

**PRELIMINARY STAFF DRAFT**  
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PROTOCOL  
SAMPLING CHROMATED COPPER ARSENATE (CCA) "PRESSURE" TREATED WOOD  
PLAYGROUND EQUIPMENT FOR DISLODGEABLE RESIDUES OF  
ARSENIC, CHROMIUM, AND COPPER

STUDY SPONSOR

U.S. Consumer Product Safety Commission

TESTING FACILITY

U.S. Consumer Product Safety Commission's Directorate for  
Laboratory Sciences

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SAMPLING CHROMATED COPPER ARSENATE (CCA) "PRESSURE" TREATED WOOD  
PLAYGROUND EQUIPMENT FOR DISLodgeABLE RESIDUES OF ARSENIC,  
CHROMIUM, AND COPPER

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### I. General Study Information

#### A. Study Title

Sampling Chromated Copper Arsenate (CCA) "Pressure" Treated Wood Playground Equipment for Dislodgeable Residues of Arsenic, Chromium, and Copper.

B. Purpose of Study: To determine the levels of dislodgeable arsenic, chromium, and copper that occur on the surfaces of CCA treated wood in existing playground equipment, new playground equipment, and unfinished lumber in the retail market in samples from various geographic locations in the U.S.

#### 1. Background:

The U.S. Consumer Product Safety Commission (CPSC) has docketed a petition from the Environmental Working Group (EWG) and the Healthy Building Network (HBN) to ban the use of CCA treated wood for playground equipment. In response, the CPSC is examining the health risks to children that are associated with chromated copper arsenate (CCA) treated wood in playground structures. CCA pesticide products are mixtures of water-soluble chemicals containing metal oxides of chromium as chromic acid ( $\text{CrO}_3$ ), copper as cupric oxide ( $\text{CuO}$ ), and arsenic as arsenic pentoxide ( $\text{As}_2\text{O}_5$ ). These products are used as wood preservatives for vacuum-pressure treatment of dimensional lumber that is marketed to commercial and general consumers via lumberyards, hardware stores, and other retailers. CCA treated wood dominates the residential consumer market for use in landscape timbers, decks, fences, and fabricated outdoor structures, including gazebos, picnic tables, and playground equipment. Playground equipment constructed with CCA treated wood can be built by the consumer using unfinished lumber. It can also be built using CCA treated wood that has been specifically finished and sold for playground use.

Concerns have been raised regarding the use of CCA treated wood in playground structures. Thus, CPSC is presently evaluating available exposure and hazard data in order to determine the risks to children who come in contact with CCA treated wood in the playground structure and the CCA contaminated soil and barrier materials adjacent to it.

A number of limited studies have been conducted on the determination of dislodgeable residues of arsenic, chromium, and copper from CCA treated wood structures found in residential and playground settings. However, significant limitations in the

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data have led the CPSC staff to conclude that additional sampling for dislodgeable residues on new and existing CCA treated wood playground equipment and new CCA treated wood is warranted. Such sampling would provide data for an exposure assessment to be used in future risk calculations for children playing on CCA treated wood playground equipment.

#### b 2. Specifics:

As part of the CCA exposure evaluation, CPSC staff has developed a sampling protocol to determine dislodgeable residues of arsenic, chromium, and copper on selected CCA (pressure treated) new and existing wood playground equipment and new CCA treated lumber.

- a. Test sites that contain existing CCA treated wood playground structures will be identified.
- b. A specific number of wood wipe samples will be collected at each site by rubbing polyester cloth wipes on the surface of the wood playground.
- c. Wood wipe samples will be analyzed by CPSC's Chemistry Laboratory.
- d. Wipe samples of new CCA treated wood playground equipment will also be collected and analyzed using polyester cloth wipes on the surface of the wood.
- e. Samples of new CCA treated lumber will be collected, and wipe samples taken and analyzed in a similar manner.
- f. All wood wipe samples will be analyzed for total arsenic, chromium, and copper (with analyses for speciated forms in a few representative samples in the pilot study).
- g. Results of the analyses will be used by CPSC staff to estimate possible exposures to As, Cr, and Cu from use of CCA treated wood playground equipment. These estimates will be used to determine health risks to children from the use of this equipment. In conjunction with this test protocol, soil samples will be taken in areas adjacent to existing playground structures, along with any overlying barrier material. The sampling protocol for these substrates is found in the EPA (2001) soil sampling protocol.

#### C. Test Substances

##### a. Active Ingredients:

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Chromated Copper Arsenate (CCA), which consists of mixtures of water-soluble chemicals containing metal oxides of chromium (Cr) as chromic acid ( $\text{CrO}_3$ ), copper (Cu) as cupric oxide ( $\text{CuO}$ ), and arsenic (As) as arsenic pentoxide ( $\text{As}_2\text{O}_5$ ).

b. Common Name: Chromated Copper Arsenate or CCA

c. CCA Treated Wood:

CCA treatment solutions are typically classified as type A, B, or C. However, CCA type C is the most commonly used to treat dimensional lumber for above-ground residential applications. Type C is composed of 34.0% arsenic pentoxide ( $\text{As}_2\text{O}_5$ ), 47.5% chromic acid ( $\text{CrO}_3$ ), and 18.5% cupric oxide ( $\text{CuO}$ ) (Lebow, 1996).

Arsenic and chromium can be retained in the wood in the range of 0.25 to 2.50 pounds per cubic foot (pcf) (based on retention of CCA type C in wood following American Wood-Preservers' Association [AWPA] standards). Typical retention levels are: 0.25 pcf, 0.40 pcf, 0.60 pcf, 0.80 pcf, and 2.50 pcf, depending on the proposed uses of the treated lumber (Lebow, 1996), although currently, most commonly used wood for consumer purposes is 0.40 pcf.

D. Test Objects

The test objects will be CCA treated wood playground structures that are located in public or private playgrounds (e.g., municipal playgrounds, private/public schools); new CCA treated wood manufactured for retail sale as playground equipment; and new CCA treated lumber from hardware or home specialty stores.

E. Study Sponsor

The U.S. Consumer Product Safety Commission (CPSC) is conducting this sampling effort.

F. Testing Facility

The CPSC Field Operations staff (FO) will obtain wood wipe and soil samples. The soil samples will be obtained and tested via another protocol (EPA, 2001). CPSC's Directorate for Laboratory Sciences Chemistry Division (LSC) staff in Gaithersburg, MD, will analyze the wood wipe samples for As, Cr, and Cu. Chemical speciation testing on wood wipe samples performed during or prior to the pilot study will be performed by

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a contract laboratory. Soil samples will be shipped to and analyzed at a laboratory, as directed by EPA.

#### G. Proposed Study Schedule

Dates for starting and ending the field portions of the study, including when samples will be taken, and dates for the analytical evaluations will be determined once the final protocol has been approved. It is anticipated that the start date for field sampling in the pilot study will be November, 2001, with the full study beginning in December, 2001. The schedule of locations to be sampled will be based upon geographic location, due to variation in seasonal temperatures. This will account for months in which children would be expected to play outdoors on playgrounds.

#### H. Reporting of Results

After collection of wood wipe samples at each site by FO, storage and transport of wood wipe samples to LSC for analyses, and analyses of wood wipe samples for total arsenic, chromium, and copper (with analyses for speciated forms when feasible):

1. LSC will provide CPSC's Directorate for Health Sciences (HS) with a report of all analytical results/findings;
2. LSC also will provide CPSC's Directorate for Epidemiology, Division of Hazard Analysis (EPHA), a report of all analytical results/findings that will be analyzed by EPHA statisticians and reported to HS; and
3. HS will review all such analyses and prepare a report that may then be used in the HS staff's exposure assessment for the assessment of health risks to children using CCA treated wood playground equipment.

#### I. Deviations from the Protocol

Any deviations from the protocol, along with reasons justifying such deviations, will be documented and approved by CPSC's project manager. CPSC staff will retain a copy of such protocol changes.

#### II. Pilot Field Study Test Procedures

A pilot study will be conducted to standardize the CPSC field sampling techniques by identifying differences in sampling procedures. The procedures to be used in the pilot field study

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will follow those outlined below for the full field study. The rationale for the methods used is provided in Appendix A. The number of playgrounds sampled and number of samples taken is summarized in Table 1. CPSC EPHA staff will use the results of the pilot field study along with other CPSC generated data to determine final sample sizes for the full study. The pilot study is expected to provide a preliminary assessment of arsenic levels in a timely manner.

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### III. Full Field Study Test Procedures

#### A. Sample Collection Design

Three types of CCA treated wood will be sampled:

- 1) CCA treated wood in existing (in use) playgrounds,
- 2) New CCA treated wood manufactured and finished specifically for playground use, and
- 3) New CCA treated lumber, otherwise unfinished, which has been manufactured for general use by consumers that might be used to build playgrounds.

#### 1. Existing Playground Wood

##### a) Sampling:

The CPSC FO staff will sample playground wood from three geographical regions across the U.S. using a methodology designed by CPSC EPHA staff to minimize selection bias. Before sampling begins, FO staff will contact local authorities (school boards, county and state park departments, etc.) to obtain permission to sample and obtain copies of any available documentation on installation and maintenance of equipment to be sampled. Efforts will be made to ensure that a variety of climatic conditions (e.g., humidity, precipitation, temperature, and altitude) are represented.

Specifically, CCA treated playground structures will be randomly selected and replicated in each of three geographic regions of the United States (US): Northeast (NE), Southeast (SE), and Southwest (SW). The pilot study will determine the specific number of playgrounds that will be sampled in each geographical region and the number and allocation of samples within each playground. The proposed estimate calls for sampling twenty-five playgrounds containing CCA treated wood structures in each geographical region. At each selected CCA treated structure, ten<sup>1</sup> samples would be obtained as shown in Table 1 below.

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<sup>1</sup>Some playground structures may have more than 1 sample taken at each structural location. The additional sample will be taken at an adjacent area on the structural location. There will be 100 total adjacent areas sampled.

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Table 1. Summary of Sampling Plan to Determine Arsenic, Chromium, and Copper in Treated Wood in Existing Playgrounds.

Study	No. of U.S. Geographic Regions Sampled	No. of Playgrounds per Geographic Region	No. of Structural Locations per Playground	No. of Wipes (Adjacent Areas) per Structural Location	TOTAL No. of Samples (Wipes)
Pilot-- Existing Playground	1	3	5	2	30
Full-- Existing Playground	3	25	10	1 or 2*	850

\* At 100 structural locations, adjacent areas of wood will be sampled and analyzed in order to estimate structural variability.

Thus, a total of 850 wood samples will be obtained from existing CCA treated playground equipment.

### 2. New Playground-Use Wood

#### Sampling

These products will be purchased through retail sources at several locations by FO or headquarters staff. Untreated lumber will also be sampled as a control for new playground wood and new CCA treated lumber. See Table 2 below.

### 3. New CCA Treated Lumber

#### Sampling

Samples of new CCA treated lumber that might be purchased by consumers and used to build residential playground structures will be purchased from retail stores in each of the three geographical locations. CPSC FO staff will purchase treated samples and untreated lumber and will perform wood wipe sampling according to the protocol methodology outlined above for existing playground wood. See Table 2 below.

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**Table 2. Summary of Sampling Plan to Determine Arsenic, Chromium, and Copper Levels in CCA Treated Wood in New Playground Materials and CCA Treated Lumber**

<b>Study</b>	<b>No. of U.S. Geographic Regions Sampled</b>	<b>No. of Retail Samples of Wood per Region</b>	<b>No. of Locations per Piece of Wood</b>	<b>TOTAL No. of Samples (Wipes)</b>
<b>Pilot--</b> CCA Lumber	1	5	2	10
<b>Full--</b> CCA Lumber	3	5	2	30
<b>Full--</b> CCA New Playground Wood	TBD*	TBD*	2	TBD*
<b>Full--</b> Untreated Lumber (control)	3	3	2	18

\*TBD = to be determined based on availability of new playground materials by manufacturers

**B. Sample Documentation Collection**

If available, FO staff will obtain the following sample documentation. Some of the data may be obtained for locations under the soil sampling study.

a. General Site Data:

- i. Date;
- ii. Time of day;
- iii. Name of site;
- iv. Geographic location;
- v. Name of individual performing sampling;
- vi. State and site number(s);
- vii. Type of site (e.g., public school playground);
- viii. Two or more photographs of the playground site taken from several vantage points. (Such photographs are to be labeled and stored in a manner that will allow for adequate identification of the site/structure during analyses of wood samples.);

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- ix. General, written diagram/description of site showing surrounding vegetation and structures (e.g., sandy playground surrounded by turf and trees);
- x. Soil types (e.g., pH, organic content; type and depth of ground cover);
- xi. Name(s) of contacts providing permission;
- xii. Local name of site/school/playground if appropriate;
- xiii. Phone number for site (e.g., school playground);
- xiv. History of site (e.g., what was on the playground site before it was built?);

b. Meteorological/Weather Data (some of these data may be obtained through the National Service, meteorological stations, or other services):

- i. Temperature on day of sampling;
- ii. General weather conditions (relative humidity, wind direction/speed);
- iii. Estimated time structure is in sun/shade throughout day on sampling day and throughout year;
- iv. Date of last rainfall;
- v. Amount of yearly rainfall for site;
- vi. Amount of annual snowfall, if applicable;
- vii. Typical acidity of rainfall for site;

c. Playground Structure Data:

- i. Relative size of structure (estimate of dimensions);
- ii. Type of wood, if known (e.g., southern pine);
- iii. Relative age of structure (when was structure built?);
- iv. CCA treatment level (e.g., level of preservative retention);
- v. General condition of structure (e.g., rough surfaces, worn surfaces);
- vi. Use of paints/sealants, if any, and how often, including date of last treatment;
- vii. Size of vertical support where wood samples were taken (e.g., 4 x 4);
- viii. Has any portion of structure been replaced; if so, when?;
- ix. Typical maintenance schedule;

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### d. Playground Usage Data:

- i. Number of children who use playground daily;
- ii. Age ranges of children using playground;
- iii. Approximate number of hours playground is in use daily or yearly, if known;
- iv. Known injuries, or illness, of children from use of equipment;

### C. Sample Collection/Shipping

Once test sites/playground structures have been located and permission granted to obtain samples, a CPSC regional FO staff person will perform the wood sampling.

The methodology will be similar for both pilot and full field studies. In order to minimize variability in sampling techniques between individuals, FO staff will be trained at CPSC laboratories using written instructions for sampling methodology developed by CPSC staff. Samples will be coded using unique identifiers after collection. All samples will be obtained and transported using CPSC standard procedures developed and used by the CPSC Compliance staff to preserve the integrity of the samples, as outlined in the CPSC Domestic Sample Collection Order 9010.36 (CPSC 1984, amended 1987). All wood wipe samples will be shipped to CPSC LSC for analysis, with one exception. Wood wipe samples scheduled for chemical speciation determinations in the pilot study will be sent directly to the contract laboratory. Samples will be sent either by United Parcel Service (UPS) or Federal Express (FEDEX).

### Existing Playground Wood:

At each playground location, ten locations of CCA treated wood will be identified for sampling. The ten locations will represent areas likely to be used or touched by children and will vary (eg., 2 each of handrails, vertical poles, decks, steps, horizontal drip line surface). See sample diagram in Appendix B.

A 50-cm x 8-cm area of the wood will be sampled at each sample site. After locating, marking, and photographing the location of each structural sample, FO staff will take one wipe sample at each of these ten structural locations on each playground. An adjacent area in the same structural location will also be sampled for 100 random locations on wood in certain random playgrounds in order to estimate statistical variability.

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Investigators will also note whether the structural location is in the drip line of nearby wood.

The sampling techniques will be similar to those used in the CPSC (1990) study. In general, for horizontal areas, a rectangular shaped area (50 cm x 8 cm) will be identified and marked on each board for sampling using a secured template. A 4.5" x 4.5" piece of polyester cloth wipe (Tx 1009 Alpha wipe) will be cut and weighed. These cloths weigh about 1.9 grams. Each cloth will be moistened to double its original weight with 0.9% saline solution (total weight of moistened cloth about 3.8 grams); wipes will be damp but not dripping. An 8-cm diameter steel block, rubberized on one side and weighing 1.1 kg, will be covered with a clean piece of Parafilm® to prevent contamination of the weight. The wet wipe will be stretched smoothly over the Parafilm® and secured with a rubber band and hose clamp. The wipe covered weight will be placed on one end of the template. A string will be placed around one of the screws at the top of the weight and should be held as parallel to the board to be sampled as possible. The weight will be pulled by this string back and forth 5 times (making 10 total passes), before being rotated 90 degrees for another set of back/forth wipes across the wood over the area to be sampled, for a total of 20 passes over the wood. The polyester cloth wipe will be removed from the block and placed in a labeled, coded, screw cap test tube (20 x 150 mm) and shipped to LSC for analysis of As, Cr, and Cu content.

Vertical posts will also be sampled using a weighted wipe. The wipe will cover the weight and will be attached to the lower arm of the vertical wiper device. The vertical wiper device will be attached to the wood using C clamps. A 1.25 kg weight will be attached to the upper arm of the wiper. This 1.25 kg weight will exert approximately 1.1 kg force on the wipe covered weight in the vertical position. The weight will be slid along the tracks of the device back and forth 5 times, for a total of 10 strokes. It will then be picked up, rotated 90°, and slid back and forth 5 more times, for another 10 strokes. The polyester cloth wipe will be removed from the block and placed in a labeled, coded, screw cap test tube (20 x 150 mm) and shipped to LSC for analysis of As, Cr, and Cu content.

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### 1) New Playground Use Wood:

The same methodology used to sample wood from existing playgrounds will be used for new playground equipment wood. Two samples will be taken from each board and samples taken from boards will come from the center two-thirds of the board. Various types and sections of wood will be tested as different boards may have several retention rates for CCA.

### 2) CCA Treated Lumber:

The same methodology used to sample wood from existing playgrounds will be used for unfinished CCA lumber. Samples taken from boards will come from the center two-thirds of the board. The pilot study will also examine samples taken from the full board to measure variability along the length of the board. Both deck- and pole-size planking will be tested, and boards may represent several of the most common retention rates.

### D. Analyses of Samples

CPSC LSC will conduct analyses of wood wipe samples. Quantitative determination of oxidation states of As and Cr will occur only during the pilot study on a small number of representative samples and will be performed by a contract laboratory. Total arsenic, total chromium, and total copper analyses will be conducted on wipe samples for the full field study.

The standard analytical technique that will be used to analyze and quantify the amounts of arsenic, chromium, or copper in the samples is Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES or ICP-OES USEPA Method 6010, 200.7). The analytical methods that will be employed by the CPSC LSC staff are listed below:

#### - Extraction

1. Heat water bath to 60°C.
2. Add 15 mL of 10% nitric acid to test tubes containing rubbed wipes. Cover.
3. Set shaker speed to 60 rpm.
4. Place tubes in heated shaker bath overnight. Remove test tubes from water bath, and cool to room temperature.
5. Vortex test tubes prior to analysis to ensure mixing.

#### - Analysis

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1. Analyze extracts using ICP to determine weight of As, Cr, and Cu.
2. Use lines 189.042nm for As, and 205.552nm for Cr, and 224.7 for Cu.
3. Standards for regression will contain 0, 1, 5, 10, and 25 ppm of As, Cr, and Cu.
4. A check standard containing 5 ppm of As, Cr, and Cu will be used to verify calibration.

### - Calculation

Results will be reported as  $\mu\text{g}$  metal per 100  $\text{cm}^2$  wood.

### E. Recording Data

Staff doing the sampling will record all sample documentation (see Section B) via appropriate media (field notebooks, still cameras, video cameras).

All analytical work will be recorded and will include appropriate correlations with field samples taken. Additionally, all pertinent analytical laboratory data will be recorded: *e.g.*, spike solution log, storage location and condition of samples, log of use.

### F. Statistical Methods

Upon completion of sampling and analyses of samples, CPSC's EPHA staff will estimate parameters of the distribution of arsenic, chromium, and copper levels in the three geographical regions and the association of these levels with environmental and other variables through a regression analysis.

### G. Reporting of Results

See discussion in I. above.

### H. Data/Samples Retention

All raw field data will be maintained in CPSC program files. All samples remaining after analytical analyses will be retained at CPSC LSC until CPSC has determined that there can be disposal of such samples.

### I. Quality Assurance (QA)/Quality Control (QC)

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All field and analytical procedures will be conducted according to CPSC Standard Laboratory Procedures and Quality Assurance and Quality Control Procedures.

### J. References

CDHS (1987) California Department of Health Services. Report to the Legislature: Evaluation of Hazards Posed by the Use of Wood Preservatives on Playground Equipment. February.

CPSC. (1984) Domestic Sample Collection Order 9010.36. The U.S. Consumer Product Safety Commission. April 18, 1984, as amended October 7, 1978.

CPSC (1990) U.S. Consumer Product Safety Commission. Project on Playground Equipment - Transmittal of Estimate of Risk of Skin Cancer from Dislodgeable Arsenic on Pressure Treated Wood Playground Equipment. August.

EPA (2001) Sampling for Residues of Arsenic, Chromium, and Copper in Substrates (Soils/Buffering Materials) Beneath/Adjacent to Chromated Copper Arsenate (CCA)-Treated Playground Equipment. U.S. EPA, Office of Pesticide Programs, Antimicrobials Division, Washington, DC.

Lebow S. (1996) Leaching of Wood Preservative Components and Their Mobility in the Environment - Summary of Pertinent Literature. General Technical Report FPL-GTR-93. U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, Madison, WI. August.

Stilwell DE (1998) Arsenic in Pressure Treated Wood. Department of Analytical Chemistry, The Connecticut Agricultural Experimentation Station  
([www.caes.state.ct.us/plantscienceday/1999psd/arsenic99.html](http://www.caes.state.ct.us/plantscienceday/1999psd/arsenic99.html)).

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**APPENDIX A**

**Rationale for Experimental Parameters**

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**Polyester Wipes.** Although nylon wipes were used in the previous CPSC (1990) study, they are not currently manufactured. Polyester wipes will be used in the proposed study. The weave of the polyester wipes is similar to that of the nylon wipes and appears to be a reasonable substitute for the nylon wiping. Polyester wipes are durable, perform comparably to the nylon wipes, and are the same material used in another recent study (Stilwell, 1998).

**Weighted Polyester Wipe.** Attachment of a polyester wipe to a weight within a given template will standardize the wiping motion and the amount of pressure placed on the wood. This will minimize the variability that would exist between and within individuals wiping a board with their hands.

**1.1-kg Weight.** The effect of weight on the wipe on total dislodgeable As and Cr was recently examined on one piece of wood. It was found that increases in weight with polyester wipes resulted in increases in dislodgeable As and Cr, but the increases were not proportionate. While using a heavier weight with the wipe removed more dislodgeable As and Cr, pulling a heavier weight across the board was sometimes difficult, and the wipes were more likely to come loose from the weight during rubbing. The 1.1-kg weight was chosen because the wipes stayed on the weight and did not tear. In addition, a 1.1-kg weight is similar to that used in other studies (CPSC, 1990, used 1 kg; Stilwell, 1998, used 1.25 kg), and visual inspection of the wipes with this amount of weight applied indicated that few wood fibers will adhere to the cloth.

**400 cm<sup>2</sup> Rub Area, Wiped Back and Forth 5 Times.** The effect of surface area and number of rubs on total dislodgeable As was recently examined at the CPSC laboratory. Limited experiments indicate that the dislodgeable As and Cr appears proportionate to surface area. Rubbing a 400 cm<sup>2</sup> area 5 times yields measurable levels of As and Cr that can be related to any given surface area. In the CPSC (1990) study, a 400 cm<sup>2</sup> surface area was wiped 10 times. The Stilwell (1998) study used a 240 cm<sup>2</sup> surface area that was wiped 5 times.

**Rotation of the Polyester Wipe.** Rotation of the wipe during sampling will help correct for any influence that the orientation of the cloth might have on the amount of dislodgeable material adhering to the cloth.

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**Soaking Wipes with Saline.** It is likely that children will be sweating when playing on playground equipment, so using saline soaked wipes is meant to address that scenario. Higher levels of dislodgeable As and Cr have been observed for saline wipes versus dry wipes or wipes soaked with deionized water (CPSC, 1990).

**Extraction Procedure.** Extracting CCA spiked wipes with 10% nitric acid in a water bath at 60°C for 3 hours, then allowing the mixture to stand overnight, and vortexing prior to analysis resulted in reported recoveries of greater than 95%. Thus, the extraction procedure described above should extract almost all available As, Cr, and Cu from the wipes.

**Analytical Procedure.** Total As, Cr, and Cu will be analyzed using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP), however, the oxidation states of As and Cr can not be determined using ICP alone. Arsenic can readily convert between oxidation states, but the toxicity of the two states does not vary greatly, unlike that of chromium. High Performance Liquid Chromatography (HPLC) coupled with ICP has been used to separate As<sup>+5</sup> from As<sup>+3</sup> and Cr<sup>+6</sup> from Cr<sup>+3</sup>. A contract laboratory will be used to determine the chemical speciation of As and Cr in select samples of wood wipes using HPLC-ICP. Speciation of copper will not be determined.

**Vertical/Horizontal Wiper Device:** The vertical/horizontal wiper device was developed to control and standardize the amount of force applied to wiping the CCA treated wood and to control the area rubbed. The device can be attached to horizontal planks with tacks, or attached to vertical posts with c-clamps. In the horizontal position, polyester wipes are placed over the 1.1 kg rubbing disk. The disk is allowed to rest flush against the board. The disk is pulled back and forth along the tracks of the wiper. Screws along the tracks are set so the block can be pulled a maximum distance of 50 cm. The disk is 8 cm in diameter, so that an area of 400 cm<sup>2</sup> is rubbed.

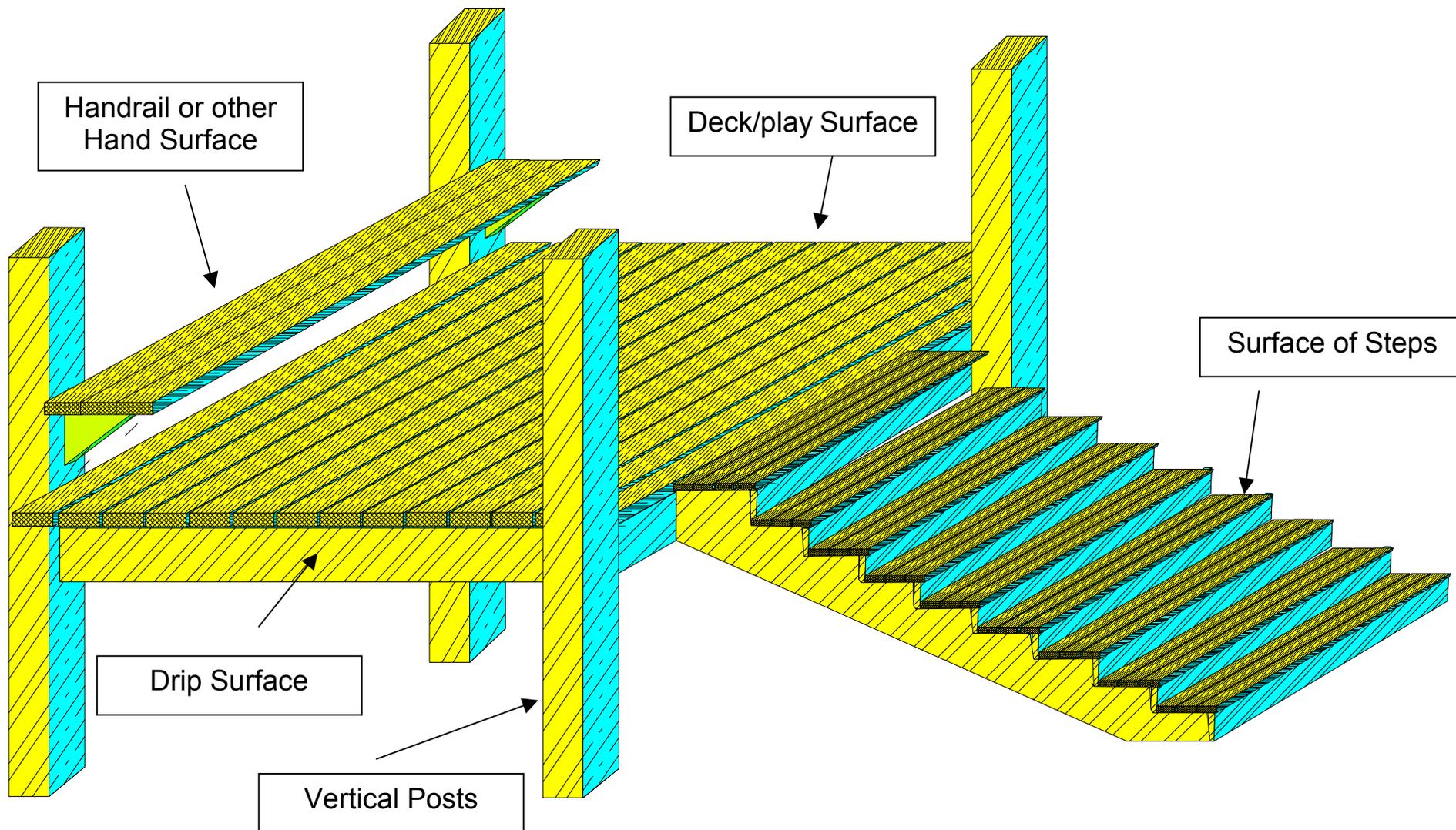
In the vertical position, a weight can be attached to the arm that is perpendicular to the arm attached to the rubbing disk. The force of gravity applied to the hanging weight exerts a constant pressure on the rubbing disk. A 1.25-kg weight hanging from the perpendicular arm exerts approximately 1.1-kg force on the rubbing disk.

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Some playground structures may have more than 1 sample taken at each structural location. The additional sample will be taken at an adjacent area on the structural location. There will be 100 total adjacent areas sampled.