paper Association.

11 Today, I'm just going to talk about
12 two issues in the interest of time: The
13 short-term arsenic toxicity value or values,
14 and then dermal uptake. I'm just going to say
15 some general things about dermal.

16 Regarding the arsenic short-term
17 toxicity value, it's the same for short-term
18 or intermediate-term. And this is the way
19 that EPA defines, 1 to 30 days or 1 to 6
20 months.

21 They selected a lowest observed effect

70

1 level of .05 milligram per kilogram per day
2 based on the Mizuta study. And, as you know,
3 the margin of exposure is 100, which is made
4 of two factors of ten, one to convert maybe
5 the LOAEL to the NOAEL, or to take into
6 account the inter-species sensitivity, and
7 another factor of ten for the severity of
8 effects. And EPA is requesting comment on
9 what they did here.

10 So what this means is -- you know,
11 this is your standard dose response curve in
12 toxicology, dose on the X axis. The lowest
13 effect level is at some level. Below that is
14 a no-observable effect level.

15 Then you incorporate a margin of
16 exposure. And as I understand, below that
17 margin -- at the bottom end of that margin
18 exposure below the NOAEL or wherever they
19 think that is below the LOAEL, there is this
20 threshold for concern. And that's where I
21 guess EPA would become concerned about CCA or

71

1 arsenic exposure from CCA.

2 The next slide is my comment on that.

3 When we looked at the general arsenic

4 literature, however, there seems to be kind of

5 a disconnect between what is being called --

6 what would be a threshold concern for

7 short-term exposures versus what we know from

8 longer-term exposures, for example,

9 subchronic -- the subchronic literature. Part

10 of that might be due to the very high

11 uncertainty in the Mizuta, et al., study.

12 I'll explain a little bit more about why that

13 LOAEL may be underestimated compared to the

14 severity of effects observed, and also the

15 margin exposure appears to be quite large.

16 Next slide. This is kind of the order

17 of dose response assessments we -- or curves

18 that we would expect from basic toxicological

19 principles for different periods of exposure.

20 The chronic dose causing effects is much lower

21 usually than the acute or subchronic or

1 subacute.

2 And this is true even though the
3 effects may be different. In the short term
4 you would expect more direct -- for example,
5 gastrointestinal irritation caused by arsenic,
6 whereas for the chronic effects, they are
7 going to be more cumulative in nature.

8 Next slide. So the expected order is,
9 to recap, acute, short-term, or subchronic,
10 chronic. But when we look at the available
11 toxicity values from the various agencies, we
12 see a different order, and it's out of order.
13 It's subchronic, acute, short-term -- and
14 short-term is very similar to the chronic
15 value, actually, for arsenic.

16 Next slide. And to just lay them up
17 so you can see these values, here is the
18 short-term RFD from region 8 that was reviewed
19 by Oswer. And that's .015. The ATSDR or
20 provisional acute MRL is .005. And the EPA
21 proposed -- by EPA OPPT -- OPP has proposed a

73

1 short-term LOAEL. When you consider the
2 margin of exposure, your dose is lower than
3 the chronic NOAEL and pretty similar to the
4 chronic RFD. So there seems to be sort of a
5 disconnect here.

6 I think the discrepancy I would like
7 to suggest is due to the Mizuta study which is
8 relied upon by the ATSDR assessment and the
9 EPA OPP for the short-term value.

10 And, in general, the short-term
11 literature for arsenic is just not as good for
12 defining dose response at the low end as is
13 the subchronic and chronic.

14 And this is a shortcoming that I don't
15 think we can really do anything about. But
16 maybe we can use some logic to figure out
17 what's the best course of action with that
18 uncertainty.

19 Next slide. Let me just tell you
20 about the Mizuta study. It is a soy sauce
21 poisoning incident in, I guess, general

1 population including children and other
2 people. There were over 400 cases -- 417, I
3 believe. 220 are reported in his paper.

4 For some reason, he doesn't report
5 anything about children. I don't know if they
6 didn't observe any effects in children or they
7 just weren't as severe. But the youngest age
8 he reports is age 14 or 15. And I just want
9 to point out that, because the soy sauce
10 concentration of arsenic is extremely high --
11 it's 100 milligrams per liter -- that small
12 differences in intake or even small
13 uncertainties in the concentration could have
14 huge consequences for the dose that some of
15 these people got, and I think Bob pointed this
16 out.

17 But I just wanted to show you as an
18 illustration that 30 mills is not really that
19 much soy sauce for a Japanese person in 1956.
20 They probably had a very traditional diet.
21 And from my observations in three trips to

75

1 Japan and looking at my relatives, including
2 my six-year-old son, 30 mills is only this
3 much, which might be a good long-term average,
4 but even for my son, he can eat more than this
5 in a day of soy sauce. I'll just pass this
6 around.

7 So you can see that if you have a
8 little more than two tablespoons per day, you
9 soon have a much higher dose than the .05
10 milligram per kilogram per day.

11 Also keep in mind, if there were women
12 or younger children, they are going to have a
13 much higher dose per body weight, and this is
14 what we always look at, dose per body weight.
15 And keep in mind that any drinking water
16 studies, when you have a large population
17 exposed, often the dose is calculated for
18 sometimes up to ten years of age or an older
19 person like an adult. But really the kids in
20 that same population had a much higher dose
21 per body weight because of their greater

76

1 intake per body weight.

2 Next slide. So I think what I would
3 like to propose is that we look at the greater
4 arsenic literature and try to ground-truth the
5 estimates and figure out where that lower
6 bound for acute or subchronic or short-term
7 might be.

8 And when we look at the literature, as
9 Bob pointed out, you have the leukemia
10 treatment studies where this is very
11 controlled dosing, and so it avoid
12 bioavailability, it avoids any uncertainties
13 in dose. It's pretty tight.

14 And what we see is that even higher
15 doses of arsenic do not cause the severity of
16 effects seen in Mizuta. Now, you wouldn't
17 expect the gastrointestinal effects because
18 it's IV, but still, it just causes some
19 question in both Mizuta, et al., 1956, and
20 Franzblau and Lilis.

21 I think the more substantial

77

1 literature is the multiple subchronic studies
2 involving thousands of people, including
3 children, and most of these populations were
4 malnourished. Many individuals in there were
5 malnourished.

6 So those studies support, as Bob
7 reviewed, a subchronic LOAEL of about .05 to
8 .06. It's very similar to the subchronic
9 LOAEL or the short-term LOAEL you get out of
10 Mizuta, et al. So you know that that
11 short-term LOAEL probably is a little low.

12 Next slide. Basically, again,
13 short-term effect levels should not be higher
14 than long-term effect levels -- it should be
15 higher -- I'm sorry. The reverse should not
16 be true. Short-term effect levels should be
17 higher than long-term effect levels.

18 There is a poor database, as I told
19 you about, for these short-term studies. They
20 are mostly poisoning incidents, case reports.
21 Dose information is very uncertain.

1 The subchronic and chronic studies
2 indicate that factors of 10 -- two factors of
3 10 are too large for a margin of exposure.
4 And certainly the subchronic information that
5 Bob presented indicates that a factor of 10 is
6 too large to go between the NOAEL and the
7 LOAEL.

8 Next slide. Just some
9 recommendations. Maybe consider setting a
10 lower bound for short-term LOAEL and the
11 margin of exposure using the larger arsenic
12 database on longer term exposures.

13 That the uncertainty in Mizuta,
14 et al., for the severity of effects noted is
15 probably in the direction of an
16 underestimation.

17 And this additional factor of 10 for
18 severity of effects for Mizuta, et al., in the
19 end is probably unnecessary, based on the
20 greater arsenic literature.

21 Now I want to talk about dermal, and

79

1 just some general comments to try to
2 ground-truth dermal.

3 Next slide. Now, I'm not saying that
4 the dermal pathway is insignificant. In
5 reality, we don't really know. But what we do
6 know is it is probably not very significant
7 compared to the oral, just based on what we
8 know about how metals behave with the body and
9 how anything that affects solubility of metals
10 at the skin surface is going to be more
11 dramatic than in the gut, I would think,
12 because there are no digestive processes,
13 there is no pinocytosis going on at the skin,
14 there is no -- low, very low pH environment
15 compared to in the stomach. So these metals
16 are not fat-soluble and they don't easily
17 cross the epidermis.

18 I mentioned the bioavailability, that
19 bioavailability should really have a big
20 impact on dermal, even bigger than oral, and
21 that the relative contribution of dermal to

80

1 total exposure should be relatively small
2 compared to oral. This is suggestive evidence
3 that tells us this.

4 Yet, when we look at the proposed
5 exposure assumptions -- let's see the next
6 slide -- dermal is a considerable part of that
7 exposure. And this is just an example that
8 shows you -- we just kind took some numbers
9 from the available literature to compare
10 apples and apples.

11 So we have the same amount of residue
12 on the wood and just focus on the yellow and
13 the light blue. Dermal is in the light blue.
14 Wood residue, dermal. Yellow is the
15 ingestion. Upper pie is central tendency.
16 Dermal is bigger than oral, using EPA
17 assumptions for intake.

18 And then in the high end of the pie,
19 you see that dermal is still a sizable
20 fraction, maybe 25 percent, a little less,
21 than oral. But the high end has some pretty

81

1 high mouthing behavior assumptions.

2 Next slide. So I thought, well, let's
3 look at what do we know from biomonitoring?
4 Urinary arsenic levels have been suggested by
5 this committee as one way to look at what kind
6 of exposure is going on.

7 What we have is not CCA residue
8 biomonitoring data, but we do have some pretty
9 good paired environmental and urinary arsenic
10 data on 364 children from Anaconda, Montana.
11 And that's arsenic in dust and arsenic in soil
12 and maybe even some -- I don't know if they
13 have -- I think they had some water, too, but
14 that was very low.

15 Basically, region 8 scientists and
16 their contractors compared the EPA soil
17 ingestion estimates for the central tendency
18 in the upper percentile to the central
19 tendency in upper percentiles of speciated
20 arsenic observed in the urine of these
21 children. They assumed a 100 milligram per

82

1 day soil ingestion rate for the central
2 tendency, 200 milligram per day for the upper
3 percentile soil ingestion rate, around a 20
4 percent bioavailability factor for arsenic.

5 And what they found was they got
6 pretty good prediction of the central tendency
7 for speciated arsenic in urine. They tended
8 to overestimate the upper percentile, but they
9 were close.

10 So this is reassuring that, with soil
11 ingestion, you could capture all the exposure.
12 What Walker and Griffen didn't realize maybe
13 at that time was that they were actually
14 overestimating the amount of urinary arsenic
15 that was due to soil ingestion and dust
16 because they didn't account for the dietary
17 contribution of inorganic arsenic to urine.

18 Next slide. As we see here, what you
19 see as a total observed dose from the urine is
20 a combination of what you get from soil, dust,
21 food, water and air. Now, water and air are

83

1 probably, for this population -- well, water
2 was accounted for. Air was probably
3 insignificant. But food can provide several
4 milligrams per day of arsenic.

5 So actually, the soil ingestion
6 assumptions, the Superfund soil ingestion
7 assumptions probably overestimated exposure.

8 But what this is telling us is if
9 dermal are significant, what I would have
10 expected is that the soil ingestion and dust
11 ingestion numbers should have underestimated
12 what we actually saw in the urine, but that
13 didn't happen.

14 So however much dermal is being -- how
15 much arsenic is being absorbed dermally --
16 next slide -- the oral intake estimates are
17 more than adequate to account for any dermal
18 exposure.

19 Now, you might ask, how does that
20 relate to residues?

21 Well, we have kind of a similar

1 situation. The mechanism is the same. In
2 both cases, children are touching residues,
3 absorbing it through their skin, I guess,
4 however much, and they are also engaging in
5 hand-to-mouth behavior that's resulting in
6 ingested arsenic -- particles in the arsenic.

7 So we know that the behavioral
8 approach EPA chose to use results in quite
9 high mouthing behavior. And if -- soil
10 ingestion is pretty high.

11 So I'm pretty comfortable that
12 probably the oral route should more than
13 account for what is dermally absorbed.

14 And maybe this is why certain regions
15 like region 8 -- I think Bob will talk about
16 this later -- they do not quantify the dermal
17 pathway.

18 Now, you may feel that you need to do
19 this just to check on it. But I think when
20 you get your final assumptions and estimates
21 and the amount of contributions, you should

85

1 kind of consider that in your mind when kind
2 of ground-truthing that with what we know from
3 reality.

4 Thank you very much for allowing me to
5 comment.

6 DR. ROBERTS: Thank you. Are there
7 questions?

8 I'll just go down the line. Dr. Chou,
9 Dr. Mushak, Dr. Francois, then Dr. Morry, and
10 we'll work our way up this side.

11 Let's start with Dr. Chou.

12 DR. CHOU: Dr. Tsuji, you presented
13 some very fundamental, very basic toxicology
14 principles at the beginning of your talk. You
15 show the toxicity values of acute, subchronic
16 and chronic and their relationships.

17 You seem to not understand why the
18 subchronic toxicity value can be reversed with
19 acute toxicity values.

20 It's a wonderful thing -- arsenic is a
21 very toxic chemical, we know. Are you aware

86

1 that one can be protected by exposing low
2 levels of arsenic chemicals through long-term
3 and then you can give a huge dose and a person
4 can take it?

5 This is also showing a lethal dose in
6 humans is a wide range from tenths of
7 milligrams to thousands.

8 So there is adaptation to the arsenic.

9 DR. TSUJI: So your question to me is
10 am I aware that you have adaptation to arsenic
11 when you have repeated dosing? Yes, this is
12 true, although --

13 DR. CHOU: Wouldn't that give you a
14 reverse relationship to acute and subacute
15 toxicity values?

16 DR. TSUJI: I guess that adaptation --
17 I don't think the adaptation is as much as
18 you're suggesting, that it would reverse the
19 order of expected toxicity.

20 I would assume that even the people
21 that started out -- you know, even if they are

87

1 having some adaptation, it would -- you know,
2 if they are having severe effects, the
3 effects, for example, that were noted in
4 Mizuta, et al., those people wouldn't have
5 been continuing to drink that water to the
6 point where they had adaptation. They were
7 already having health effects, so you are
8 going to see those health effects -- for
9 example, in neurological, were irreversible.

10 So I understand what you're saying,
11 and it does play a role in arsenic toxicity,
12 but I think the amount of adaptation with
13 chronic exposure is not to the extent where
14 it's going to reverse that order.

15 DR. CHOU: We don't know the actual
16 exposure at that time, but it is reasonable to
17 assume the beginning of exposure varies
18 between individuals --

19 DR. TSUJI: I totally agree.

20 DR. CHOU: So those that consumed at
21 the beginning, they would be more resistant to

88

1 the exposure later.

2 DR. TSUJI: I would agree that we
3 don't know a lot about what people are exposed
4 to, particularly in the Mizuta, et al.

5 I would like to also submit that in
6 1956, the Japanese had a fairly traditional
7 diet with a high amount of rice. Rice has a
8 fairly large proportion of inorganic arsenic,
9 so I think there have been various papers in
10 the literature showing that such diets do
11 contribute quite a bit of dietary arsenic,
12 more than you would expect, for U.S.
13 populations.

14 DR. CHOU: Wouldn't that make that
15 population more resistant to arsenic toxicity?

16 DR. TSUJI: No, I would think that
17 would make them more susceptible, because they
18 are already having a high dose of arsenic.

19 I guess with your comments about
20 resistance, I don't know if that -- you are
21 almost implying that one should consider that

89

1 for chronic exposure to treated wood as well.
2 I mean, the diet and -- we're talking about
3 additive exposures, and yet you're -- I mean,
4 the two are not connecting in my mind. Maybe
5 I'm just having problems.

6 DR. ROBERTS: Dr. Mushak?

7 DR. MUSHAK: Two quick questions,
8 Joyce, the first one regarding the potential
9 for urinary levels in screening, the lowball
10 uptake rates.

11 Yesterday, I tried to corner Professor
12 Aposhian with this problem of biliary
13 clearance, and Professor Styblo this morning
14 brought that up again.

15 To the extent that we don't really
16 know what the proportionality is, biliary
17 versus urinary clearance, isn't it the case
18 that all urinary levels are low estimates of
19 what probably the best estimate is? That's
20 one.

21 Two, could you comment on the fact

90

1 that the academy reports on the malnutrition
2 as a factor in the Taiwanese population is
3 probably a no-issue.

4 You seem to preserve the idea that
5 they are a non-representative population on
6 the basis of malnutrition. I think we've put
7 that issue to rest.

8 DR. TSUJI: Let's just talk about
9 these separately before I lose track.

10 You asked me whether urinary data are
11 low estimates of exposure. And I know about
12 biliary excretion of arsenic, but I have never
13 heard anybody say the urinary estimates or the
14 urinary measured data are low-end indicators.
15 And I think they are -- that is the biomarker
16 that everybody uses for arsenic exposure and
17 it's one of the better ones we have. Now, it
18 does reflect short-term exposure, within the
19 last few days.

20 But, there again, in the case of
21 Anaconda, when you have a large cross-section

91

1 of children, that should hopefully take into
2 account daily variation.

3 But, you know, I haven't heard what
4 you just said, that because of biliary
5 excretion, that it would be the underestimate
6 you're talking --

7 DR. MUSHAK: Well, absence of
8 acceptance of biliary -- you know, has nothing
9 to do with the popularity of a measure. I
10 mean, all measures have problems. They all
11 have limitations.

12 DR. TSUJI: Oh, sure. Yes.

13 DR. MUSHAK: So to say that no one has
14 really brought up the issue of biliary
15 clearances, I mean, that's an irrelevancy.

16 DR. TSUJI: Well, no one has brought
17 up that urinary estimates are underestimates
18 because of biliary excretion. I have heard
19 people discuss biliary excretion --

20 DR. MUSHAK: But I think it follows,
21 doesn't it, I mean, from basic toxicokinetics

92

1 of arsenic or anything else?

2 DR. TSUJI: It's complex.

3 Dr. Steinberg mentioned -- there is also
4 possibly intestinal uptake, too. I don't
5 think we know enough, but I think we do have
6 good information correlating to oral doses
7 with urinary excretion rates. And I think
8 maybe that's the way to check on whether
9 biliary excretion is being -- is really
10 affecting that relationship.

11 DR. MUSHAK: If you want the full
12 magnitude of uptake, I mean, if the issue is
13 bioavailability, you want to know all of the
14 excretory pathways. If you simply want to
15 answer the question is there excessive
16 exposure, urine is fine. Those are two
17 different issues.

18 DR. TSUJI: Your second question had
19 to do with malnutrition. I know that the NRC
20 2001 update commented on whether -- I think
21 what they were trying to put to bed is this

1 idea that because the Taiwanese population
2 were malnourished, that's why they were having
3 all those health effects. I don't believe
4 that's true, either. It's clearly that they
5 were having arsenic exposure, and that was
6 probably the main contributing factor to the
7 cancer rate.

8 What we don't know is to what extent
9 malnourishment contributes to it. The NRC
10 report felt that it didn't contribute enough
11 for them to consider it. But on the other
12 hand, we do have good data within individuals.
13 For example, Mazumder has shown that if you
14 are below a certain percentage body weight,
15 you have higher incidence of skin lesions and
16 other arsenical effects.

17 So on -- there are other studies that
18 show that. On individual levels, severe
19 malnourishment does cause sensitivity. So I
20 wasn't raising malnourishment to say that,
21 that in the sense that you are talking about,

94

1 that needed to be put to rest, that
2 malnourishment explains all the arsenic
3 toxicity we see in the world. I was just
4 saying that we have included sensitive
5 populations.

6 DR. ROBERTS: Before we go on with any
7 questions -- and I will give you the
8 opportunity to do that -- let me remind the
9 panel, we still have lots of presentations
10 coming from EPA today. We still have a very
11 full schedule ahead of us.

12 So let me ask -- and I certainly want
13 to give panel members the opportunity to
14 clarify issues that have been raised by
15 Dr. Tsuji, but let me ask the panel to keep in
16 mind that we still have a lot ahead of us
17 today and try and make this process as
18 efficient as possible.

19 Dr. Francois?

20 DR. FRANCOIS: I just have a quick
21 question. With so much resting on the Mizuta

95

1 study, it seems to me that the dose -- the
2 estimated dose in that study is not really
3 clear. And the authors themselves word it
4 this way: They say the estimated dose is
5 about -- and they gave us -- and it seems to
6 me we all take this at face value.

7 What are your thoughts on that? Did
8 you go back and try to estimate the dose from
9 the amount that was excreted in the urine of
10 the five patients that were reported?

11 DR. TSUJI: See, the problem is I
12 don't think that would characterize the
13 population of people having the effects,
14 either.

15 I don't think the Mizuta data provide
16 enough information to really get any better
17 estimate, and I think the problem with all the
18 acute short-term studies we have -- which are
19 not really studies; they are case reports --
20 is that they don't quantify dose very well in
21 the end. And.

1 That's the reason why we need to rely
2 on the greater arsenical literature to help us
3 try to bound the estimates and decide where
4 should we start becoming concerned about
5 short-term exposure.

6 DR. FRANCOIS: And there was no
7 mention of food intake either, was there?

8 DR. TSUJI: No. This was all dose
9 based on soy sauce. It didn't account for
10 food. It didn't account for -- you know,
11 there are a multitude of factors that could
12 have been interplaying here, for example, the
13 high salt content of soy sauce and the high
14 salt content of the Japanese diet is
15 irritating to the stomach. That could have
16 combined to make the gastrointestinal effects
17 worse.

18 DR. ROBERTS: Dr. Morry, I believe you
19 were next.

20 DR. MORRY: The question I was going
21 to ask is similar to what Dr. Francois just

97

1 asked about the Mizuta soy sauce study. It
2 might be interesting -- he just sort of
3 guessed how much soy sauce people were using,
4 and you apparently have your own guess --

5 DR. TSUJI: Based on this, I would say
6 it's an average, and it's probably not bad for
7 a long-term average.

8 DR. MORRY: So it might be interesting
9 if you would make your own estimate and just
10 see how much that would change the LOAEL.

11 The other thing is, you said that
12 rice -- the kind of rice these people were
13 eating was probably high in arsenic. Could
14 you be --

15 DR. TSUJI: Yeah. All the rice
16 samples that have been measured in the
17 literature show that the inorganic arsenic is
18 relatively --

19 DR. MORRY: Could you be quantitative
20 about that and actually determine whether the
21 amount of arsenic that would have been added

98

1 from rice diet would have been significant
2 compared to the amount that they would be
3 getting in that amount of soy sauce?

4 DR. TSUJI: Yeah, that's a good point.
5 You know, I haven't gone back and made that
6 calculation. I do know from looking at
7 Indonesian populations that having rice at
8 every meal does increase your overall arsenic
9 intake quite substantially over the U.S.

10 But you are right, they were getting
11 an amount of arsenic in this soy sauce. So
12 you are right, it may not have contributed
13 that much. I haven't done that calculation.

14 And if you want to see the impact, I
15 did some preliminary guesses, and I can't say
16 that I'm any better, but just based on what I
17 have observed people ingest and what I think
18 might be possible, I did some dose
19 calculations and I will leave Dr. Roberts a
20 copy of my slides and you can look at those at
21 your leisure and stick in your own numbers.

99

1 And who knows.

2 DR. ROBERTS: Other questions?

3 Dr. Steinberg?

4 DR. STEINBERG: I guess we should
5 start out with some hard data and then we can
6 go into speculations.

7 The leukemia studies that you quote
8 related to effect of arsenic, there is no
9 conceivable way that anyone can extrapolate
10 data on patients with cancer who receive
11 radiation, who receive chemotherapy, where
12 they are not looked at closely related to
13 their neurology, related to the effect on
14 their nerves, related to the effect on other
15 organ systems, related to the arsenicals. The
16 oncologists never even dreamed of looking at
17 that well and they don't look at that well.
18 That was not the point of those studies.

19 No one can really extrapolate any
20 meaning related to those studies with horribly
21 sick people that are receiving such a large

100

1 overdose of other toxics who are also under
2 cancer.

3 Regarding some of your earlier -- the
4 picture characters related to your short-term
5 versus long-term, you know, I love regulators,
6 some of my best friends are regulators.
7 However, I am not a regulator.

8 And, of course, I am cautioned to use
9 the best science possible. And if I have a
10 good mechanism of action -- and it looks at
11 this point as we are very, very, very quickly
12 evolving a mechanism of action on two fronts.

13 One front is, again, the direct
14 interaction of arsenic with DNA. And, two, we
15 now have about these 30,000 genes that exist
16 in the human genome -- you know, in animals,
17 we have the arsenite methyltransferases. You
18 know, a lot of this data is fluid. And I'm
19 going to be very worrisome -- I'm going to be
20 worried about speculating on uncertainty
21 principles when I have better science that may

101

1 tell me that there may be something awry and
2 amiss.

3 Also, regarding --

4 DR. TSUJI: Wait a minute. Can I just
5 start in because I'm going to forget what you
6 said.

7 DR. STEINBERG: Why don't you write
8 them down and then I'll finish my last
9 comment. And then you can roll along and I'll
10 try to stifle myself.

11 The third comment is I, of course, had
12 sushi. I apologize to admit it. I weigh 55
13 kilograms. I have maybe even a touch less. I
14 had 12 pieces of sushi last night. I had
15 exactly 10 mill of soy sauce.

16 I recently returned from two weeks in
17 Japan. I had the opportunity of watching my
18 children over that two-week period. I think I
19 can also speculate. I would tell you that the
20 best guess that I could see is that there are
21 no Japanese that I saw, and there was no one

102

1 else that I saw that's knocking off 30 mill of
2 soy sauce, with a very good meal. So we can
3 speculate on the other end also.

4 So, again, all of this open
5 speculation is exactly that and it would be
6 great for a quiz show or something else, but I
7 don't know how pertinent it is here.

8 DR. TSUJI: Let me go in backwards
9 order.

10 The soy sauce. There was probably a
11 range in that population. There are probably
12 people that eat less. I think I eat less than
13 this. That seems like a lot to me except on
14 certain days, I think I do eat this much, when
15 you add up all the meals together. Maybe one
16 sitting, 10 mills, okay. But when you add it
17 up in the different ways they use soy sauce
18 and the fact that, in '56 they had a more
19 traditional diet, and just observing what my
20 son will do who I have had to really severely
21 cut back because he will drink it out of the

103

1 bowl, the silly kid.

2 DR. STEINBERG: All speculation.

3 DR. TSUJI: Yeah, you can speculate
4 all over the place. And that's why I'm
5 telling you to be very careful about hanging
6 your gold standard on Mizuta and on that
7 number and then citing that that is the only
8 thing you can use.

9 I think -- and that gets into what you
10 are saying about the science. I would
11 encourage you to use the best scientific
12 information available. In this short
13 presentation I didn't have an opportunity to
14 present anything else. You, obviously, have
15 more, and the panel collectively has more
16 experience that could bear on this issue that
17 I can't present or have the experience to
18 present in the 15 minutes.

19 So I differently encourage you to do
20 that and not rely on simplistic, okay, let's
21 find one number and then throw in a whole

104

1 bunch of uncertainty factors. Let's use the
2 best science.

3 Regarding the leukemia study, I'm not
4 saying that that is the gold standard either.
5 All I was trying to point out is there we do
6 have controlled dosing and you didn't see the
7 severity effects to the extent of Mizuta. I'm
8 not saying that they didn't have any effects
9 at all or that that should be used as the
10 study.

11 So I hope I didn't give you that
12 impression.

13 DR. ROBERTS: Any other questions?

14 Dr. Kosnett?

15 DR. KOSNETT: Joyce, hi. I wanted to
16 ask you -- you addressed the issue of margin
17 of exposure with respect to severity of
18 symptoms.

19 What would you suggest to us to
20 consider a severe effect that would warrant a
21 margin of exposure of 10 and what type of

105

1 effects, you know, relevant to the studies
2 we're talking about do you think should merit
3 a lower margin of exposure?

4 DR. TSUJI: If I thought the LOAEL,
5 the .05, was directly correlated with the
6 effects they were seeing, I don't see any
7 problem with putting some margin of exposure
8 in. But I think once you do that, you do need
9 to back up and decide, well, am I getting
10 below what we know about the dose response for
11 arsenic? So using all available Science, what
12 do we know about that?

13 In this case, I am very uncertain on
14 whether the severity of effects seen in
15 Mizuta, et al., are related to that .05. And
16 so the whole severity issue, I think, should
17 be set aside until you can decide where should
18 we be in that dose. And use the more
19 scientific approach to the whole --

20 DR. KOSNETT: Granted, and I think
21 your point is well taken that we need to

106

1 carefully consider the dose issues in that
2 study with respect to how much they were. But
3 I'm talking, that aside, in your opinion, you
4 know, EPA has a policy of putting margin of
5 exposure depending on the severity effects.

6 And what I wanted to ask you -- you
7 know, you have studied this issue. What is
8 your feeling about what margins of exposure
9 should be used for what severity of effects?
10 I mean, we have things like prolongation of
11 Q-T intervals, we have nausea and vomiting and
12 diarrhea, we have peripheral neuropathy.

13 From your perspective, what is a
14 severe effect and what merits a ten-fold
15 margin of exposure and which ones are not
16 substantial and don't merit a margin of
17 exposure and which ones fall in between?

18 DR. TSUJI: You know, you are right.
19 The margin of exposure -- EPA elsewhere has
20 said that it can be anywhere from 1 to 10 and
21 then you can have multiple factors. And I

107

1 think what you also need to consider is, you
2 know, how severe the effects are, but what do
3 you know about the dose response curve? For
4 arsenic, it seems rather steep. So in some
5 cases, there isn't that much difference
6 between having severe effects and having less
7 severe effects.

8 In some cases, I don't think there is
9 a full factor of 10, it appears, (ph) between,
10 for example, the NOAEL and LOAEL that Bob was
11 looking at.

12 So I guess I don't have a perfect
13 answer. And I certainly can't give you an
14 answer for -- you know, any answer I give you
15 has to be specific for a chemical. In this
16 case, arsenic, I think it depends on the type
17 of effect you are looking at and, obviously,
18 neurological is much more severe than acute GI
19 symptoms. But I think you have to take into
20 account the shape of that dose response curve
21 and what you can see about that.

1 DR. ROBERTS: I think we need to move
2 along.

3 Thank you very much, Dr. Tsuji, for
4 your comments and your answers to our
5 questions.

6 I have one other public commenter
7 listed, Scott Conklin, who is with Universal
8 Forest Products, Incorporated.

9 Welcome. Could you please introduce
10 yourself to the panel.

11 MR. CONKLIN: Good morning. My name
12 is Scott Conklin. I'm the director of wood
13 preservation for Universal Forest Products.
14 Let me start by saying that had I known I was
15 going to address the panel, I would have
16 brought a tie on this trip, so I do apologize.

17 Yesterday, EPA gave you a very good
18 description of the treating process. However,
19 in questions, I think EPA was asked to get
20 into some kind of levels of detail that those
21 of us in the industry thought we might be able

109

1 to help clarify. So that was the purpose of
2 asking for a couple of minutes to address the
3 panel.

4 There were three principal things that
5 I wanted to try to clarify. One was -- you
6 were asking about the different times of CCA,
7 CCA types A B and C. There was a question
8 related to the use of final vacuums in the
9 treating process. And then a fairly specific
10 point to make about fixation.

11 First, starting with types A, B and C,
12 types A, B and C represent an evolution of the
13 CCA formulation. And that evolution was
14 working to improve the efficacy of
15 preservative and minimize leaching from the
16 product.

17 Type C was introduced in the 1960s and
18 effectively type B replaced type A; type C
19 replaced that. So it was introduced in the
20 late '60s.

21 Today, there is only type C. There is

110

1 no type A. There is no type B used in the
2 United States.

3 Our best estimate -- again, it was
4 introduced in the '60s. Pretty well, people
5 went over to that. I can say with confidence
6 that there hasn't been anything besides type C
7 used for over 20 years.

8 Second point -- so I guess the bottom
9 line is it doesn't seem to me that that's
10 really going to play a role in your
11 deliberations. You have plenty on your plate
12 and you can probably take that one off.

13 A question was asked about final
14 vacuum in the treating process. The process
15 used is a vacuum -- pressure vacuum process.
16 Pretty well always has been. Wood species and
17 some other factors affect how much liquid
18 preservative, how much treating solution is
19 left in the wood at the end of the process.

20 The point I wanted to make -- and in
21 some types of wood, the treater has the

111

1 ability to play around with that through other
2 parts of the process, of how much liquid, how
3 much water I'm going to leave in that wood.

4 The point I wanted to make was that it
5 does not affect the amount of CCA left in the
6 wood.

7 If I set the process up so that I'm
8 going to leave three gallons per cubic foot in
9 the wood, I use a lower solution strength
10 because, as a treater, I want to put in
11 exactly what the standard calls for, no more,
12 no less.

13 So while final vacuum is out there, it
14 probably really, again, isn't relevant to the
15 things you are being asked to address.

16 Third point on fixation. The main
17 point I wanted to make here is that fixation
18 is not a separate process. In our treating
19 plants, we don't have to go from the treating
20 process and say, okay, now let's do the
21 fixation process.

1 Fixation is, as you have heard a
2 couple times now, a chemical reaction where
3 the preservative binds with the wood. It is a
4 time, temperature and moisture-dependent
5 reaction. That fixation process starts
6 immediately when the treating solution comes
7 in contact with the wood.

8 In work that we have done in our
9 company -- and I think this is pretty well
10 documented in the literatures as well --
11 literally right out of treating cylinder, you
12 are already at about 60 percent because,
13 again, this chemical reaction starts
14 immediately.

15 Also, in terms of -- some points have
16 been made about cold weather. And, again, it
17 is -- the length of time that it takes to go
18 to completion is dependent on temperature.
19 Warmer temperatures, faster reaction.

20 But even at temperatures as low as 5
21 degrees Fahrenheit, fixation will still occur.

113

1 It's just that it's about ten times longer
2 than at 37 degrees Fahrenheit. So, again,
3 what's going to happen is the amount of time
4 is going to change. But that reaction will
5 still proceed.

6 Just very briefly two other points
7 that came up later in the day. There was a
8 question about sealants. Let me just try to
9 clarify what the industry position has been on
10 sealants.

11 Sealants have been recommended since
12 the late 1980s. And, again, it is for
13 aesthetic reasons to reduce checking and
14 splitting of the wood. Then, in the mid
15 1990s, the industry introduced a
16 factory-applied water repellent which is
17 incorporated right into the treating solution
18 and pressure applied to the product.

19 The benefit of that was that it
20 allowed consumers to go a year to two years,
21 depending on the water repellent, the product

114

1 you were talking about, before they had to go,
2 in order to follow our recommendations, and
3 apply another layer of water repellent.

4 Final point is on wood chips. I don't
5 want anyone on the panel to misunderstand that
6 the wood chips that are used as a buffer in
7 play areas, these are not CCA-treated wood
8 chips. Wood chips are not treated by this
9 industry. By nobody in this industry.

10 In fact, the only instances we have
11 ever heard of the idea of a treated wood chip
12 actually came from Florida out of
13 Dr. Solo-Gabriele's work and Tim Townsend's
14 work where they were talking about material
15 being brought to a landfill ending up getting
16 chipped up as mulch.

17 Now, this is both infrequent, a
18 violation, as I understand it, of Florida
19 regulation, and something that's absolutely
20 not supported by the treating industry.

21 So -- and we have talked about it

115

1 before. We are happy to do whatever we can to
2 minimize that happening. But this is --
3 treated wood chips are not a product that you
4 find out there in the marketplace. Thank you.

5 DR. ROBERTS: Thank you, Mr. Conklin.

6 I believe Dr. Solo-Gabriele has a
7 question for you.

8 DR. SOLO-GABRIELE: Before I get to
9 the wood chips, I had a question about
10 fixation.

11 It's my understanding -- I'm not a
12 wood treater. It's my understanding that you
13 can allow natural processes to just air dry
14 it. But there are some wood treaters that do
15 undergo an extra step such as kiln drying,
16 it's my understanding. Is that --

17 MR. CONKLIN: There are some folks who
18 do that. We're talking about a very tiny
19 fraction of the industry. It has been
20 predominantly used on poles. There are
21 literally one or two treaters.

1 I mean, in terms of a percentage, you
2 are talking about well under 1 percent of the
3 industry that's chosen to do that.

4 To be honest with you, you know, we
5 know what happens when you leave the wood
6 alone. There is information that says -- and
7 you can use kiln drying to speed it up. One
8 of my concerns has always been that if you
9 don't do the kiln drying right and you dry the
10 wood prematurely, you can actually -- I'm more
11 concerned that you can mess up the process.

12 You can use it to speed it up, but
13 it's a very, very tiny fraction of the
14 industry that actually does that.

15 DR. SOLO-GABRIELE: But there are
16 these processes that exist that can be
17 included.

18 Getting to the issue of wood chips, a
19 lot of our work has focused on the wood
20 material that comes from construction,
21 demolition recycling facilities. We analyzed

117

1 13 different facilities throughout the State
2 of Florida. And in 1996, the average content
3 of CCA was 6 percent.

4 We went back out in 1999, three more
5 facilities, and we found that the
6 concentration of CCA within those piles was
7 anywhere from 9 to 30 percent.

8 We have taken samples from retail
9 establishments, found that they leach arsenic
10 above levels, indicating that they do contain
11 CCA.

12 We have received samples not only from
13 Florida but we've received samples from other
14 states as well. And they show evidence of CCA
15 in the mulch. So it's getting everywhere.
16 And it's getting very hard to control.

17 MR. CONKLIN: Well, again -- I guess
18 the main point was that this is not a product
19 that anyone in the industry would support if
20 it is inadvertently getting into the much
21 stream. I mean, you have done a lot of work

118

1 on identifying that in the waste stream and
2 trying to help control that. And we're
3 absolutely supportive of that work.

4 DR. SOLO-GABRIELE: Yes, but when you
5 state that it's insignificant and it's not
6 happening, the data is overwhelming the other
7 way, that it's getting into places that it
8 should not be.

9 DR. ROBERTS: We have several more
10 questions.

11 Again, let me remind the panel, we
12 have -- after we finish the public comments,
13 we have three-and-a-half hours of
14 presentations left today before we begin our
15 discussion. If there are comments that you
16 want to make and they can fit into our
17 discussion of the issues when we get to those,
18 please hold them until then.

19 Dr. Styblo?

20 DR. STYBLO: I think this is an
21 important question. I'm still confused about

119

1 the chemistry of the treatment. We heard
2 yesterday and today again that this is a
3 complex redox reaction in which chromium is
4 reduced from 6 to 3 and, for some reason
5 arsenic, stays pentavalent and copper stays
6 oxidized.

7 By definition, chemical redox
8 reactions involve two kind of processes and at
9 least two components. In this kind of
10 reaction, one component is oxidized; the other
11 one is reduced.

12 Because there is a concern about
13 residual copper 6 in the product -- or in the
14 leaching substance, could you explain what
15 exactly reduces chromium from 6 to 3 in the
16 process?

17 MR. CONKLIN: Well, I am a chemical
18 engineer and not a chemist. So the one thing
19 I can tell you is that it is well understood
20 and very well documented in the literature
21 that the order of materials locking in of

120

1 fixation is that the copper and arsenic locks
2 in first, and that the last thing to go is the
3 conversion -- is the complete conversion of
4 the hexavalent chromium. That's why there
5 have been test methods established in the
6 industry that look for hexavalent chromium.

7 And in all of those test methods, they
8 indicate that the presence of hexavalent
9 chromium is not there after the fixation
10 reaction is complete.

11 And whether it takes, you know, three
12 days or two weeks -- certainly wood that is
13 out there in service for any period of time,
14 all the data I have seen says that that
15 hexavalent chromium is not present.

16 So I'm afraid I really can't answer
17 the question you are getting to except to say
18 that the hexavalent chromium does not appear
19 to be there in the finished product.

20 DR. ROBERTS: Drs. Gordon, Francois,
21 Smith and then Ginsberg.

1 DR. GORDON: I'm curious about the
2 fixation, the speed of fixation. You said
3 that as soon as it comes out, it's 60 percent
4 fixed, meaning it's reduced -- the chromium is
5 reduced. But unless I read the McNamara
6 papers or reports incorrectly or my memory
7 failing, which is more likely, I thought that
8 he had, for the first three days, what he
9 squeezed out, which is different than what you
10 probably measure -- but what he squeezed out
11 was predominantly hexavalent for the first
12 three days, and then within a week, it dropped
13 below detectable levels.

14 But regardless of that, what is
15 done -- I mean, what's on the outside versus
16 what you take as a core -- I mean, how do you
17 know? We're all sort of interested in what is
18 the speed of fixation in winter versus summer,
19 if you can do it succinctly?

20 MR. CONKLIN: Well, again, the only
21 thing I can tell you is that there are

122

1 quantitative measures, and I have done work --
2 in fact, I have done work in Jamesville,
3 Wisconsin, in the dead of winter when it's
4 about 10 below outside. In that work -- and
5 it's been repeated a few times since then -- I
6 regret that it hasn't been published -- what I
7 was finding was that right out of the treating
8 cylinder, I was right around 60 to 70 percent
9 fixation and, even in those conditions, was
10 going to complete fixation in a short period
11 of time.

12 So I would have to go back and read
13 Dr. McNamara's paper to try to really answer
14 your question. But I can tell you that based
15 on the work that I have done, that's about
16 where you are coming right out of the
17 cylinder.

18 DR. ROBERTS: Dr. Francois?

19 DR. FRANCOIS: We heard yesterday that
20 there is a relationship between the amount of
21 leaching that you can get and the fixation,

1 that there is a relationship there. And as
2 you mentioned that right out of the
3 cylinder -- right out of the cylinder the
4 fixation rate is about 60 to 70 percent.

5 And, therefore, my question is, since
6 it's a time-dependent process, how long is the
7 treated wood -- how long does the treated wood
8 stay in your facility before it's shipped out
9 to be sold to consumers?

10 MR. CONKLIN: I'm glad you asked that
11 question because, from some of the
12 conversations yesterday, I was wondering if
13 maybe people had this impression that it comes
14 out of the treating cylinder and, two hours
15 later, it's sitting on the store shelf, which
16 is not the case. I can tell you, from my own
17 company, we have minimum holding requirements
18 of 24 to 48 hours before it's moved to outside
19 storage.

20 So, typically, you are looking at
21 probably on the earliest end, three to four

1 days after treatment where it could possibly
2 be on a shelf, and that would be very
3 infrequent.

4 More common is that it sits in my
5 plant for weeks to months in inventory before
6 it ends up on that store shelf.

7 So I hope that answers -- and to some
8 extent, that answers -- Dr. Solo-Gabriele
9 pointed out that there are some people who
10 have gone to the much-added expense -- I won't
11 bore you with why it's so expensive, but just
12 trust me, it's very expensive to do something
13 like kiln dry after treatment to force
14 fixation.

15 And the only reason someone would do
16 that is if they wanted to try to shorten that
17 time frame and try to bring it to market --
18 and to try to bring it to market sooner.

19 DR. ROBERTS: Dr. Smith?

20 DR. SMITH: Thank you. I just want to
21 make sure I have the dates correct here that

125

1 you gave.

2 You said it was basically around the
3 1980s that the industry began giving its
4 general recommendation of sealing the wood
5 with some sort of sealant every year or two
6 years. Is that correct?

7 MR. CONKLIN: Yes. We kind of did a
8 huddle-up yesterday, and that was our guess
9 was that probably mid-'80s or so when those
10 recommendations started.

11 DR. SMITH: And did you generate any
12 of your data on the efficacy of different
13 sealants in helping to prevent this sort of
14 cracking or other sort of -- what you describe
15 as aesthetic concerns with wood?

16 MR. CONKLIN: That work is basically
17 done by the registrants, by the CCA
18 manufacturers.

19 And as a treater, I would say yes, but
20 I couldn't quantify for you. And, again, what
21 they were doing was looking at, if you applied

126

1 these things, that you -- the mechanism for
2 causing checking and splitting is that wood in
3 an environmental situation goes through cycles
4 of wetting and drying. And by putting a
5 sealer, you are trying to minimize its uptake
6 and, therefore, try to smooth out those cycles
7 that it's going through.

8 DR. SMITH: But it might be possible
9 for you to inquire with your colleagues about
10 whether or not you have any data on the
11 efficacy of different sealants in this
12 checking, cracking --

13 MR. CONKLIN: We can do that. Should
14 we come back to you on that?

15 DR. SMITH: Yes, or EPA or whoever. I
16 think it would be interesting to know if you
17 have any data on that.

18 Also, what was the date that you said
19 that you began adding some sort of
20 pretreatment into the actual fixation -- or
21 the process itself?

1 MR. CONKLIN: Right now, it's a very
2 small portion of the market. It's probably
3 something like 6 percent of the CCA-treated
4 wood market has a factory-applied water
5 repellent. Those were really introduced into
6 the market in probably the mid 1990s, but
7 continues to be kind of a specialty product.

8 The vast majority of material that you
9 are talking about out there does not have a
10 factory-applied water repellent. It's
11 expensive, it's kind of an added thing that
12 you can buy.

13 DR. SMITH: And why is it that -- and
14 at least this is my understanding of it, and
15 perhaps I have it wrong. What's the
16 recommendation to builders and consumers to
17 wait a certain amount of time before applying
18 sealants?

19 MR. CONKLIN: That goes back and
20 forth. My own recommendation is that they can
21 apply that within 30 days or so. And all you

128

1 are really trying to do is give the water --
2 when I treat wood, I'm basically taking -- the
3 treating solution is 1 to 2 percent CCA; the
4 rest of it's water. So I'm taking this wood
5 and I'm basically filling it up with water.
6 And it's probably just a little more
7 effective, particularly if you are talking
8 about a paint, to -- you want to let that
9 water get out.

10 We have done some work with just
11 topical sealers that says, probably doesn't
12 make a huge difference, particularly if you
13 are not sealing the whole board. You are just
14 sealing the top surface of, say, a deck board,
15 so you're allowing the bottom surface that's
16 still unsealed to continue to dry. But my
17 standard recommendation is give it 30 days or
18 so.

19 DR. SMITH: And my last question, if I
20 may.

21 So am I correct that it is the

1 industry's conclusion that sealants are an
2 effective way to reduce this sort of checking
3 and cracking of the wood, since you seem to be
4 making recommendations?

5 MR. CONKLIN: Yes.

6 DR. SMITH: So it is your position
7 that it is an effective way to reduce that?

8 MR. CONKLIN: Yes.

9 DR. ROBERTS: Short questions, please,
10 from Ginsberg, Solo-Gabriele, MacDonald --
11 Dr. Steinberg and then Dr. MacDonald.

12 DR. GINSBERG: I think that the issue
13 of how long one should wait, the 30-day
14 waiting period you just described is very
15 germane to any -- if there are any
16 recommendations coming out of this committee
17 regarding sealant use, the proper way to do
18 it -- it would be helpful if there was any
19 data, if you actually had any studies along
20 those lines, it would be very useful for us to
21 see.

1 And the other point you sort of didn't
2 think was very germane to this discussion, but
3 I think it is, and that is the CCA-A and CCA-B
4 which I was asking about yesterday, and thank
5 you for clarifying the time frame for that.

6 But if one goes out and does a random
7 study of decks or playscapes and some are old
8 and some are new and you are going to be
9 introducing some variability, then, into your
10 results, it sounds like, because the arsenic
11 content of these different formulations was
12 different, as EPA presented yesterday, and you
13 are saying that if something is beyond, say,
14 1970 in age, there is a pretty good chance
15 that it had some other formulation.

16 I had done a little bit of background
17 reading on this. Maybe you can answer this
18 question. Was the fixation of the materials
19 the same as CCA-C? Is there a greater or a
20 lesser potential? Maybe it's just an
21 impression I have that there was a greater

1 potential for leaching or less fixation or
2 something along those lines with these older
3 formulations. Is that accurate?

4 MR. CONKLIN: Well, let me first tell
5 you that the reason I think that it's probably
6 going to be insignificant is that, if you
7 think about it, everybody didn't have a deck
8 in the back of their house in 1970.

9 The popularity of decks also traces a
10 huge increase -- essentially, the industry
11 that I am in, which is the residential treated
12 wood components, as opposed to utility poles
13 and railroad ties, that pretty much started in
14 the 1970s in any significant way.

15 And I'll tell you the industry enjoyed
16 tremendous growth through the late '70s
17 through about the mid-'80s. I have to tell
18 you it's been dead flat since then. The
19 market has not really increased or changed in
20 size. It's been a flat market since then,
21 basically. But that's really when it

1 happened.

2 So part of why I said that I thought it
3 would be insignificant is the combination of
4 that time frame that it was introduced in the
5 '60s, was pretty much the thing in the '70s,
6 which is when people started building all
7 these decks. So you might hit one. I
8 honestly think it will be pretty rare.

9 I do think you are right in saying
10 that those earlier formulations probably were
11 not as well fixed. That was one of the things
12 that they were working on as they evolved it,
13 was modifying the formulation to get the right
14 balance and to improve the fixation.

15 DR. ROBERTS: Short questions, please,
16 from Solo-Gabriele, Steinberg and MacDonald.

17 DR. SOLO-GABRIELE: I just wanted to
18 reiterate Dr. Ginsberg's request for some data
19 on the fixation process, the time, moisture
20 and the temperature effects, if there is a way
21 to get some of that published information.

133

1 It's my understanding that there are some
2 published studies on that, but I don't know if
3 we can get it before the end of the meeting.

4 MR. CONKLIN: To be honest, I would
5 have to ask somebody else. I mean, the stuff
6 that --

7 DR. ROBERTS: We'll treat that as sort
8 of a general call for information. If there
9 is anyone in the audience who can respond to
10 that and provide the panel with information in
11 a timely fashion, that would help our decision
12 process.

13 Dr. Steinberg?

14 DR. STEINBERG: If we could also get
15 some more information on other resistant woods
16 and other treatments, for example, the
17 ammonium-chromium type treatments, as
18 potential alternatives to CCA, I think that
19 would be very helpful. I would love to see a
20 menu of what else is out there and what else
21 can be used.

134

1 Also, I would love for someone to be
2 able to comment from the industry on an
3 economic impact of some of these things. And
4 I think, you know, if we're looking at a \$7
5 billion square foot market of wood and, for
6 example, in only playgrounds, 50 million
7 square feet, which may be a small part of
8 that, that may be consideration that I think
9 people around the table may be interested in
10 hearing.

11 Also, any further protections that you
12 can think of or come up with, in particular as
13 it relates to woodworkers and hobbyists who
14 somehow fall into these things, I would also
15 be interested in hearing. You can supply that
16 information at any time.

17 DR. ROBERTS: We won't put all that
18 burden on your shoulders, but we'll consider
19 that a general call for information.

20 Dr. MacDonald?

21 DR. MacDONALD: The SCS hand-loading

135

1 study showed more than twice the arsenic
2 concentration with the water repellent
3 CCA-treated than with plain CCA-treated. Is
4 this information consistent with the
5 industry's point of view on the water
6 repellants?

7 MR. CONKLIN: Well, I tell you, I
8 think that that was -- the first time I had
9 ever seen that was in the SCS data. I don't
10 believe anyone else has done a similar look,
11 and so that was very interesting data.

12 We have spent some time talking about
13 those results, and we think it is probably
14 related to the nature of the water repellent.
15 When you treat with a water repellent, you are
16 more likely, we think, to have some of this
17 waxy material loading up on the surface, you
18 know, initially.

19 So we think it's probably an artifact
20 of that process. It is probably very
21 temporary in that, in the longer term, those

136

1 things may end up getting reversed because you
2 are not dealing now with whatever was on the
3 surface initially. You are looking at what's
4 there four months, five months, ten months
5 later, which will probably be as much driven
6 by the behavior of the wood out there.

7 So I'm not sure that that is a
8 long-term -- that you are going to see that in
9 the long term, but that was the first time we
10 had seen that.

11 And, again, that was part of what I
12 wanted to point out, that was a fairly small
13 portion of the market, probably about 6
14 percent of the treated wood market.

15 DR. ROBERTS: Thank you, Mr. Conklin,
16 for your presentation and your comments.

17 Before we close the public comment
18 session of the agenda, I will ask if there is
19 anyone in the audience, any other public
20 commenters that would like to address the
21 panel. This would be your last opportunity to

1 do so as we move further into to the agenda.

2 Anyone else? I see a hand. Could you
3 please come forward, identify yourself.

4 MR. TURKEWITZ: I'm Rob Turkewitz.
5 I'm an attorney in Charleston, South Carolina.

6 One thing -- and I'm not an expert in
7 this area, although I have read as much as I
8 can over the last couple of months. One thing
9 I'm concerned about -- and I share a concern
10 by the woman who addressed the panel from
11 Florida -- and that is whether the panel or
12 whether the EPA outlook is maybe
13 underestimating the potential risk, and that
14 is -- again, in Charleston, South Carolina, we
15 have a longer period in which children play on
16 playsets. And, also, we have a very hot and
17 humid environment, and I think that may be
18 something that ought to be taken into
19 consideration.

20 I also want to mention one thing. And
21 one of the things that brought this to my

1 attention was a friend of mine who is a
2 veterinarian, and it's kind of an interesting
3 thing that happened with him, and I'm sure a
4 lot of you here have heard of situations like
5 this.

6 Here is an individual who is very
7 learned and actually knew that there was
8 arsenic used in the treatment of the wood. He
9 was building -- I think it was a playset for
10 his children. And he took the wood afterwards
11 that was left over and he burned it in the
12 middle of his field and he had goats that his
13 children had as pets. And the goats went in
14 there and licked the residue, the ashes, and
15 they were dead the next day. And he did an
16 autopsy on his own goats and found out that
17 they were poisoned from arsenic, and that's
18 how they died.

19 And the interesting thing about that
20 is why did the goats lick the arsenic residue?
21 And that's just something that I wonder if

139

1 this panel has taken into account. And that
2 is, I was told by my friend that he believed
3 that it was a sweet, salty taste to it.

4 And that would be something that
5 perhaps the panel ought to consider is whether
6 or not there is a taste involved with the
7 arsenic that's used on the -- that's on the
8 surface of the wood and whether that would
9 actually result in children putting their
10 hands in their mouths even more than what the
11 current estimate is.

12 Those are my comments.

13 DR. ROBERTS: Thank you. Are there
14 any quick questions from the panel? Dr. Shi?

15 DR. SHI: My question is, are you
16 aware are there any requirements to put a
17 label on the wood? For example, this is toxic
18 or arsenic-treated or something, to warn
19 people this is toxic or dangerous? Are you
20 aware about that?

21 MR. TURKEWITZ: Actually, I'm not

140

1 right now aware of any requirements as far as
2 a label. It's my understanding that it was a
3 voluntary requirement that's in place right
4 now.

5 And I also -- I mean, I have seen -- I
6 have been to Lowe's and Home Depot and I have
7 seen the literature that's being put out, like
8 by Universal Forest Products, where they
9 actually say that it's perfectly safe for
10 children in playsets and that the arsenic is
11 locked in. And I may have a copy of that. I
12 can distribute that if you'd like to see it.
13 They say that the arsenic is locked into the
14 wood. And what I'm hearing in the last two
15 days is that may not be correct.

16 DR. ROBERTS: This may be an issue, if
17 it comes up later in our discussions, that the
18 agency can clarify for us in terms of labeling
19 requirements.

20 Any other questions? If not, thank
21 you very much for coming forward and making

1 your comments.

2 Is there anyone else who would like to
3 make a comment before we close the public
4 comment session? Last chance.

5 We'll then close the public comment
6 session. Let's take a 15-minute break, and I
7 mean a 15-minute break.

8 (A recess was taken.)

9 DR. ROBERTS: As we reconvene, there
10 was apparently one additional public commenter
11 that was here, has been invited at the
12 agency's request, and we wanted to be able to
13 accommodate that individual.

14 So before we begin with the agency
15 presentations scheduled for today, I would
16 like to offer the opportunity for Dr. Lamm to
17 speak.

18 Dr. Lamm, are you ready to go?

19 DR. LAMM: Yes, I am.

20 DR. ROBERTS: Could you please
21 identify yourself for the panel.

1 DR. LAMM: Yes, I will. Thank you
2 very much, Mr. Chairman.

3 My name is Dr. Steven Lamm. I'm a
4 physician epidemiologist. I've been in the
5 private practice of epidemiology for over 20
6 years. I was formerly with CDC, with the
7 Epidemic Intelligence Service. I have no
8 experience with anthrax. I was formerly the
9 senior epidemiologist at the National
10 Institute of Child Health and Human
11 Development and I am on faculty in the School
12 of Public Health at Johns Hopkins, associate.
13 I am full professor at the Uniformed Services
14 University for the Health Sciences in
15 biometrics and biostatistic -- for preventive
16 medicine and biostatistics, biometrics. And I
17 am associate professor of pediatrics at
18 Georgetown.

19 I have been interested in arsenic for
20 over 20 years, having started off in 1977 when
21 I did the medical examinations of the smelter

1 workers in Anaconda. I am an occupational
2 health physician, in addition.

3 Arsenic and benzene have been the two
4 chemicals of greatest interest to me as an
5 epidemiologist because they are the two
6 chemicals for which there is no decent animal
7 model and, thus, the question of assessing the
8 risk from exposure has to be related to
9 epidemiology, which for me is a pleasure.

10 My reason for speaking today -- I have
11 two. And both of them I have in documents
12 which I had prepared and which I have
13 submitted to you, and hopefully are being
14 distributed.

15 Back in 1984 I did a quantitative risk
16 analysis on the issue of skin cancer risk to
17 children who played on arsenic-treated wood in
18 playgrounds. This was done at the request of
19 an industrial group and was presented to the
20 California Health Department in their
21 deliberations at that time. I have given you

144

1 a copy of that report with all its typos and
2 so on in there, and that's one thing I would
3 like you to have for your consideration.

4 Since then, I have expanded the
5 research work that we have done on arsenic.
6 We have two major projects. One which we have
7 brought to completion is our study of skin
8 cancer in inner Mongolia and its relationship
9 to arsenic in the drinking water. It is an
10 unique study in that it is an epidemiologic
11 study rather than an ecological study. That
12 means we have an individual exposure history
13 on each of the people exposed and we have an
14 individual medical examination of each person.

15 The results -- that study has been
16 presented at the International Conference on
17 Arsenic and Health. Its analysis was funded
18 by the ATSDR and is in press at the present
19 time.

20 The findings of that study are, for a
21 population of over 2,000 people exposed at

145

1 less than 150 ppb, there was an absence of
2 skin cancer.

3 For those exposed above 150 ppb,
4 micrograms per liter, there was an excess of
5 skin cancer.

6 These data are consistent with the
7 threshold hypothesis and reject -- are
8 sufficiently strong to reject the linear
9 hypothesis. There is statistically
10 significant deficit of skin cancer in the
11 group with exposure at less than 150 ppb.
12 That is point one.

13 Second, we became -- as we were
14 preparing this for our final report for ATSDR,
15 we became aware of the work going on at EPA
16 and the National Research Council, became
17 interested in that and decided to give that a
18 closer look.

19 If you will turn to my document that's
20 written as a letter to you --

21 DR. ROBERTS: We may not have that

146

1 yet, Dr. Lamm. We are still trying to get
2 this material -- some panel members have it
3 and some don't. We're trying to get some
4 copies made.

5 DR. LAMM: I understand.

6 I am making -- I have not read your
7 materials. I am making the assumption that
8 your risk analysis is based on analysis of the
9 Southwest Taiwan data set. Am I correct in
10 that?

11 DR. ROBERTS: No. It's actually more
12 on the exposure and non-cancer issues that
13 we're dealing with in this particular session.

14 DR. LAMM: Then my comments are
15 related to the issue of cancer effects.

16 On that, with respect to the
17 carcinogenic assessment of arsenic -- excuse
18 me -- of internal cancers within ingested
19 arsenic, the major point I wish to make is
20 that the Southwest Taiwan study is an
21 inappropriate marker for U.S. exposure.

1 We now have studies which are in --
2 have been submitted to the literature for
3 review, which we had submitted to the National
4 Research Council, in which we asked whether
5 the type of ecological study that was done in
6 Taiwan could be done in the United States.

7 We have, using data from the U.S.
8 Geological Survey, identified 133 counties who
9 use well water as their source, whose well --
10 excuse me -- groundwater as their drinking
11 water source, whose analyses of groundwater is
12 well-known by the U.S. Geological Survey.

13 Based on that, we have identified the
14 median exposure level which fall in the United
15 States between the range of 3 and 60 parts per
16 billion. And we find that there is no change
17 in the bladder cancer rate throughout this
18 range.

19 The Taiwan study includes 300,000
20 person years of observation among people
21 exposed to less than 400 parts per billion.

148

1 Our study includes -- is based on 75 million
2 person years of observation among groups
3 exposed to between 3 and 60 parts per billion,
4 micrograms per liter.

5 The exposure data come from the U.S.
6 Geological Survey. The outcome data come from
7 the National Cancer Institute report on
8 county-specific mortality rates by cancers for
9 1950 to 1979.

10 The results of those reach for us the
11 conclusion, and a conclusion consistent with
12 the rest of the population-based mortality
13 studies, showing no increased risk of internal
14 cancers at exposures less than 100 or less
15 than 50 or 60 parts per billion.

16 This may be explained either on the
17 basis of a threshold model or on the basis of
18 some confounding exposures, particularly
19 occurring within the Southwest Taiwan.

20 I will stop there since I have
21 probably used up my time, and I thank the

149

1 chairman and the committee for the courtesy of
2 allowing me to speak, and I will be happy to
3 take any questions.

4 DR. ROBERTS: Thank you, Dr. Lamm. To
5 point out, since you sort of just arrived
6 today, the agency has indicated earlier that
7 certainly their risk assessment will take
8 cancer risks into consideration and then they
9 plan to consult with the Office of Water in
10 their -- as far as methodology and potency
11 estimates and so forth for estimating those
12 cancer risks. So it's really not among the
13 scientific issues that are posed to the panel
14 during this session.

15 But I would certainly offer panel
16 members the opportunity to ask any questions
17 that they might have before we move on, but
18 would request that they keep them fairly
19 brief.

20 Dr. Steinberg?

21 DR. STEINBERG: Dr. Lamm, as you know,

150

1 we don't have that skin cancer study. Did you
2 circulate that study?

3 DR. LAMM: The one from --

4 DR. STEINBERG: The one that you
5 say -- the skin cancer study that you quote
6 from Mongolia, was that it?

7 DR. LAMM: From inner Mongolia. No, I
8 did not. I would be happy to submit a copy of
9 that.

10 DR. STEINBERG: And where is that in
11 press?

12 DR. LAMM: At ATSDR.

13 DR. STEINBERG: But where is that in
14 press? You said it's in press.

15 DR. LAMM: As an ATSDR report.

16 DR. STEINBERG: So it's a publication
17 of ATSDR, which is not a journal, of course.
18 That's a report to ATSDR.

19 DR. LAMM: Correct, but according to
20 the NRC in their deliberations, they
21 considered that the internal and external peer

151

1 review process of that made it equivalent for
2 their purposes as a peer --

3 DR. STEINBERG: Again, we would have
4 to see that and we would be interested in
5 seeing that.

6 How many cancers -- how many skin
7 cancers did you find?

8 DR. LAMM: Eight.

9 DR. STEINBERG: You found eight?

10 DR. LAMM: Yes.

11 DR. STEINBERG: That's a small number
12 of skin cancers to be able to then make an
13 assumption of threshold versus non-threshold
14 for arsenic. And who looked at those cancers?

15 DR. LAMM: Those cancers were looked
16 at by the Chinese dermatologists and confirmed
17 by Professor Stephen Tucker, professor of
18 dermatology at University of Texas.

19 DR. STEINBERG: A dermatologist. Do
20 you have slides on those? Is it a
21 dermatopathology? Do you -- can you tell

1 me --

2 DR. LAMM: There exists on some of
3 them. Others are by visual determination by
4 the U.S. professor.

5 DR. STEINBERG: So you don't have
6 slides on those of dermatopathology to
7 definitively say that those are, indeed,
8 cancers and what type of cancers those are?

9 DR. LAMM: Yes, those have been
10 reviewed. The laws of China do not allow the
11 material to leave the country. But they have
12 been reviewed there.

13 DR. STEINBERG: By dermatopathologists
14 there?

15 DR. LAMM: By their dermatopathologist
16 and by Professor Tucker.

17 DR. STEINBERG: So there are slides,
18 and Professor Tucker, a dermatologist, not a
19 dermatopathologist, has access to those
20 slides? I mean, this is all a little -- you
21 know, these are small numbers without really

153

1 achieving the gold standard in the United
2 States. I think we have to be cautious about
3 our saying that arsenic is, therefore -- that
4 there is a threshold versus linear based on
5 this.

6 DR. LAMM: Excuse me. I have not
7 reached that conclusion. What I said is that
8 this one study demonstrates that. And it
9 ought to be reconfirmed.

10 DR. ROBERTS: This is a very important
11 discussion, but probably not for the purposes
12 of our panel here. I'm not trying to minimize
13 this, but I would like to go ahead and just
14 move through this as quickly as we can,
15 especially since --

16 DR. STEINBERG: I think also related
17 to any of the other studies in Taiwan, again,
18 we would have to see those, we would have to
19 know what diet they are on. I mean, these are
20 all very complicated things and without having
21 that information, it's very hard to comment.

154

1 I think we could leave it at that.

2 DR. ROBERTS: Thank you. Again, since
3 it does not directly pertain to our
4 discussion, unless there are some really
5 important questions to be asked, I'd suggest
6 that we move on.

7 DR. LAMM: I thank you.

8 DR. ROBERTS: Thank you, Dr. Lamm.

9 Mr. Cook, I believe we have on the
10 schedule now a presentation by the agency on
11 some of the exposure aspects?

12 MR. COOK: That's correct.

13 DR. ROBERTS: And let me turn it over
14 to you to introduce that topic and the
15 presenter.

16 DR. COOK: All right. I'll try to
17 keep this brief because I know we're behind
18 schedule.

19 Today, the agency would like to
20 present to the panel a discussion of the
21 exposure data and assumptions that we propose

1 to use in a children's risk assessment for
2 CCA.

3 At this time, I would like to
4 introduce the speakers at the table. To my
5 far left is Dr. Timothy Townsend from the
6 Department of Environmental Engineering
7 Services, University of Florida. To
8 Dr. Townsend's right should be Dr. Bob Benson,
9 who is from U.S. EPA region 8.

10 Okay. I got it wrong. Anyway,
11 Dr. David Stilwell from the Connecticut Ag
12 Experiment Station, University of Connecticut.
13 Then we have Dr. Winston Dang who will be in
14 assistance if needed. And Ms. Doreen Aviado
15 will make the presentation on the exposure
16 scenario.

17 I would like to point out that today
18 we have do have present -- not to put them on
19 the spot, but we do have present exposure
20 experts from the Health Effects Division, as
21 well as staff from the Office of Solid Waste,

156

1 if we do reach that area, as well as staff
2 from the CPSC if we do get into the protocols.

3 So I'll just conclude with that and
4 turn it over to Doreen Aviado.

5 MS. AVIADO: Thank you, Norm. Good
6 morning, Mr. Chairman, members of the panel,
7 ladies and gentlemen. My name is Doreen
8 Aviado. I'm a biologist with the
9 antimicrobials division and it is my pleasure
10 to present to you this morning an overview of
11 OPP's proposed approach for developing the CCA
12 child playground exposure assessment.

13 Based on presentations you have heard
14 from yesterday and this morning, you are
15 already familiar with the complexities and the
16 issues associated with this assessment.

17 This morning I'll put into perspective
18 for you the scope of the exposures and discuss
19 in more detail our proposed approach on the
20 methodology.

21 Next slide. For this assessment, it's

157

1 very important that we clarify what we intend
2 as the scope of the playground exposures. To
3 put this into context, we consider that
4 residential playground settings will include
5 schools, day care centers, municipal and
6 public parks and home sites where CCA-treated
7 play structures are located. The playground
8 structures themselves would be both the
9 treated wood playsets and any related
10 recreational equipment and timbers that are
11 used to border the play area for which a child
12 may come into contact.

13 The playground soils would refer to
14 any soils under or adjacent to the structures.
15 The soils may also be considered to encompass
16 those playground buffering materials which are
17 found on public playgrounds under the
18 equipment. These are used as shock-absorbing
19 playground surfacing -- loose surfacing
20 materials, such as the wood chips, mulch,
21 shredded tires and pea gravel.

1 Specifications for these materials are
2 set and provided by the U.S. CPSC, Consumer
3 Product Safety Commission.

4 Next slide. We need to clarify also
5 what we intend as our final approach for the
6 exposed child, the camera snapshot, if you
7 will, of what we're looking at for the child.
8 We need to characterize the non-dietary
9 exposures for a three-year-old toddler
10 weighing 15 kilograms, representing children
11 ages one through six wearing a short-sleeved
12 shirt, shorts, shoes, and clothing -- other
13 clothing that certainly would be considered
14 appropriate for warm weather conditions, while
15 playing on playground settings. These
16 children would be on the settings from one
17 hour per day for 130 days per year, six years
18 over their lifetime.

19 This is general schematic, just to
20 review with you the major exposure pathways
21 through which our representative

1 three-years-old would be exposed to the
2 compounds from CCA on a playground.

3 In service CCA-treated wood playground
4 structures are the source of the dislodgeable
5 arsenic and chromium residues on wood
6 surfaces. Also, these compounds can leach
7 into the substrates surrounding the
8 structures, resulting in contaminated soils
9 and significant residues of arsenic and
10 chromium.

11 The concentration of the residues,
12 their availability for child contact via the
13 dermal and oral ingestion routes would vary
14 based on several factors.

15 For the wood surface residues, the
16 factors are related to the nature of the wood
17 used to fabricate these structures, the
18 conditions on the wood surfaces, for instance,
19 the wood type, the pressure treatment
20 conditions, the age of the structure, the wood
21 moisture content, if the surfaces are now

160

1 weathered or sanded, abraded or coated.

2 In addition, for the soil residues,
3 factors related to exposed wood surface areas
4 and environmental conditions apply. For
5 example, the soil characteristics are
6 important, precipitation patterns, soil and
7 water pH.

8 Based on these exposure pathways, we
9 propose to develop four scenarios. We've
10 talked extensively yesterday on these, so I'll
11 just quickly run through them.

12 There are four scenarios, two which
13 are dermal: Child dermal contact with the
14 wooden play structure; dermal with
15 contaminated soils; child incidental oral
16 ingestions from hand-to-mouth contact with the
17 wood surfaces; and incidental ingestion of the
18 contaminated soil.

19 For your consideration, we also have
20 on this slide two additional scenarios that
21 may be considered. We have spoken about

161

1 buffering materials, and there may be the
2 possibility that we need to look more closely
3 at developing a dermal and incidental oral
4 ingestion scenario for the CCA-contaminated
5 buffering materials.

6 One point I did want to make here is
7 we spoke at length yesterday about wood mulch
8 and wood chips and the propensity for a child
9 to be in contact with those. Please consider
10 that buffering materials also include pea
11 gravel.

12 If you are not familiar with that,
13 it's possibly a high-affinity substrate for a
14 child. There are very small pebbles, the size
15 of a jelly bean. And we know that children
16 ages two, three -- our typical representative
17 child could very much inadvertently be
18 involved with mouthing of those types of
19 buffering materials.

20 Let's move on. I would like to
21 discuss with you now in more detail our

162

1 proposed methodology.

2 Our goal within OPP is to develop
3 realistic child playground exposure scenarios.
4 We propose to rely at this point on a
5 deterministic approach whereby the central
6 tendency exposure values are used to calculate
7 the lifetime average daily dose estimates for
8 the cancer assessment, and the high-end
9 exposure values will be used to calculate the
10 average daily dose estimates for our
11 non-cancer assessment.

12 In contrast to methods which generate
13 the single-point estimates of risk, which may
14 not adequately address the uncertainties and
15 variabilities associated with the derived
16 estimates, we would propose for consideration
17 an alternate approach using probabilistic
18 techniques such as the Monte Carlo simulation.

19 Probabilistic techniques -- as you
20 know, they do take into account the
21 variability of existing data from the exposure

163

1 parameters and yield a distribution of
2 potential exposures.

3 To develop realistic scenarios, we
4 certainly need to look at the separate
5 components. We need to select appropriate
6 parameters to achieve this goal. These
7 include the routes of exposure, the duration
8 of exposure, input variables, which are
9 subsetting as child activity assumptions and
10 exposure factors, the residue data,
11 concentrations on the wood, in the soil, and
12 the equations we'll use for the dose
13 calculations.

14 Regarding the selection of the residue
15 data, I'm very pleased to have with us today
16 sitting at our panel table Dr. Stilwell and
17 Dr. Townsend who, as part of their discussions
18 on the research they have conducted, they will
19 include a discussion of the contaminated soils
20 and surface soil residues as a comparison of
21 the existing data sets that we're aware of

164

1 from the current data. And they will present
2 those for the panel's consideration.

3 The major routes proposed for child
4 playground exposures are dermal and oral --
5 and we can move to the next slide.

6 The inhalation exposure route at this
7 point we have not considered. We consider it
8 negligible.

9 We don't propose to do this route as
10 a -- we don't propose to develop this route
11 yet. It is a topic for discussion by the
12 panel.

13 Our assumption today is that the
14 exposure is negligible because of the level of
15 surface residues not being respirable at
16 significant concentrations. We also know
17 that, on the wood surfaces, these are not
18 volatile compounds.

19 Next slide. We spoke about this
20 yesterday, so this will just look familiar to
21 you. Within OPP, we have exposure durations

165

1 set from one day to one month for short-term,
2 one to six months as intermediate-term, longer
3 than six months, long-term, and for cancer
4 assessment we conduct lifetime exposure
5 durations, where the portion of the exposure
6 is amortized over the lifetime.

7 For the non-cancer assessment, we
8 proposed, therefore, for this child playground
9 portion of our comprehensive assessment to
10 conduct it for short-term and
11 intermediate-term. This is based on the
12 assumption that children are exposed for up to
13 130 days a year on playground structures and
14 soils.

15 The cancer assessment, as we mentioned
16 earlier, is to amortize the cancer exposure
17 for children over a lifetime, and this is
18 based on duration of six years out of their
19 75-year lifetime.

20 The input variables that we're
21 considering include child activity assumptions

1 and exposure factors. Some of these are
2 variables considered as general inputs for all
3 four scenarios and others will be specific to
4 certain scenarios.

5 The child activity assumptions are
6 based on a child's behavior and anticipated
7 activity patterns on playgrounds versus other
8 residential sites.

9 This is a point of clarification, to
10 note that when OPP finalizes the human health
11 assessment for the re-registration of CCA, we
12 will include a comprehensive residential
13 exposure assessment for children in contact
14 with CCA compounds in other residential as
15 well as playgrounds, for instance, residential
16 exposure to residues from decks.

17 OPP assumes that a three-year-old
18 child would be engaged in sustained
19 self-directed play behaviors on playsets and
20 in adjacent soils and substrates. Children at
21 this age are assumed to be capable of play

167

1 activities that are independent of a parent or
2 guardian.

3 Also, we assume that children at this
4 age will exhibit frequent hand-to-mouth
5 behavior and soil mouthing behavior.

6 The exposure factors are measured
7 inputs and they are not necessarily based on a
8 child's activity patterns. These are agency
9 default assumptions from peer-reviewed data
10 sources. This slide shows you the sources of
11 our inputs.

12 The guidance document shown here --
13 there are three listed -- they are relied upon
14 for conducting agency exposure and risk
15 assessments, and they may be familiar to most
16 of the panel members.

17 The California Department of Health
18 Services study of 1987 presents an analysis of
19 CCA residue data collected from numerous field
20 tests on wood structures in outdoor sites
21 across that state, including parks and

168

1 playgrounds, and it's cited here because the
2 study provided useful information on
3 estimating the frequency of child playground
4 visits.

5 The following slides will identify the
6 data we propose to use for each of our input
7 variables. Each slide shows you the source of
8 the input and whether they are central
9 tendency or high-end values.

10 We'll cover the child activity
11 assumptions first.

12 For the exposure frequency, we're
13 proposing 130 days a year on playgrounds.
14 This, as you see, is based on the California
15 work. It assumes five times a week, 26 weeks
16 a year. OPP considers this a central tendency
17 value. However, in the California study, it
18 was used to estimate high-end exposures.

19 This is an important input because, as
20 you have heard from some of the public
21 comments, we may be tending to underestimate

1 what would be expected as child play behavior
2 in southern, warm weather geographic regions.

3 For exposure duration, we are
4 proposing to use six years for a child engaged
5 in outdoor play activity on residential sites.
6 This is adopted from Superfund's draft
7 guidance, and the value is not necessarily
8 specific to playground sites, but was selected
9 by OPP for this assessment based on
10 professional judgment.

11 For the exposure time, we propose
12 values of one hour a day and three hours a day
13 as the time a child will spend engaged in
14 outdoor play activity. They are based on data
15 of high confidence for school grounds and
16 playgrounds. Note that these values are
17 proposed for developing the dose estimates in
18 the oral ingestion scenario involving
19 hand-to-mouth contact with the wood residues.

20 The one-hour-a-day value as a central
21 tendency input will be used in conjunction

170

1 with a hand-to-mouth frequency of 9.5 events
2 per hour, and the high-end value of three
3 hours correlates to the 20 events per hour
4 hand-to-mouth frequency.

5 The proposed soil ingestion rate
6 values are 100 milligrams and 400 milligrams,
7 and these are based on data of medium to low
8 confidence due to limitations in the studies
9 from which the values were derived.

10 The proposed hand-to-mouth frequency
11 of 9.5 events per hour and 20 events are based
12 on data generated from videotaped observations
13 of children in home and day care environments,
14 and the frequencies were, in fact, recommended
15 by the SAP in their 1999 meeting with the
16 agency for adoption into the latest version of
17 the residential SAPs.

18 For the exposure factors, the data
19 input shown here for age, body weight and life
20 expectancy are considered standard agency
21 inputs and they are derived from data we feel

171

1 are of high confidence.

2 The proposed body surface area of 1640
3 square centimeters for dermal contact surfaces
4 of exposed hands, arms and legs -- it's based
5 on data for soil contact clothing scenarios
6 for children wearing short-sleeved shirts,
7 shorts and shows.

8 This value depicts 25 percent of a
9 three-year-old's total body surface area at
10 the 90th percentile, and it takes into account
11 that, even with clothing, the portions of the
12 skin under the clothing may be potentially
13 exposed.

14 The hand surface area measurement of
15 20 square centimeters was selected as a more
16 realistic estimate by the agency for this
17 assessment as opposed to the assumption of
18 children using whole hand surfaces. The 20
19 square centimeters is recommended for
20 screening level estimates, again, by the SAP
21 in their 1999 recommendation to the EPA.

1 For fraction ingested, we propose a 50
2 percent removal efficiency of residues from
3 fingers by human saliva based on studies for
4 organic chemical pesticides.

5 Without data specific for transfer of
6 residues from playground soils to hands, we
7 relied as a surrogate on an assumption of a
8 one-to-one relationship of dislodgeable
9 residue transfer based on transfer dynamics
10 for turf to skin.

11 We propose to use an adherence factor
12 of 1.45 milligrams per square centimeter to
13 best represent the playground soil substrates.
14 Existing data recommendations in our exposure
15 factors handbook for soil adherence to skin
16 are rated of low confidence due to associated
17 data limitations and high variability.

18 So what we did is we took a look at
19 guidance offered by EPA Superfund program. We
20 adopted their 1.45 value based on their
21 commercial potting soil data from the

173

1 Superfund risk assessment guidance document of
2 1989.

3 They have updated their guidance.
4 There is a current draft Superfund guidance
5 document issued in 2000 which offers
6 additional data for adherence factors based on
7 results from studies conducted with children
8 with dry and wet soils, indoor/outdoor
9 settings. And OPP will need to determine the
10 suitability of these data over our proposed
11 value for use in this assessment.

12 Now, I have a few tables here. The
13 benefit of the table would be just to point
14 out for the panel which values we would like
15 you to focus on.

16 These next slides here are tables
17 which overview OPP's ranking of the proposed
18 input variables for use in calculating the
19 exposure estimates. I want to qualify -- the
20 column that says OPP data confidence
21 specifically is our confidence in proposing

174

1 the value for the assessment as opposed to the
2 confidence of the data point itself within the
3 study which we're citing.

4 OPP's level of confidence is
5 characterized as low, medium or high. The
6 tables are intended to help the panel focus
7 discussions on the variables of low to
8 moderate confidence which we highlight here as
9 either general or scenario-specific factors.

10 For example, the proposed exposure
11 frequency and duration may truly underestimate
12 exposures for children spending considerable
13 time in the warm-weather geographic regions.

14 Our overriding concern in conducting
15 this assessment is to make sure that the over
16 or underestimation of exposures are somehow
17 minimized.

18 We can scroll through the rest of
19 these just to give the panel a look at these.

20 Now, the last set of slides we'll look
21 at will be for the equations for the exposure

1 dose.

2 These equations are derived from
3 standard exposure algorithms found in our EPA
4 residential SOPs. The non-cancer dermal and
5 oral ingestion doses are derived from the
6 average daily dose equations yielding maximum
7 estimates of short and intermediate-term
8 exposure.

9 Our cancer dermal, oral ingestion
10 doses are derived from the lifetime average
11 daily dose equations to yield central tendency
12 estimates representative of exposures
13 amortized over a lifetime.

14 The non-cancer ADD equations are shown
15 by scenario as follows: This first slide is
16 for dermal contact with wood.

17 I would like you to just note here
18 that we propose to use the maximum arsenic and
19 chromium residue concentrations from the wood
20 surface residue data and apply a dermal
21 absorption factor as proposed in yesterday's

176

1 hazard characterization presentation, 6.4
2 percent for arsenic and 1.3 percent for
3 chromium to account for the oral toxicity
4 endpoints in this dermal scenario.

5 For the dermal contact with soil, note
6 that the equation is expanded here to include
7 an adherence factor, and that we propose to
8 use, again, maximum levels for soil residue
9 concentration data.

10 For the hand-to-mouth oral ingestion
11 of wood residue scenario, aside from the
12 inputs that have already been noted, we plan
13 to use high input values, as you see here, for
14 the frequency of hand to mouth, the exposure
15 time, and apply a fraction ingestion.

16 For the oral ingestion of contaminated
17 soil, we include the maximum residue data and
18 high-end inputs for the soil ingestion rate.
19 And we are applying here, as you see, based,
20 again, on the hazard characterization -- we're
21 proposing the 25 percent bioavailability

177

1 factor be applied for the arsenic from the
2 soil ingestion.

3 The cancer LADD equation for both
4 dermal and oral ingestion, they include the
5 ADDs, which are derived using the average
6 values, and the central tendency inputs for
7 one hour for the exposure time, 9.5 events per
8 hour for the hand-to-mouth frequency, and the
9 soil ingestion rate of 100 milligrams per day.

10 That concludes my presentation for
11 this morning. Thank you for your attention.
12 I'll be happy to take any questions you may
13 have at this time.

14 DR. ROBERTS: Thank you, Ms. Aviado.
15 Do I have a -- holding comments, of course,
16 until later, are there questions among panel
17 members?

18 Dr. Morry and then Dr. Clewell.

19 DR. MORRY: With regard to the soil
20 adherence factor and so forth, do you have any
21 data on what kind of soil is actually

178

1 underneath these play structures, like what
2 percentage of them have wood chips, what
3 percentage have sand and so forth?

4 MS. AVIADO: What I'll do, Dr. Morry,
5 is try to clarify the issue, and if someone
6 else here from the agency has additional
7 information, I will certainly hand the mic
8 over to them.

9 What I want to clarify for you,
10 because the playground setting, the
11 residential setting includes both public
12 playgrounds for which CPSC specifies these
13 buffering materials, and homeowner backyard
14 playsets for which there are no
15 specifications, you have a wide range. You
16 have soils -- depending on the soil
17 characteristics of the geographic area, you
18 have wide variability just in the true raw
19 soil under a playset.

20 There are protective substrates, as we
21 mentioned, these buffering materials, which

179

1 you would be more likely to find in public
2 playgrounds. There are statistics that show
3 that, even though there are specifications for
4 what we would like as surfacing, whether they
5 are adopted or not, the enforcement of that,
6 there may not be 100 percent enforcement.
7 There was a survey that showed between 70 and
8 90 percent of the public municipal playgrounds
9 do have buffering surfaces.

10 DR. ROBERTS: Dr. Clewell?

11 DR. CLEWELL: You will have to remind
12 me what CF is in the non-cancer equations.
13 It's not mentioned on the slides.

14 MS. AVIADO: The nature of our
15 non-cancer equations?

16 DR. CLEWELL: No. CF. There is a
17 term "CF" in the non-cancer --

18 MS. AVIADO: Oh, I'm sorry.
19 Conversion factor. That's just a simple
20 conversion factor --

21 DR. CLEWELL: That would be -- oh,

180

1 units?

2 MS. AVIADO: -- from units to --

3 DR. ROBERTS: Dr. Wargo and then
4 Dr. Thrall.

5 DR. WARGO: Thank you. That was an
6 excellent presentation. A few quick
7 questions.

8 I'm interested in your judgment about
9 data confidence. And you have applied this
10 judgment across a variety of the factors that
11 you are considering.

12 Could you give us some indication of
13 how you might classify a factor as high
14 confidence versus moderate or low confidence.

15 MS. AVIADO: I would be very happy to
16 do that for you, and I'm glad you brought that
17 issue up because I think this will be central
18 to our discussions tomorrow.

19 DR. WARGO: Excuse me. And before you
20 do that, what I'm interested to know is what
21 the rating of confidence would do to your

181

1 judgment about the selection of the magnitude
2 of the factor that you choose or the range.

3 MS. AVIADO: I will do the best I can
4 to at least address a portion of that. Your
5 second part of the question is much more
6 involved. I will certainly defer to others
7 from our agency to help me answer that, or
8 they can address that issue.

9 But in basic terms, the tables were
10 meant to show you our confidence in applying
11 the input for the exposure estimates for the
12 playground settings.

13 The first table showed age, body
14 weight and life expectancy as high confidence
15 for us because those are considered standard
16 defaults. We don't assume that those would be
17 debatable inputs.

18 The exposure frequency was moderate to
19 low confidence because, even as you've heard
20 in the public presenters, there is much
21 concern that we are underestimating child

182

1 activity, child frequency of visits on
2 playgrounds.

3 I would say there is an element of
4 professional judgment and subjective
5 decisionmaking that went into preparing the
6 table. They are based on our stance as we sit
7 here with you today.

8 There was not a true methodology to
9 validate our selections. That's why we would
10 like more input from the panel.

11 But let me just continue to assist
12 you. The six-year duration is noted here as
13 moderate because it may or may not represent
14 the length of time that children do spend on
15 playgrounds, especially if you are considering
16 home playgrounds where they may spend more
17 time. There may be children spending less
18 time than six years, so it's moderate
19 confidence. There is a lot of variability we
20 anticipate.

21 The body surface area measurement we

183

1 have high confidence in because it was based
2 on the 25 percent of the 90th percentile body
3 weights that are averaged in the
4 child-specific exposure factor handbook. The
5 male/female body weight totals are averaged,
6 and that 25 percent is documented specific as
7 appropriate for clothing scenarios in warm
8 weather settings, children with short-sleeve
9 shirts on, shoes and shorts. And it seemed
10 appropriate to us that that would transition
11 very well into a playground assessment.

12 For moderate confidence -- we rated
13 the 20 square centimeter hand-to-mouth surface
14 area of the three fingers moderate because
15 there is not enough site-specific data
16 conducted to observe children on playground
17 settings for us to know 100 percent if three
18 fingers is appropriate. They may be putting
19 more hand --

20 DR. WARGO: I appreciate you going
21 through each of these, but my question was

184

1 more generic.

2 As your perception of the uncertainty
3 surrounding our understanding of each factor
4 increases, so the more uncertain the
5 understanding is, would that cause you to
6 choose a higher bound, more conservative
7 default assumption?

8 MS. AVIADO: If we were sticking with
9 a deterministic point estimate approach, we
10 probably would certainly want to look at the
11 high end because of the level of uncertainty
12 within each of the parameters.

13 It may, in fact, give us the
14 springboard to consider truly maybe as a
15 screening tool, the deterministic point risk
16 estimates, and then, from there, really
17 conduct more of a Monte Carlo type simulation
18 or probabilistic simulation because of the
19 nature of the variability within the inputs.

20 DR. WARGO: One very minor question.

21 Do you consider the variability in

185

1 exposure that might occur from the result of
2 thumb-sucking behavior as the dad of a couple
3 of former thumb-suckers?

4 MS. AVIADO: As you see, we haven't
5 separated it out as significant. And, in
6 fact, initially when we were scoping out
7 questions for the panel, one of our thoughts
8 was because the developmental differences of
9 children from 18 months to two years, let's
10 say, as a snapshot -- their behaviors may be
11 distinct from children who are already three
12 and include higher frequencies, as Dr. Freeman
13 is nodding there to acknowledge.

14 We were considering whether we should
15 even, in terms of the surface area body weight
16 parameter, consider a ratio that might be more
17 reflective of that. But as a subset of this
18 population, we have not considered just the
19 thumb-suckers.

20 And I would just want to -- before I
21 forget, I wanted to make a quick point that,

186

1 other than those buffering scenarios, it would
2 be worthwhile for the panel to help us work
3 through any additional scenarios that would be
4 appropriate to characterize the exposure.

5 We heard yesterday the importance of
6 considering maybe splinters that children
7 would have as occurring to them on
8 playgrounds. Also, we heard abraded skin in
9 contact with the wood. And these sorts of
10 things we would appreciate consideration of.

11 DR. WARGO: One final thought. The
12 window of exposure you are measuring the
13 variables of behavior is six years. I'm
14 assuming that you are choosing that because
15 you believe that variability in behavior and
16 variability of exposure that would occur
17 within that six-year window is irrelevant to
18 the judgment about the risks that the children
19 develop.

20 MS. AVIADO: Initially, when this was
21 scoped out for a preliminary assessment, that

187

1 refinement was not taken into consideration.

2 DR. WARGO: So that the exposure at
3 year two, you are saying is equivalent to the
4 exposure at year six?

5 MS. AVIADO: Correct. If you look at
6 the approach as presented, correct. That
7 three-year-old, as representative of all
8 behaviors, all potential exposure scenarios
9 for children one through six. Correct.

10 DR. WARGO: Thank you.

11 DR. ROBERTS: Dr. Thrall?

12 DR. THRALL: This is probably a naive
13 question because I'm coming from completely
14 outside of this area, so bear with me.

15 But we've spent a day and a half
16 talking about lots of really very variable
17 things, many of which are very subjective:
18 Type of wood, type of soil, amount of
19 dislodgeable arsenic, time on playground,
20 amount of hand-to-mouth contact, number of
21 fingers put in mouth, whether they're

188

1 thumb-suckers and so on and so on. So my
2 question is, why don't we just take a large
3 number of children and measure the amount of
4 arsenic that's in their urine and then just
5 absolutely know what their risk is?

6 Is it detectable at these levels?

7 MS. AVIADO: I would like to defer
8 that question for you. I'm going to defer to
9 Dr. Winston Dang sitting next to me.

10 DR. DANG: My name is Winston Dang.
11 Your question is very interesting and,
12 actually, we discussed it with Dr. Andrew
13 Smith a few months ago and we are very
14 interested to understand his research.

15 As a matter of fact, if we have a
16 large data of biomonitoring studies, that data
17 would be very helpful to us. We can determine
18 how is the real world, realistic estimate of
19 the number we can get from the exposure.

20 And biomonitoring either from urine or
21 from hairs.

1 So, again -- one of the panel may give
2 a better answer than me in this question here.

3 DR. ROBERTS: I'll follow up and then
4 I have a number of other people that want to
5 raise questions as well.

6 DR. CLEWELL: I just wanted to point
7 out that they primary source of arsenic is in
8 the food, and that secondary would be water,
9 and that we all have significant levels of
10 arsenic in our urine and, yes, it's
11 measurable.

12 The question is whether the
13 contribution from playground equipment contact
14 could actually impact the levels in the urine
15 compared to the much larger, at least order of
16 magnitude, even by the most conservative
17 estimates, contribution from the food.

18 And if you look at the gradient
19 document, which is about an inch and a half
20 thick -- but in the middle there is a summary
21 of the epidemiological studies conducted on

190

1 people who work with CCA-treated wood. So
2 these are workers exposed to the wood in a
3 much more intimate fashion than the children.
4 And some of the studies show increased urine
5 levels and some do not. So even in that case,
6 they weren't able, in some cases, to detect an
7 increased urinary level of arsenic.

8 DR. ROBERTS: I'm sure this topic will
9 come up when we get into our issues in terms
10 of possible approaches.

11 I had Dr. Ginsberg next, then
12 Dr. Styblo, then Dr. Smith.

13 DR. GINSBERG: Regarding the use of
14 the three-year-old as a surrogate for the one
15 to six-year period, that wouldn't concern me
16 too much if it was just an LADD you were
17 calculating, but it sounds like you are also
18 gunning for a one-year or a very short-term
19 acute exposure. So I was wondering if you
20 thought about how those acute exposures would
21 be calculated and whether the three-year-old

191

1 is reasonably conservative for an acute
2 exposure for, say, a younger child? And I
3 have a couple other questions. I just want to
4 hear the response to that.

5 MS. AVIADO: That's a very good point.
6 Thank you for raising it. I think that really
7 does illustrate the complexity of doing an
8 assessment like this. Because the exposures
9 can be from one day to 130 days, it may make
10 sense to choose a more sensitive subpopulation
11 for those acute exposures.

12 Did we consider that before we came to
13 you? I would say no. We were looking in more
14 broad terms in this preliminary approach, and
15 we were certainly wanting to refine it through
16 your input. And that's a very good
17 suggestion.

18 DR. GINSBERG: As a follow-up, the
19 hand-to-mouth videotapes, was that -- the
20 essential tendency and the upper bound that
21 you are using, is that for a three-year-old

1 child? And is there a distribution of data
2 for various ages?

3 MS. AVIADO: I'll start off on the
4 response on this, and I may ask for Dr. Dang's
5 assistance.

6 Those are videotaped behaviors
7 observed for children within an age range that
8 would include three year olds. These are day
9 care settings. They were monitored over the
10 course of a 24-hour period, both indoor and
11 outdoor.

12 So part of our uncertainty with that,
13 even though the data itself is high
14 confidence, is how appropriate those indoor
15 dust sort of -- you know, you are
16 extrapolating your thinking in terms of the
17 wood surface dust into the mouth. How
18 realistic those events represent child exposed
19 to outdoor wood surfaces as opposed to indoor
20 day care, you know, mouthing behavior? I
21 mean, there may be some refinement required.

1 We have -- we are so pleased to have
2 on the panel Dr. Natalie Freeman who certainly
3 was intimately involved in the generation of
4 that data with some of the Dr. Reid,
5 Dr. Freeman studies we've relied upon to make
6 these estimates.

7 I'm not sure if she would like to
8 further clarify the nature of the subsets
9 within that study because it was quite
10 involved.

11 DR. FREEMAN: The Reid videotaped
12 data, which is based on 30 children, 10 of
13 them were in homes and the other 20 percent
14 were in one day care program. The ages of the
15 children ranged from -- I believe it was about
16 not quite two years old to five years old.
17 And, on average, they were three-year-old
18 kids.

19 The hand-to-mouth data -- I should say
20 that for most of the kids, we were observing
21 them for seven to eight hours a day so that --

1 and within child and also between child, there
2 is an enormous amount of variability in these
3 behaviors over time.

4 The 9.5 -- we have since been looking
5 at another 60 kids on the border of Mexico and
6 Texas on the Texas side, ranging from 6 months
7 to 48 months old. And we find that for the
8 three to four year olds, the 9.5 shows up
9 again, and that is substantially less than the
10 6-month-old to 18-month-old children, where
11 there is a great deal more mouthing.

12 One of the things I guess I was going
13 to bring up tomorrow but I might as well say
14 it since I'm talking, is that the 9.5 is based
15 on the eight hours of observations. This
16 includes both indoor and outdoor environments.

17 What we see when children are actively
18 playing outdoors, that for the most part,
19 other than little kids, the under 18 month
20 olds, is that mouthing outdoors is less
21 frequent -- and we'll be able to provide you

195

1 with some of this data broken down by indoor
2 and outdoor, which I think you might be able
3 to use.

4 That most of this is during down time.
5 It's during quite time. They have come
6 indoors. They are watching television or, if
7 they are in the day care program, they are
8 listening to story time. And that's when the
9 mouthing becomes very, very active.

10 It doesn't necessarily mean that they
11 aren't consuming things that they acquired
12 outdoors, but it's not in that outdoor
13 location.

14 MS. AVIADO: Thank you for qualifying
15 that for us.

16 DR. GINSBERG: And I just had one more
17 quick question. Your relative bioavailability
18 factor for soil ingestion of 25 percent,
19 that's just for soil ingestion? The
20 dislodgeable ingestion, that doesn't apply to?
21 Is that correct?

1 MS. AVIADO: That is correct. It is
2 just for the one scenario of the arsenic for
3 the ingestion from soil. The others are
4 assumed 100 percent.

5 DR. ROBERTS: Next on the list I have
6 Dr. Styblo followed by Dr. Smith,
7 Solo-Gabriele, Mushak and Kosnett.

8 DR. STYBLO: I will ask my questions
9 later. I'm fine.

10 DR. ROBERTS: Dr. Smith?

11 DR. SMITH: Your equation for doing
12 the ingestion scenario for hand-to-mouth
13 contact, as I understand it, this is the
14 concentration -- or this is the data from the
15 wipe test; is that correct? So this is going
16 to be micrograms per centimeter squared.

17 MS. AVIADO: Correct. This would be
18 the wood surface dislodgeable --

19 DR. SMITH: Wood surface dislodgeable
20 estimate.

21 And then you apply that to a surface

1 area of a hand, assuming a one-to-one
2 relationship. Is that correct?

3 MS. AVIADO: Correct.

4 DR. SMITH: So just help me out. I
5 just want to make sure I understand the logic
6 of this.

7 We have some -- wipe method, be it a
8 block or a cloth, we wipe some 100 centimeters
9 squared, so there is some accumulation onto
10 the surface, and we get some number. We
11 normalize it over 100 centimeter squared.

12 You assume that when you put the hand
13 down on the surface, that there can be no
14 accumulation on the hand, that all you can get
15 is the same concentration. Is that correct?
16 So on the empirical data, you are allowing for
17 accumulation, but are you not allowing for
18 accumulation on the hand. Is that correct?

19 MS. AVIADO: I don't believe it's
20 correct to view it that way. I would like
21 more clarification for you, Dr. Smith. I'll

198

1 have Dr. Dang walk you through that scenario.

2 DR. SMITH: Thank you.

3 DR. DANG: We understand they have some
4 uncertainty associated with this. Yesterday,
5 we have a lot of presentations between wipe
6 test and also the hand press. And those
7 tests, some are very variable, is from 25
8 percent, and some is -- like 1987, CDHSS have
9 some studies show between those two tests,
10 it's 100 percent.

11 But uncertainty associated with this
12 is, so far, we have a very limited data to
13 show the true values of that residue on the
14 surface of the wood.

15 So in other words, those transfer
16 residues -- in here, we have to assume it's
17 100 percent. Those residue transferred to the
18 wipe, test, 100 percent transfer to skin.

19 But here we say we don't have real
20 data to see here is because all the data we
21 show here we understand that transfer

199

1 efficiency is highly dependent on the moisture
2 of the content of the hands and also some
3 texture of the skin and also is wood type and
4 age of the types.

5 So that is a lot of uncertainty where
6 we associate with this kind of transfer
7 efficiency.

8 But here in our equation we had to use
9 the best available and best estimate we have
10 from available data in the last 25 years. We
11 can select the best credible studies we can
12 have to use into the equation.

13 DR. SMITH: Let me rephrase the
14 question because I think we'll get into
15 extended discussion on this during the
16 questioning period.

17 With the existing data sets, and there
18 are a few out there that have both hand and
19 wipe test data, in some cases for other
20 pesticides, in some cases for CCA wood, have
21 you attempted to use that data to validate

200

1 your assumption of this equation model?

2 MS. AVIADO: Can you further elaborate
3 what you mean by validate?

4 DR. SMITH: There are some data sets
5 where you could actually start with a
6 microgram per centimeter squared from the wipe
7 test data.

8 And then there is calculate based
9 on your model what you would expect for
10 loading on the hand and compare it to the
11 observed loading on hand to see if your model
12 holds up to a test.

13 MS. AVIADO: As you can appreciate, we
14 have only developed thus far a very
15 preliminary approach, deterministic. We
16 haven't used models to help us simulate.

17 DR. SMITH: This is just a question of
18 using the empirical data available. Running
19 a calculation from two sets of the data and
20 seeing if they compare well.

21 There is a gentleman with his hand

201

1 raised in the back.

2 MR. MOSTAGHIMI: My name is Siroos
3 Mostaghimi, and I work with colleagues in
4 antimicrobials division.

5 I think you have a good point. We
6 basically got to that point, that we have all
7 of our empirical formulas and everything and
8 we were starting to try to do that. This is
9 the process we're going to go through if we
10 cannot find more reliable data. Whatever we
11 have, we're going to look at it.

12 One way we were thinking was that one.
13 It's a very good suggestion. The problem we
14 had so far is that there is so
15 much variability among the data that you
16 really don't know which one is the best one.
17 That is one of the things that we're asking
18 the panel to make to comments on, reliability
19 of data, and afterwards we'll take care of it.

20 DR. SMITH: One last question again
21 regarding to the validation of the model.

1 Have you looked to see if there are
2 any studies out there which determine whether
3 or not implicit assumption of linearity in the
4 transfer efficiency. In effect, you go out
5 and somebody wipes 100 centimeters squared,
6 they get a certain mass, they normalize it to
7 100 centimeters squared and they say now we
8 have so much micrograms per centimeters
9 squared. So they basically assume linearity.

10 Have you looked to see if there are
11 any studies that would tell us if we happened
12 to do those experiments, but instead of
13 wiping 100 centimeters squared, wipe 200
14 centimeters squared or 400 centimeters squared
15 or 10 centimeters squared would we get the
16 same transfer efficiency.

17 I'm asking the question in somewhat -
18 - because I think the question is no, there is
19 no data for that.

20 MS. AVIADO: That is the answer at
21 this point. We have not done that level of

203

1 analysis. We'll be hearing in some of the
2 later presentations a little bit more about
3 the existing data sets and some of the
4 variability. So maybe those issues can be
5 discussed then.

6 DR. ROBERTS: Dr. Solo-Gabriele?

7 DR. SOLO-GABRIELE: I was interested
8 in getting some more information concerning
9 the exposure frequency and exposure duration,
10 the 130 days per year and the six year time.

11 Were those taken from the U.S. EPA
12 Exposure Factor Handbook? And, if so, how did
13 those numbers -- how were those numbers
14 derived for that handbook?

15 MS. AVIADO: I'll address that. The
16 130-day frequency, because the Exposure Factor
17 Handbook does show some daily calculations for
18 the amount of time in minutes per day that
19 children spend on playgrounds or outdoor on
20 school yards, the factors handbook does not
21 characterize how many days per year a child

204

1 visits playgrounds, what we ended up doing is
2 we took a look in more depth at some of the
3 assumptions made by the California Department
4 of Health Services Study and from professional
5 judgment went ahead and determined that that
6 130-day frequency may be adequate as a central
7 tendency.

8 In terms of the basis for their
9 assumption, they ran through some exposure
10 calculations, assuming the child would have
11 low moderate and high exposures. For their
12 moderate exposure frequency, it was closer to
13 78 days a year, their high-end was five days,
14 26 weeks out of a year -- five days a week,
15 130 days at their high-end.

16 But the actual basis for that number,
17 I think from our viewpoint, we chose it as a
18 possible appropriate input from professional
19 judgment.

20 Your other question, I believe, was
21 the six year.

1 The six year we adopted using
2 Superfund's approach. They have an age
3 adjusted factor approach to when they do
4 exposure risk assessments where they will
5 break out certain subpopulations for certain
6 exposure scenarios.

7 And, again, our own exposure factor
8 handbook, which we tend to rely quite heavily
9 on, did not cover what we felt might be the
10 appropriate exposure duration information for
11 this scenario.

12 So for lack of really adequate data,
13 site-specific data for playgrounds, we made
14 the assumption again that maybe the Superfund
15 guidance would be more appropriate, and we
16 based it on that.

17 DR. DANG: I believe Doreen just
18 mentioned about the Superfund six years old is
19 for residential sites. It is not necessary
20 for playground equipment. She mentioned in
21 her presentation already.

1 DR. SOLO-GABRIELE: I agree with
2 earlier comments that were made that it may
3 underestimate especially in the southern
4 climates, both the frequency and duration.

5 MS. AVIADO: Right.

6 DR. ROBERTS: Dr. Mushak.

7 DR. MUSHAK: Let me change the focus
8 of this and ask some clarifications about
9 jurisdictional issues between offices, because
10 you are constrained, as I understand it, to
11 those exposure scenarios that entail end use
12 aspects of treated wood, right?

13 That is, you will never meander off
14 the reservation of OPP requirements as to what
15 you can do and not do.

16 To the extent that there are other
17 exposure scenarios out there that are further
18 downstream, say, with disposal and recycling,
19 do the solid waste folks, if they are here,
20 have some role in collaborating with you
21 folks?

1 The second question related to that is
2 what happens with this stuff in terms of what
3 are the levels of hazards that may be raised?

4 I realize that this is not regulated
5 as hazardous waste provide you leave it
6 intact. But any recycling scenario that I see
7 that would be feasible without filling up
8 landfills requires doing something with this.

9 It seems like that generates hazardous
10 waste. How does OSWER deal with that?

11 MR. COOK: Let me make a few comments.
12 Then I'll ask my OSWER colleagues to step up
13 to the microphone.

14 In the life cycle of the process, you
15 have the manufacturer of the pesticide, and
16 usually OSHA handles the workplace issues.
17 Then you get into the wood treatment. We
18 would actually do the risk assessment for the
19 workers.

20 But any of the emissions, you have the
21 Clean Air Act, you have the Clean Water Act

208

1 and then you have RCRA that get involved.
2 Then when you get into the actual end use,
3 that's primarily the big area where FIFRA
4 comes into play.

5 As Debbie mentioned earlier, most of
6 the thrust of FIFRA is at the pesticide.
7 Actually, the wood is a treated article. But
8 because of the unique risk characteristics,
9 obviously, we're looking at the risk of
10 treated wood. Then when you get into the
11 disposal area, that's where OSWER comes into
12 play. I will defer to them. I don't know if
13 they want to make a few comments. We do have
14 two representatives here.

15 MR. ELLIOTT: Ross Elliott. I'm not
16 really sure what your question was about the
17 interaction between solid waste and
18 pesticides? What --

19 DR. MUSHAK: Will there be an
20 interaction. And second, can you take us
21 through the sequence of regulating the

209

1 disposal aspect of the lifetime of treated
2 wood.

3 I know that there is this issue of you
4 don't particularly treat it as a hazard.

5 But if you try burning it, then that
6 gets you into the Clean Air Act. If you try
7 burying chips, that becomes a hazardous waste,
8 presumably. What are the options for disposal
9 that trigger different regulatory --

10 DR. ROBERTS: Let me interject. Is
11 this -- I want to understand how this question
12 is going to pertain to sort of the issue.

13 DR. MUSHAK: It's trying to get a feel
14 for all of the exposure scenarios versus those
15 that are resident in our charge.

16 I'm perfectly happy to let it go.
17 It seems like we're looking at a very narrow
18 picture.

19 DR. ROBERTS: Let me suggest this.
20 Perhaps you guys could talk sort of off-line
21 at lunch. And if it looks like there is an

210

1 issue that pertains to feedback that we might
2 want to provide in terms of exposure
3 assumptions or scenarios, then I would
4 encourage you to bring that back in when we
5 have that discussion.

6 DR. ROBERTS: Dr. Bates?

7 DR. BATES: I want to go back to the
8 issue of hand-to-mouth oral ingestion of
9 residues.

10 There is a factor in here for hand-to-
11 mouth frequency of 20 events per hour and a
12 fraction ingested of 50 percent.

13 This seems to imply that there is a
14 sort of reloading every three minutes of the
15 hand. It seems to me that might be a little
16 unrealistic.

17 I was wondering if any consideration
18 might be given to another factor in here like
19 a reloading frequency or something of that
20 nature.

21 MS. AVIADO: That's a very good point.

211

1 I think it was illustrated actually this
2 morning when Exponent showed some of the pie
3 charts to show the large numbers attributed
4 based on this high frequency of hand-to-mouth.

5 At this point, we are certainly open
6 and encourage discussion from the panel to
7 help us work through a much more realistic
8 scenario.

9 That additional consideration for a
10 different component into the equation we have
11 not presented that, but we certainly would
12 want to consider it.

13 The idea initially was that because it
14 is a one-to-one transfer, that 50 percent
15 based on the efficiency from saliva reduces
16 that load. But you are correct. In our
17 assumptions, we are assuming that the same
18 amount of surface residue is constantly
19 reloaded onto those three fingers into the
20 mouth.

21 In terms of working through a more

212

1 realistic equation that would be encouraged
2 for the panel to help us work through if you
3 do have some suggestions.

4 DR. ROBERTS: Dr. MacDonald and
5 Dr. Ginsberg.

6 DR. MacDONALD: Given the difference
7 between wet and dry hand uptake, I'm surprised
8 the model is not including time with wet
9 weather play.

10 And my other question is there
11 doesn't seem to be a simple relationship
12 between exposed dermal surface, the contact
13 surface and the arsenic loading. In fact, the
14 limited data we saw on the SCS study suggests
15 even a zero or negative correlation between
16 hand size and loading.

17 It would seem to me that these
18 factors would make a model like you are
19 proposing very tenuous.

20 DR. ROBERTS: Dr. Ginsberg?

21 DR. GINSBERG: Regarding the

213

1 California use of the 130 days a year as an
2 upper end exposure, I just wanted to add to
3 your consideration that they were dealing with
4 play structures that were not in people's
5 backyards.

6 This wasn't residential. So a
7 child would have to travel to a school or
8 municipal playground. So I think that's why
9 they may have had a different exposure
10 frequency mindset than what we might be
11 thinking of in terms of this panel.

12 MS. AVIADO: That's a very good point.
13 That's why we appreciated, in addition, the
14 public comments from the gentleman from South
15 Carolina and Ms. Applegate yesterday to really
16 encourage us to look at more realistic --

17 DR. GINSBERG: I know we'll be
18 spending time later talking about how we're
19 going to make recommendations on dislodgeable
20 data sets and soil data sets for you to plug
21 into these equations. But you have also, EPA,

1 has reviewed these data.

2 And what was your thinking in terms
3 of how you were going to select a C-max for
4 soil and a C-average for soil and a C-max for
5 dislodgeable?

6 MS. AVIADO: As Dr. Mostaghimi relayed
7 to the panel when he gave us some input as to
8 the current status of the agency's evaluation,
9 we are just beginning to take those data sets,
10 try to take a hard look, number one, at is
11 this treated wood from a wood treatment plant
12 or in-service playground structure?

13 There are certain parameters or
14 criteria that we're sorting through to try to
15 make better sense of this large set. In fact,
16 the soil residue data seems to be much more of
17 a smaller concise data set when you compare it
18 to all of the numerous studies done on
19 dislodgeable residues from wood.

20 We try to look at the methodology.
21 We try to look at the conditions for which the

215

1 wood may be weathered or if the protocol took
2 into consideration any sort of simulation of
3 real use conditions for the wood. There are
4 so many variables.

5 In fact, as I mentioned, we're just
6 starting to look at this. But that would be
7 our natural progression, to take dry wipe
8 studies, hand wipe studies, kim (ph) wipe
9 studies, vacuum brush studies. Try to compile
10 them into subsets, then really analyze them
11 for applicability to this scenario. And we
12 have just begun to do that.

13 DR. GINSBERG: One final
14 clarification. Where did the 50 percent
15 factor come from in terms of how much will get
16 off the hand and into the mouth.

17 MS. AVIADO: Actually, that is based
18 on data from the residential SOPs and the
19 Exposure Factor Handbook as based on data for
20 children in contact with organic pesticides.

21 Clorpirophase (ph) and some of the

216

1 organophosphate. So it is measured data.

2 DR. DANG: We probably have to conduct
3 uncertainty analysis and maybe if we don't
4 have enough database, we probably have to look
5 into the sensitivity analysis.

6 Because those database, whether
7 we're going to use C-max, maybe have impact
8 for the risk.

9 So we have to be conduct more further
10 studies on those huge dislodgeable data set
11 and also soil data set also.

12 And regarding those 50 percent removal
13 efficiency, what we are concerned is we
14 understand there is maybe a lot of uncertainty
15 associated with this 50 percent. Because so
16 far that is variable data from 1994 to 1998.
17 We look at those data. Most spike test due to
18 spike test on the test tube, either on test
19 tube or furniture or toys.

20 We don't have any spike test from any
21 wood. So we don't know that from wood to the

1 skin and from skin to the mouth.

2 We just mention about best test. The
3 published article mostly is from organic
4 chemical. We have to consider lipophilic and
5 hydrophilic issue of the inorganic matters
6 here.

7 DR. ROBERTS: Let's take one more
8 short question from Dr. Smith.

9 DR. SMITH: Thank you, Dr. Roberts.
10 A question on your policy on
11 probabilistic analyses.

12 Through your presentations I have seen
13 over the past couple days the key word I
14 always see next to any sort of mention of
15 probabilistic analyses by the agency is the
16 word variability.

17 What is the agency's policy on
18 undertaking probabilistic analyses to get at
19 an issue of uncertainty. I think we can all
20 appreciate here we have got not only a
21 question of variability, but we have

218

1 considerable questions of uncertainty as well.

2 DR. DANG: So far we use a so-called
3 point estimate technique. We're looking where
4 we can use so-called distribution estimate and
5 use probabilistic base model.

6 We are shopping around what kind of
7 model is the best for this CCA case studies.

8 Fortunately, we have our sister office
9 in ORD. They currently develop a model called
10 SHEDS model, Statistic Human Exposure Data
11 Simulation model.

12 They use two-stage Monte Carlo
13 approach to get rid of this. And hopefully we
14 can have a more detail on this model we can
15 use it to consider for those model perimeter
16 (ph) and model pass away exposure analysis.

17 DR. SMITH: Just to clarify. By two
18 stage, you are referring to the two stage
19 uncertainty versus variability approach is
20 that it's sometimes used in probabilistic
21 analyses to get at both? Is that correct?

219

1 DR. DANG: That's correct. The amount
2 as far as I know is include of the variability
3 analysis also, uncertain analysis also.

4 DR. SMITH: Thank you.

5 DR. ROBERTS: Thank you. The next
6 item up is a presentation by Dr. Styblo.

7 How about if we start after breaking
8 for lunch with yours? I think the panel could
9 probably use a little nourishment. I'll ask
10 them to eat something light so they will be
11 alert for your presentation.

12

13 Let's convene -- it is 12:45 now.
14 Let's convene in one hour, promptly. Be ready
15 to start.

16 (Thereupoun, Volume I of II
17 concluded.)

18

1
2
3
4
5
6
7
8
9

CERTIFICATE OF STENOTYPE REPORTER

I, Frances M. Freeman, Stenotype Reporter, do hereby certify that the foregoing proceedings were reported by me in stenotypy, transcribed under my direction and are a verbatim record of the proceedings had.

FRANCES M. FREEMAN

221

1 I-N-V-O-I-C-E**** *****I-N-V-O-I-C-E****
2
3
4
5 FRANCES M. FREEMAN
6 21168 Wildflower Square
7 Ashburn, VA 20147
8 703/723-3550
9
10 TODAY'S DATE: 11/19/01
11
12 DATE TAKEN: 10/24/01
13
14 CASE NAME: FIFRA SAP
15
16 DEPONENTS:
17
18 **TOTAL: -- PAGES:** 215
19
20 ATTORNEY TAKING DEPO:
21
22 COPY SALES To:
23
24 DELIVERY:
25
26 COMPRESSED:
27
28 DISK:
29
30 E-MAIL:
31
32 EXHIBITS:
33
34 TRIAL DATE:
35
36 **SIGNATURE: