

January 6, 2009

Concord Public Works
133 Keyes Road
Concord, MA, 01742
Attn: Richard Reine, Public Works Director

**RE: Concord-Carlisle High School Multi-purpose Fields
Lead Testing, Current and Future Regulations Related to Synthetic Turf Fibers**

Dear Rich:

As a follow up to the initial erroneous and unauthorized testing conducted by Guive Mirfendereski, the Editor of the Synturf.org website, I have enclosed formal test results and chain of custody documentation related to the fiber testing conducted by technicians from Chemserv Laboratories of Milford, New Hampshire, a fully accredited analytical laboratory specializing in environmental testing. In addition, I have provided information detailing the recent findings related to lead content in artificial turf fields along with background explaining how this relates to the newly installed fields and turf fibers located in Concord.

Historic Overview of Products and Regulations:

Synthetic turf fibers used in outdoor sports fields consist of polyethylene and nylons among other yarn-like materials knitted or tufted into a carpet system. A key component of these fibers had been lead chromate incorporated to provide pigment and UV stability for certain colors of these products. This provides a level of durability and bright colors required of the marketplace. This improved durability allowed product manufacturer's to offer the 8-year product warranty that has been a standard required of the industry.

Lead chromate is an inorganic pigment that is encapsulated into the resins used in the manufacture of turf fibers. Prior to the encapsulation of the lead chromate into the resin polymers the lead chromate has a very low solubility due to the fact that lead chromate is stabilized (encapsulated) with a fast coating of aluminium and titanium compounds and silicates or antimony compounds and silicates. This continuous dense, amorphous shell of "glass" of the encapsulation reduces the solubility, bioavailability and toxicity.¹

Since the start of manufacturing of synthetic turf systems, there have been no specific regulations related to lead content of turf fibers. The products have never been classified as a children's product in the past, and this status continues to date. Due to this non-children's product status, the fact that children are exposed to turf, the regulations governing lead content specifically, 16 CFR 1500 previously and those proposed under HR 4040, are used determine allowable lead content in artificial turf fields.

Notwithstanding the lack of regulation, the extremely low solubility of the lead in lead chromate substantially limits the bioavailability of this lead compound. 16 CFR 1500 was the Federal regulation in place at the time of manufacturing of the Concord fields. The regulation stated, "young children should not chronically ingest more than 15 micrograms of lead per day from consumer products". Under the

Federal Hazardous Substances Act 15 1261(q)(1)(B) the “bioavailability of lead, and the accessibility of lead to children need to be evaluated in determining potential hazards.³ To reiterate, the regulations that were current during manufacturing and in place at the issuing of the Certificate of Occupancy were 16 CFR 1500 which did not classify synthetic turf as a children’s product and considered bioavailability in determining potential health risks. It should be noted that 15micrograms per liter is also the current Federal Drinking Water Standard for Lead.

Lead Found in Turf Fibers:

Concerns regarding the presence of lead in synthetic turf sports fields were brought to the public’s attention initially in New Jersey, with an old AstroTurf (AstroTurf XL) synthetic turf field in Newark located in an industrial section known as Ironbound during early fall of 2007 and spring of 2008. The field is bordered on three sides by an abandoned industrial complex of the former Tidewater Bailing Company, a facility that reclaimed and recycled various types of scrap metals. The EPA found the Tidewater property was contaminated with heavy metals. The contamination was also found in an adjacent natural grass field, after which the EPA tested the synthetic field and detected levels of lead chromate. The New Jersey Department of Health and Senior Services (NJDHSS) then checked 12 more fields, 10 of which were fine. Two of the fields, in Ewing and Hoboken, had lead chromate levels ranging from 3400 to 4100 mg/kg. These test values represented not only specific colors such as safety yellow but the basic green body of the field.

Key Findings (This Section is a Direct Quote):²

From its tests, the NJDHSS reported that the amount of lead chromate contained in fibers from the three fields available for absorption in the intestine, which is where food altered by stomach acid is absorbed by the blood and lymphatic systems, ranged from 2.5% to 11%. We used the most extreme scenario, 11%, to calculate the amount of turf that would have to be ingested to equal the federal standard of 600 parts per million. In practical terms, it is very unlikely for a child to be at risk from synthetic turf:

- According to calculations made by forensic toxicologist Dr. David Black, a 50 lb. child would have to ingest over 100 lbs. of synthetic turf to be at risk of absorbing enough lead to equal the minimum threshold of elevated blood lead. That level is even more unreachable than Dr. Black’s original worst case bioaccessibility, which was based on ingesting 23 lbs. of turf.
- The Consumer Product Safety Commission's guidance states that young children "should not chronically ingest more than 15 micrograms of lead per day from consumer products." Putting these test results in perspective, polymer and fiber engineering specialist Dr. Davis Lee calculated that a child playing on the three New Jersey fields would have to wipe his fingers on the turf and put them in his mouth 750 times in a day to receive enough lead to equal the CPSC threshold level.
- Dr. David Black performed the same tests as the NJDHSS, using the same protocol during late May, which showed an average bioaccessibility of 4%. The results of the two tests are similar and validate the safety of synthetic turf, including the synthetic turf NJDHSS reported to contain concentrations of lead chromate of between 3,400 and 4,700 part per million.

Consumer Product Safety Commission Statement:

After a testing program which was followed by discussion and review, during the late spring and early summer of 2008, between the Consumer Product Safety Commission (CPSC), the Synthetic Turf Council (STC), NJDHSS, key synthetic turf industry members, toxicologists and chemists the CPSC issued a statement in Release #08-348 dated July 30, 2008, “Staff Finds Synthetic Turf Fields OK to Install, OK to Play On. The U.S. Consumer Product Safety Commission (CPSC) staff today released its evaluation of various synthetic athletic fields. The evaluation concludes that young children are not at risk from exposure to lead in these fields.”⁴

Basically, at the levels of 3,400 to 4,700 ppm noted in the New Jersey fields above, the CPSC determined that the use of synthetic turf sports fields does not represent a health risk for children as it relates to lead exposure. This is based significantly on the results of the lead wipe testing that was completed by both NJDHSS and Dr. Davis Lee and can be attributed to the extremely low bioavailability of lead chromate. It is important to note that as of the date of this letter the CPSC has not listed synthetic turf products as children’s products due in part to lack of health risk.

As backup to the work completed by CPSC and Dr. Lee noted above the CPSC Staff Analysis and Assessment of Synthetic Turf Grass Blades⁶ is attached and made part of this document. It outlines the testing procedure and results from wipe testing performed by four different CPSC testing firms. The wipe test is officially known as ASTM E1792 - 03 Standard Specification for Wipe Sampling Materials for Lead in Surface Dust and is the EPA standard for exposure testing to lead. The testing included turf from old fields as well as new fields and included the turf from Ironbound fields in their analysis. The results of estimated daily ingestion exposure to lead range from negligible to 9.9 micrograms of lead on turf fields which was well below the 15 micrograms identified in CPSC 16 CFR 1500 Consumer Product Safety Commission Part 1500 - Hazardous Substances and Articles. The higher amounts were from the Ironbound Fields.

Current Progress:

Currently synthetic turf is not a children’s product as defined by the CPSC and there is no specific regulation regarding lead content in synthetic turf. The industry has however looked toward the Federal Hazardous Substances Act 15 1261(q)(1)(B) that relate to products that are not children’s products but children may be exposed to which states the “bioavailability of lead, and the accessibility of lead to children” need to be evaluated in determining potential hazards.³ The results from Dr. Davis Lee quoted above follow that direction, and demonstrate that synthetic turf fields do not represent a health risk for lead exposure in children. This has been confirmed by the CPSC.

In a letter from the NJDHSS dated September 22, 2009 the Commissioner stated regarding fiber dust containing lead, “Assessment of the IAFB by the NJDHSS and USEPA in August and November 2007, respectively, indicated lead in surface dust of the field at average concentrations of 1,280 to 3,742 milligrams per kilogram (mg/Kg) or 49 to 133 micrograms of lead per square foot (µg Pb/ft²).”⁵ and, “Additionally, based on the lead concentrations in the fibers of the new synthetic turf product, if this field surface deteriorates over time and creates a synthetic-based dust, the resulting lead concentrations in this dust would not be of concern.”⁵ The implication is that fiber dust containing lead from the older fields is a health risk. In their letter the NJDHSS failed to recognize the CPSC Staff Analysis and Assessment of “Synthetic Turf Grass Blades”⁶ results which was prepared at by CPSC at their request

and also failed to consider the difference between exposure and chronic daily exposure as outlined in CPSC 16 CFR 1500 Consumer Product Safety Commission Part 1500.

The concern regarding dust from both old and new fields was taken into account by the CPSC and is clearly addressed in their Statement of Lead where they stated, “Staff recognizes that some conditions such as age, weathering, exposure to sunlight, and wear and tear might change the amount of lead that could be released from the turf. As turf is used during athletics or play and exposed over time to sunlight, heat and other weather conditions, the surface of the turf may start to become worn and small particles of the lead-containing synthetic grass fibers might be released. The staff considered in the evaluation that particles on a child’s hand transferred to his/her mouth would be the most likely route of exposure and determined young children would not be at risk.”⁴ The CPSC used the same data noted in the NJDHSS letter as the basis of their assessment and their conclusion of no risk. The NJDHSS failed to recognize the position of the regulating agency, the CPSC, on this issue.

Through the effort associated with concerns regarding lead in synthetic turf products, and considering the fact that synthetic turf is not currently regulated as a children’s’ product, the STC has issued a statement indicating, “The STC voluntarily agrees to comply with the revised lead restrictions currently proposed for children’s products in H.R. 4040. Specifically, the level of lead will be reduced in all pigments used to color synthetic turf to 300 ppm or less by no later than January 1, 2010, and to 100 ppm or less by no later than January 1, 2012”. These levels are based on new laws which regulate lead in children’s products and were not in effect at the date of the manufacturer of the Concord Carlisle Fields. The implementation dates are dates which allow the industry to technically meet these levels and not the statutory dates for children products outlined in HR 4040.

ASTM has been asked to develop test methods for use by the industry to assure this voluntary compliance. This method is currently in balloting and should be approved as a new standard by late winter of this year. ASTM worked with the CPSC, users and members of the synthetic turf industry in the development of this standard which is a consensus based standard and will be adopted by the CPSC as their recommended test method for compliance. The author of this letter is a member of the ASTM Task Group developing this new standard.

Results from the Concord Carlisle Fields:

During the fall of 2008 the Town of Concord Public Works was contacted by a Boston Globe reporter who informed town officials that testing was performed, without the approval of the Town, on their new high school fields. Samples were sent to the Center for Environmental Health (CEH) in California, a non-accredited lab, for testing. The equipment used for testing was an X-Ray Fluorescence Analyzer type equipment which tends to be highly inaccurate and is not listed as a suitable method under the pending ASTM Test Method. No chain of custody documentation or testing protocol was provided. It was reported by the reporter that Lead content test results ranged from 13,900ppm for green and 11,100ppm for yellow which are excessively high and not indicative of these products. Following receipt of this information the Town initiated its own independent Lead testing program utilizing an independent lab with chain of custody protocols and coordinated through the Town’s Health Department. Below are the results of this testing:

Fiber Color

Lead Content

Red Fiber	19.5mg/Kg
Yellow Fiber	373 mg/Kg
Green Fiber	371 mg/Kg
Lime Green Fiber	483 mg/Kg

These results were based on the pending ASTM Test Method using *U.S. EPA Standards* Method 3050B Acid Digestion of Sediments, Sludges, and Soils, and, Test Methods for Evaluating Solid Waste Method 6010C Inductively Coupled Plasma--Atomic Emission Spectrometry, SW-846, Test Methods for Solid Waste and represent a significantly lower level than those of the X-Ray Fluorescence Analyzer and are consistent with the pending ASTM methods.

The field in Concord consists of a green body with equal amounts of each of the two green color fibers, and inlays in red, yellow, blue and white. Both blue and white are made with no lead chromate pigment. Based on the construction plans the average concentration of lead in the fields based on our own testing lead is 416mg/Kg. The percentage breakdowns are outlined below.

<u>Fiber Color</u>	<u>Percent in Field</u>
Red Fiber	0.4%
Yellow Fiber	0.7%
Green Fiber	48.4%
Lime Green Fiber	48.4%
Blue Fiber	0.3%
White Fiber	1.7%

As part of the Globe’s further research, testing conducted by an accredited laboratory resulted in reported average levels of 294 mg/Kg as published in their recent article. The results of the Globe’s testing averaged with Town’s results provides an average of known accredited testing to date of 355 mg/Kg.

Conclusion:

The field as tested by the Town using the pending ASTM Methods noted above contains and average of 416 mg/Kg of Lead. This average value is eight to ten times less than the values, from the two New Jersey fields, used in the development of the CPSC statement that these synthetic turf fields do not represent a health risk from Lead exposure to children. When testing by the Globe is averaged into the evaluation the resulting comparison is 9 to 13 times less than the no-health-risk levels considered in the CPSC analysis. It should be noted that Town testing average value is 27 to 33 times less than those values reported by the non-accredited CEH laboratory. That having been said it is expected that a margin of safety ranging between eight and thirteen exists at the Concord fields beyond those criteria used by the CPSC in determining that fields are safe.

As it relates to the wipe test ASTM E1792 – 03, used to determine exposure to dust containing lead, tests from fields that had little or no lead to those at Ironbound with lead content at as much as 4,700ppm, all results were below the threshold for chronic ingestion of lead per day of 15 micrograms. The highest values from Ironbound were two-thirds of the maximum threshold and considered to not represent a health hazard to children. The expected values from the Concord fields are expected to be eight to ten times less. An important fact to consider in evaluation of potential health risk is that the

threshold value is for “chronic daily exposure” and not exposure during a school year PE, from recreational sports programs, or during a sports season after school. Chronic daily exposure is exposure that takes place every day like one might expect from a carpet in ones living room.

Beyond the CPSC position that considered both the fibers and fiber dust in older fields, these fields are below the current children’s product threshold for lead of 600mg/kg. Considering both of these facts and the current state of the industry there is not a concern for Lead exposure in children from these fields. If there was a concern of exposure to lead the CPSC would have stated it clearly.

Please contact me if you have any questions or concerns.

Sincerely,

A handwritten signature in black ink, appearing to read "JJA", written over a light blue horizontal line.

John J. Amato, P.E.
President

D:\JJA Sports\Projects\jja sports 0071 concord fields\letters\l-rr01 lead.doc

1. Lead Chromate Pigments EU Classification Mutagenicity and Carcinogenicity by Eurocolor 27 July 2004
2. Synthetic Turf Council News Release dated July 30, 2008, “U.S. Consumer Product Safety Commission Validates Safety of Lead Chromate in Synthetic Turf and STC Announces Voluntary Reduction Standards”
3. CPSC 16 CFR 1500 Consumer Product Safety Commission Part 1500 - Hazardous Substances and Articles; Administration and Enforcement Regulations, 16 CFR 1500.230.1
4. Consumer Product Safety Commission Release #08-348 dated July 30, 2008, “Staff Finds Synthetic Turf Fields OK to Install, OK to Play On.
5. NJDHSS Letter Health Consultation dated September 22, 2009 to the Agency for Toxic Substances and Disease Registry/DHAC
6. CPSC Staff Analysis and Assessment of Synthetic Turf Grass Blades

Saturday, November 29, 2008

John Amato
John Amato
88 Chamberlain Rd
Westford MA 01886

Project Name: Concord Carlisle High School
Project #: N/A
Project Location: Concord, MA
Control #: 75464

Lab ID: 08110191

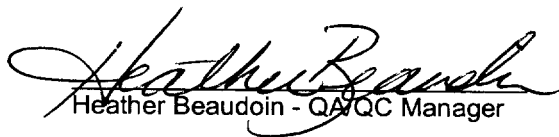
Date Received: 11/17/2008

Dear John Amato

Enclosed please find the laboratory results for the above reference samples that were received by the ChemServe sample custodian on the above referenced date. Any abnormalities to the samples upon receipt would be noted on the enclosed chain of custody document. This report is not valid without a completed ChemServe chain of custody with the corresponding control number, attached.

All samples analyzed by ChemServe are subject to quality standards. These standards are as stringent or more stringent than those established under NELAC, 40 CFR Part 136, state certification programs, and corresponding methodologies. ChemServe has a written QA/QC Procedures Manual that outlines these standards, and is available for your reference, upon request. Unless otherwise stated on the Chain of Custody or within the report, all holding times, preservation techniques, container types, and analytical methods are analogous with those outlined by NELAC. All units are based on "as received" weight unless denoted "dry".

I certify that I have reviewed the above referenced analytical data and state forms, and I have found this report within compliance with the procedures outlined within NELAC.


Heather Beaudoin - QA/QC Manager

Jay Chrystal - President/Laboratory Director

This report includes 5 pages.



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 Milford, NH 03055
 (603) 673-5440
 Sales@chemservelab.com

John Amato
 John Amato
 88 Chamberlain Rd
 Westford MA 01886

Control #: 75464
 Project Number: N/A
 Project Name: Concord Carlisle High School
 Project Location: Concord, MA

Lab ID: 08110191
 Date: 11/29/2008

Lab ID: 08110191

Sample Receiving and Comment Summary

Were Samples Submitted with a chain of custody?	Yes
Do all samples received match the chain of custody?	Yes
Were all samples received within holding times?	Yes
Were all containers intact when received?	Yes
Was there evidence of cooling?	Yes
Were samples for Volatile organic analysis free of headspace (per method)?	N/A
Was the cooler temperature recorded?	Yes
If the sample pH was not correct was it adjusted where applicable?	Yes
If samples for dissolved metals were not filtered were they filtered in the lab?	N/A

Sample	Method	Client Identity	Matrix	Analyst
08110191-001	SW 3050B	CCRHS Red #1 11.17.08	Solid	CharleneF

Comment: no comment

* Blank comment sections denote "No Comment"



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 Sales@chemservelab.com

John Amato
 John Amato
 88 Chamberlain Rd
 Westford MA 01886

Control #: 75464
 Project Number: N/A
 Project Name: Concord Carlisle High School
 Project Location: Concord, MA

Analytical Results
 Lab ID: 08110191
 Date: 11/29/2008

Sample	Method	Client Identity	Units	Matrix	Analyst
08110191-001	SW 3050B	CCRHS Red #1 11.17.08		Solid	CharleneF

Start Date/Time Sampled: 11/17/2008 9:00:00 AM Composite End Date/Time:

Parameter	CAS Number	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Hot Plate Digestion				11/20/2008	1	0

Sample	Method	Client Identity	Units	Matrix	Analyst
08110191-001	SW 6010B	CCRHS Red #1 11.17.08	mg/Kg	Solid	PaulF

Start Date/Time Sampled: 11/17/2008 9:00:00 AM Composite End Date/Time:

Parameter	CAS Number	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Lead	7439-92-1	19.5 mg/Kg		11/20/2008	1	2.5

Sample	Method	Client Identity	Units	Matrix	Analyst
08110191-002	SW 3050B	CCRHS Yellow #2 11.17.18		Solid	CharleneF

Start Date/Time Sampled: 11/17/2008 9:00:00 AM Composite End Date/Time:

Parameter	CAS Number	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Hot Plate Digestion				11/20/2008	1	0

Sample	Method	Client Identity	Units	Matrix	Analyst
08110191-002	SW 6010B	CCRHS Yellow #2 11.17.18	mg/Kg	Solid	PaulF

Start Date/Time Sampled: 11/17/2008 9:00:00 AM Composite End Date/Time:

Parameter	CAS Number	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Lead	7439-92-1	373 mg/Kg		11/20/2008	2	5

Sample	Method	Client Identity	Units	Matrix	Analyst
08110191-003	SW 3050B	CCRHS Green #3 11.17.08		Solid	CharleneF

Start Date/Time Sampled: 11/17/2008 9:00:00 AM Composite End Date/Time:

Parameter	CAS Number	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Hot Plate Digestion				11/20/2008	1	0



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Sample	Method	Client Identity	Units	Matrix	Analyst
08110191-003	SW 6010B	CCRHS Green #3 11.17.08	mg/Kg	Solid	PaulF

Start Date/Time Sampled: 11/17/2008 9:00:00 AM Composite End Date/Time:

Parameter	CAS Number	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Lead	7439-92-1	371 mg/Kg		11/20/2008	2	5

Sample	Method	Client Identity	Units	Matrix	Analyst
08110191-004	SW 3050B	CCRHS Lime #4 11.17.08		Solid	CharleneF

Start Date/Time Sampled: 11/17/2008 9:00:00 AM Composite End Date/Time:

Parameter	CAS Number	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Hot Plate Digestion				11/20/2008	1	0

Sample	Method	Client Identity	Units	Matrix	Analyst
08110191-004	SW 6010B	CCRHS Lime #4 11.17.08	mg/Kg	Solid	PaulF

Start Date/Time Sampled: 11/17/2008 9:00:00 AM Composite End Date/Time:

Parameter	CAS Number	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Lead	7439-92-1	483 mg/Kg		11/20/2008	2	5

- Qualifier: Description:
- B- Method blank contaminated with target analyte.
 - B1- BOD had total oxygen loss. Result reported as ">"the highest dilution.
 - B2- BOD had no oxygen loss. Result reported as "<" the lowest dilution.
 - G- Reporting limit elevated due to matrix interference.
 - H- Method prescribed holding time exceeded.
 - J- Indicates an estimated value. Value is less than the quantitation limit.
 - LH- Laboratory control spike(s) was high. Results may be biased high.
 - LL- Laboratory control spike(s) was low. Results may be biased low.
 - MH- Matrix spike recovery high due to matrix. Results may be biased high.
 - ML- Matrix spike recovery low due to matrix. Results may be biased low.
 - NC- Spike recovery was not calculated due to the concentration of the analyte being >4 times the concentration of the spike added.
 - R- RPD outside acceptable recovery limits.
 - RO- Sample received out of holding time.
 - SH- Surrogate recovery high due to matrix
 - SL- Surrogate recovery low due to matrix
 - TNTC- Too numerous to count.
 - U- BOD/CBOD blank had an oxygen depletion greater than the suggested amount of 0.200.

Chain of Custody No. 74564
 Multiple COC's Yes No



317 Elm Street Milford, NH 03055
 (603) 673-5440 / Fax (603) 673-0366

A CUSTOMER INFORMATION

CUSTOMER: John Amato
 ADDRESS: 88 CHAMBERLAIN RD
CITY/STATE/ZIP WESTFORD, MA 01886
 TELEPHONE: 978 692 0247
 REPORT TO: _____
 P.O. NUMBER: _____

B PROJECT INFORMATION

JOB NAME: CONCERN CHARLES HIGH SCH
 JOB NUMBER: _____
 LOCATION: CONCORD, MA
 TELEPHONE: SAME
 CONTACT: SAMS
 QUOTE NUMBER: _____

C SAMPLE INFORMATION

TURNAROUND TIME: (CIRCLE ONE)
 STANDARD RUSH
 RUSH T.A.T. _____ (CHECK W/LAB)
 MCP YES GW1 GW3
 NO GW2

STATION # (D)	SAMPLE IDENTIFICATION & LOCATION (E)	COLLECTED (F)		SAMPLE TYPE (H)	COMP (I)	MATRIX (J) SOLID (S) LIQUID (L) COMBINED (C) HAZARD (H)	# OF CONTAINERS (K)	CONTAINER AND PRESERVATIVE (K)	ANALYSIS (L)
		DATE	TIME						
1	CCRHS RED 11.17.08	11.17.08	9:00						Lead by ICP
2	CCRHS YELLOW 11.17.18	11.17.08	9:00						
3	CCRHS GREEN 11.17.08	11.17.08	9:00						
4	CCRHS LIME 11.17.08	11.17.08	9:00						
		DATE	TIME						
		DATE	TIME						
		DATE	TIME						

(M) CUSTODY SAMPLER: John Amato
 (print name)
 SIGNATURE: [Signature]

RECEIVED: [Signature] DATE: 11.17.08 TIME: 9:12 AM

RELINQUISHED: _____ DATE: _____ TIME: _____

RECEIVED FOR LAB: [Signature] DATE: 11/17/08 TIME: 12:33

RECEIVED FOR LAB: [Signature] DATE: 11/17/08 TIME: 12:33

GROUP # D810191 1213

SAMPLE CHECK LIST:
 RECEIVED WITHIN HOLD TIME YES NO
 TEMP BLANK YES NO
 SHIPPED OR HAND DELIVERED YES NO
 SAMPLES WERE PROPERLY PRESERVED YES NO
 SAMPLES WERE FILTERED IN FIELD YES NO
 IF NO EXPLAIN: _____

FIELD READINGS(S) & COMMENTS:

Lead Chromate Pigments EU Classification Mutagenicity and Carcinogenicity

- Lead chromate, CAS No. 7758-97-6; PbCrO_4
Annex I Index No. 082-004-00-2; ECB code C010 (A)**
- C.I. Pigment Yellow 34; Lead sulfochromate yellow; CAS-No. 1344-37-2; $\text{Pb}(\text{Cr,S})\text{O}_4$
Annex I Index No. 082-009-00-X; ECB code W045 (B)**
- C.I. Pigment Red 104; Lead chromate molybdate sulfate red; CAS-No. 12656-85-8;
Annex I Index No. 082-010-00-5; ECB code W046 , $\text{Pb}(\text{Cr,S,Mo})\text{O}_4$ (C)**

SUMMARY

- Pure lead chromate (**A**), being the basis for many studies, was never of important technical use. Only the two lead chromate pigments (C.I. Pigment Yellow 34 and Red 104) (**B,C**) have now been used commercially for more than 100 years.
- Since some decades the lead chromate pigments on the EU market are stabilized (encapsulated) to reach the required high properties. Encapsulation reduces solubility and bioavailability and thus toxicity compared to unstabilized lead chromate pigments.
- For many of the old studies pure lead chromate (**A**) or unstabilized lead chromate pigments were used.
- The majority of all toxicological investigations, and especially all newer in vitro studies were performed with PbCrO_4 (**A**) only.
- A commercial PbCrO_4 (**A**) was tested to have about 0.2 % of soluble chromate compounds (0.14 % Na_2CrO_4). Generally there are no informations available about the purity and contaminations of PbCrO_4 (**A**) used for the toxicological tests.
- Based on the absence of valid positive in vivo studies and with only some evidence from a series of different in vitro test systems, a classification for mutagenicity is not warranted.
- The results of the intrabronchial pellet implantation study led to the conclusion that only those chromate pigments with a certain degree of solubility such as calcium chromate, strontium chromate and zinc chromate, were biologically active and capable of exerting a carcinogenic effect. Barium chromate, pure lead chromate (**A**) and six samples of lead chromate pigments (**B, C**) did produce either no or no significant increase in the incidence of tumors. From all tested pigments the lead chromate pigments show the lowest solubility of hexavalent chromium.
- In the absence of inhalation tests, studies with intrabronchial implantation, intratracheal instillation and intrapleural administration are more relevant than the other ones, since they mimic at least partly the situation in the respiratory tract. With the exception of one single study with PbCrO_4 (**A**) after subcutaneous or intramuscular administration (i.e. no standard routes) only local tumors at the site of administration or even no increase in tumor incidence were observed; these local tumors are not regarded as relevant.
- In all epidemiological studies with exclusive exposure to lead chromate no increase in tumor incidence was observed.
- No new relevant toxicological studies are available since the last classification.
- The total weight of evidence of all toxicological information indicates that there is only a suspicion for a low carcinogenic potential of the lead chromate pigments Yellow 34 and Red 104. Therefore the current classification Carc.Cat. 3: R 40 should be maintained, in order to have a clear differentiation to the clear-cut carcinogenic chromates.
- Reclassification into Carc.Cat. 2 would be such a great step with such a drastic impact for the use, that the reasons for such a step must be of sufficient evidence. This is not the case for the lead chromate pigments.
- Unjustified reclassification of lead chromate pigments would result in serious problems for the pigment producers and downstream users. Therefore the pigment industry could not accept a reclassification of their lead chromate pigments based on the available information. The pigment industry and their consumers have learned to handle these lead chromate pigments in a safe manner.

1. CHEMICAL COMPOSITION, PRODUCTION and ECONOMIC IMPORTANCE

The pure lead chromate with the formula PbCrO_4 (**A**), also existing as the naturally occurring mineral crocoite, was never of important technical use.

The two so called lead chromate pigments (C.I. Pigment Yellow 34 and Red 104) (**B,C**) have now been used commercially for many decades. World production in 2000 about 80,000 t, EU about 30,000 t. The two pigments are used for coloring plastics and paints due to their excellent properties, brilliant colors and a cost benefit ratio not shown by any other pigment class.

CI Pigment Yellow 34 (**B**) with the formula $\text{Pb}(\text{Cr,S, Mo})\text{O}_4$ consists of mixed phase crystals of lead chromate and lead sulfate, and are not simply mixtures.

CI Pigment Red 104 (**C**) with the formula $\text{Pb}(\text{Cr,S})\text{O}_4$, consists of mixed phase crystals of lead chromate, lead sulfate and lead molybdate and are also not mixtures.

To improve the required properties, all lead chromate pigments are stabilized (encapsulated) with a fast coating of aluminium and titanium compounds and silicates up to 6% or antimony compounds and silicates up to 10 %. These encapsulated pigments have been brought to the market already some decades ago and the non encapsulated are not in use since that time in the EU, since they do not fulfill the required properties today with respect to lightfastness and resistance to sulfur dioxide.

Some toxic effects of lead poisoning in epidemiological studies made in the 80ies and before might be misleading, because the workers in those pigment producing factories were exposed to non or moderate encapsulated pigments. The preparation of soluble lead compounds from lead metal and exposure to dusty lead oxide has been stopped in these factories about 15 years ago at the latest.

Production:

In the manufacture of the pigments sodium dichromate solution (for Red 104 additionally molybdate solution) containing varying amounts of sulfate is added to a lead nitrate solution. The precipitation is washed with water to remove soluble compounds and afterwards the most important step the stabilization (encapsulation) takes place.

2. SOLUBILITY

The so called "solubility product" of pure lead sulfate is $10^{-8} \text{ Mol}^2/\text{l}^2$ and of pure lead chromate (**A**) $2 \times 10^{-14} \text{ Mol}^2/\text{l}^2$. That means, that lead sulfate shows an extremely higher lead solubility than lead chromate. In the mixed phase crystals of the pigments the lead solubility is much lower. Additionally the continuous dense, amorphous shell of "glass" of the encapsulation reduces the solubility, bioavailability and toxicity. Nevertheless if some soluble lead is found in tests it comes from the lead sulfate in the mixed phase crystals and not from the lead chromate part. Soluble lead does not mean automatically that also soluble hexavalent chromate is present (**Annex 2**).

Although ecological tests species are very sensitive to traces of hexavalent chromium the lead chromate pigments (**B,C**) have shown no acute toxicity to fish, daphnia, bacteria and algae (Annex 6) in ecological test conditions. This is due to the practical insolubility of the pigments referred to hexavalent chromium in water ($<0.005 \text{ mg/l}$, measured as total chromium, **Annex 1**).

Of all chromate pigments the encapsulated lead chromate pigments show the lowest solubility with respect to hexavalent chromium. Barium chromate and zinc tetra oxo chromate show moderate solubility. Other chromate pigments like zinc chromate and strontium chromate (and as known of the literature calcium chromate) show an extremely higher solubility of hexavalent chromium (**Annex 2**).

3. ACTUAL EU CLASSIFICATION WITH RESPECT TO MUTAGENICITY AND CARCINOGENICITY

- Barium chromate is excluded of classification Carc.Cat. 2; R 49 of chromate compounds
- Lead chromate and the pigments Yellow 34 and Red 104 are classified Carc.Cat 3; R 40
- Calcium chromate and strontium chromate are classified Carc.Cat 2; R 45
- Zinc chromate and zinc potassium chromate are classified Carc. Cat 1; R 45

4. TOXICOLOGY

There is a great number of studies with pure lead chromate (**A**), whereas there are only sparingly results on the two pigments C.I. Pigment Yellow 34 (**B**) and C.I. Pigment Red 104 (**C**). Since (**B,C**) possess different physico - chemical properties to (**A**) it can be assumed and has been shown experimentally, that they differ also in bioavailability and thus also in toxicological properties. Moreover as described before the pigments (**B**) and (**C**) are now produced and used in Europe only in encapsulated form which are less bioavailable and thus less toxic. Therefore not only a differentiation is indicated between the soluble chromates and the highly insoluble ones, but in addition between insoluble lead chromate pigments which are unstabilized and those which are stabilized (encapsulated). Most of the old studies have been performed with unstabilized pigments.

A commercial lead chromate was tested to have about 0.2 % of soluble chromate compounds (0.14 % Na_2CrO_4) (**Annex 2**). For the majority of the studies there is no information available about the purity and contaminations of PbCrO_4 (**A**) used for the toxicological tests.

Mutagenicity

– Genotoxicity in vitro:

At a first glance many tests have been postulated as positive, but a more critical assessment is necessary. A number of studies were false positive, since after "solubilising" in NaOH or NTA (Nitrilotriacetic acid) in these studies in reality free chromate ions were investigated. Not a simple physical solution process, rather a chemical reaction took place:



With NTA a respective reaction occurs:



NTA is a powerful chelating chemical, which forces the equilibrium of the reaction to the right, thus giving rise to the free chromate ion.

• Gene mutation in bacteria:

Generally all gene mutation tests (1979 -1989) in bacteria (Ames-Test and E. Coli) with all three substances (**A,B,C**) showed negative results in the standard tests, since studies under artificial unphysiological conditions (addition of NaOH or NTA) cannot be regarded as valid (details s. Annex 3, table 1a).

• Gene mutation in mammalian cells:

Again all studies (1979 -1987) with different cell types were either negative or false positive. Only PbCrO_4 (**A**) has been tested (Annex 3, table 1b).

- **Clastogenicity:**

Besides a few tests which were either negative or only positive after reaction with NaOH or NTA there were positive results, mostly in CHO cell lines or human lung cells, many of them performed by Wise et co-workers (1992 - 2004). Wise (1994; ECBI/32/02-Add. 32) found that the CHO medium increased solubility of the lead chromate. Wise et al. (2002; Add. 28) found also an increased chromosomal damage in a certain type of primary human lung cells (bronchial fibroblasts) after 24 hrs of exposure towards PbCrO₄ (**A**) and NaCrO₄ at similar levels. The exposure duration of 24 hrs in tissue cultures, however, gives opportunity to several ways of Cr VI **and**, respectively, Cr III entrance into the cells: phagocytosis of particles (Landolph, 1994; Add. 24) as well as extracellular reduction to Cr III by lysed and shredded cells, solubilisation and redox-reduction by released glutathione reductase plus NADPH as cofactor (Leonard et al., 2002; Add. 23) after 24 hrs of culture, especially if the test concentration exerts also significant cytotoxicity as in this case. In contrast, under in vivo conditions in animal experiments or in the work place, exposure time is mostly only few hours, clearance is allowed to take place after much shorter times and cytotoxic concentrations are normally avoided. Previously, Wise et al. (1994; Add. 32) have shown that the intracellular accumulation of lead and Cr is highly time-dependend. Only PbCrO₄ (**A**), but not the two pigments (**B,C**) were investigated (Annex 4, table 1c).

In conclusion, the positive results in clastogenicity tests should not be overemphasized, since many compounds exhibit clastogenicity in vitro under cytotoxic conditions, e.g. NaOH (Morita et al.).

- **DNA damage:**

Some SCE tests (1980 - 1993) were either negative or only positive after artificial dissolution in NaOH. Yet there were positive results in CHO cells and in a newer study by Leonhard (2002; Add. 23) with DNA strand breaks; the latter results is not unexpected and no new evidence, since oxidative stress was caused. Again only lead chromate (**A**) was investigated (Annex 3, table 1d).

- **Genotoxicity in vivo:**

- **Gene mutation:**

In *Drosophila melanogaster* PbCrO₄ (**A**) was negative under normal conditions and only after reaction with NTA positive (Annex 3, table 2).

- **Clastogenicity:**

PbCrO₄ (**A**) was investigated by Watanabe (1985; Add. 10) in a mouse micronucleus test by intraperitoneal administration. This study is regarded as not valid since there is no sufficient description of the method; but more importantly the test substance is described as 92% pure with no information on soluble impurities. The supernatant of 4 grams substance was investigated after filtration. Thus the positive result cannot be regarded as valid.

There are two newer studies (Odagiri, 1989 and 1993; Annexes 4, 5) with intraperitoneal administration in mice which have not been discussed in the CMR WG before. In both tests PbCrO₄ (**A**) proved to be negative. Pigment Red 104 (**C**) was also negative, whereas Na₂CrO₄ proved to be positive. Interestingly enough in the newer tests bone marrow was investigated by atomic absorption spectroscopy with respect to chromium, which was not increased significantly. This explains on one hand the negative outcome of the micronucleus tests, but it showed that under these test conditions PbCrO₄ (**A**) is not bioavailable. This result is very important for the assessment of the bioavailability in general (Annex 3, table 2).

Carcinogenicity

– Transformation:

Again only PbCrO₄ (**A**) was investigated in several tests (1988 – 1994) which showed a transforming activity. Some results are not clear, e.g. the positive mouse embryo cell test with (**A**) (Patierno 1988; Annex 6), whereas K₂CrO₄ was negative; in mouse embryo and human fibroblast cells (**A**) was positive, but CaCrO₄ negative (Landolph 1994; Add. 24).

– Animal studies:

All studies performed with PbCrO₄ (**A**) or the two pigments (**B,C**) followed non-standard carcinogenicity protocols and are rather old:

Maltoni (1974,1976) found high incidences of local tumors for both (**A**) and (**C**) with the **subcutaneous** route.

In studies with administration of PbCrO₄ (**A**) via the **intramuscular** route (Furst et al., 1976) (rats) there was a distinct increase in local tumors; besides the local tumors there were three late renal tumors detected after 24 months. Contrasting to the Furst-results there was another rat study (Hueper, 1961), which was negative and a negative mouse study, both also with **intramuscular** administration of PbCrO₄ (**A**) only. According to a statement of the EU SCOEL positive results from s.c. and i.m. administration are not relevant study types per se ("... however such locally induced tumors are no longer considered evidence of carcinogenic potential per se"; EU SCOEL, 03/2004). For a critical assessment of locally induced tumors by implantation or subcutaneous administration see a review by P. Grasso and M. Sharatt (Grasso, 1991).

In the absence of inhalation tests, studies with intrabronchial implantation, intratracheal instillation and intrapleural administration are more relevant than the other ones, since they mimic at least partly the situation in the respiratory tract. On the other hand they can be regarded as worst case because of the high local dosimetry:

A two year investigation with rats was carried out by Levy et al., 1986 using an **intrabronchial** pellet implantation technique. The results of this study, summarized in the **table**, led to the conclusion that only those chromate pigments with a certain degree of solubility such as calcium chromate, strontium chromate and zinc chromate were capable of exerting a carcinogenic effect. Barium chromate, lead chromate (**A**) and six samples of lead chromate pigments (**B, C**) did produce either no or no significant increase in the incidence of tumors. Only chromate pigments with a certain degree of solubility of hexavalent chromium. This finding supports a differentiation of carcinogenicity potential based on solubility – bioavailability differences among chromate compounds.

Table

Effects of intrabronchial implantation in rat lung vs. chromate solubility

Pigment	Number of bronchial carcinomas/100 rats	Solubility of Cr(VI) in 1g/l water suspension in mg/l (Annex 2)
Barium chromate	0	0.78
Lead chromate (A)	1	<0.02
6 lead chromate pigments samples (B,C)	0 or 1	< 0.002 to 0.01
Zinc chromate	5	159
Calcium chromate	25	-
Strontium chromate	43	167

PbCrO₄ (**A**) was also negative in rats and guinea-pigs after **intratracheal** instillation (Steffee & Baetjer, 1961) and in rats after **interpleural** administration (Hueper, 1961).

In **conclusion**, the most relevant studies (intra-bronchial, intratracheal as well as intrapleural administration in different species) are all negative for PbCrO_4 (**A**), and after intra-bronchial administration also for the pigments (**B**) and (**C**). Thus, there is only limited evidence for a carcinogenic potential from animal experiments for lead chromate and even less for the two pigments.

– Epidemiological studies:

Since, the decision of the working group in 1994 to classify the three substances into Cat. 3 there are no new studies besides the one Deschamps et al., 1995 (Add. 3). This study is a follow-up of an earlier study (Haguenoer et al., 1981; Add. 27) and has been criticized for a number of deficiencies: Mixed exposure with lead and zinc chromate; production procedures, basic chemicals have not been described sufficiently; no personal related exposure measurements; furthermore, smoking as a relevant confounder was not regarded.

In all other studies there were increased tumor rates only where there was mixed exposure, mostly with zinc chromate or calcium chromate or with the starting material Na_2CrO_4 . Interestingly enough Davies (1991; Add. 6) after the change of the process (i.e. elimination of calcium chromate) no excess of lung tumors was found anymore.

Davies (1984a and b; Add. 7, 8) detected lead poisoning. Lead in contrast to chromium ion is better soluble and bioavailable as have been shown by solubility tests in water, acute toxicity tests in algae (cf. chapter "2. SOLUBILITY"). Furthermore higher exposure to lead occurred in the former production processes where lead was used as starting material which was heated. Thus a conclusion that concurrent to lead poisoning a respective poisoning with chromate took place is not possible. On the other hand due to generally lower occupational standards in the 80ies and before, exposure to lead compounds and the pigments can be assumed. Nevertheless no increased tumor incidences were found.

It can be concluded that there is no indication of an excess in lung cancer incidence for lead chromate pigments exposure alone, rather there is a reduction of cancer rates when the process was changed, i.e. proven carcinogenic substances e.g. CaCrO_4 had been eliminated. Thus, there is no evidence for a carcinogenic potential for the two pigments in humans.

Mechanistic considerations:

Landolph (1994; ECB/32/02 Add. 24) and Leonhard et al. (2004; Add. 40) found that PbCrO_4 is able to generate Hydroxyl radicals; chelation of PbCrO_4 impaired the formation of OH-radicals. The Hydroxyl radical mechanism yet is common and not specific. Chemicals forming OH-radicals cannot be generally regarded to be carcinogenic, e.g. H_2O_2 .

Induction of apoptosis has been found in several cell culture systems (Blankenship, 1997; Add. 26 and Singh, 1999; Add. 21). It had been postulated that PbCrO_4 - induced apoptosis may be a mechanism to eliminate chromium- and/or lead-damaged DNA (Singh).

Bioavailability:

There is evidence for bioavailability from in vitro clastogenicity and mechanistic studies in some systems already in 1992 with later additional studies.

The negative micronucleus test has shown, that chromium concentration was not significantly increased in the bone marrow, i.e. under these test conditions PbCrO_4 (**A**) is not bioavailable **in vivo**. This result is very important for the assessment of the bioavailability in general.

In ecological studies with encapsulated pigments **(B)** and **(C)** for example in algae - a very sensitive species with respect to chromate poisoning - the low bioavailability of these forms has been also demonstrated (Annex 6).

Though not all encapsulated pigments have the same kind of stabilization, it can be concluded that encapsulation drastically reduces the bioavailability with respect to chromium - and also to lead - and thus generally reduces toxicity.

Conclusion:

Mutagenicity:

Based on the absence of valid positive in vivo studies and with only some evidence from a series of different in vitro test systems, a classification is not warranted.

Carcinogenicity:

Based on the following:

- no new relevant data / evidence
- low solubility / bioavailability, especially of the two pigments **(B and C)**
- only limited evidence from non-standard animal experiments
- no excess of lung cancers in epidemiological studies with lead chromate exposure only
- only some indication of a mutagenic potential in vitro and some indication of transforming activity
- necessity for a differentiation as compared to other chromates with clear carcinogenic potential (Na_2CrO_4 , SrCrO_4 , CaCrO_4), which are classified in Cat. 2, resp. Cat.1 (ZnCrO_4), and on the other hand BaCrO_4 with no classification.

the present EU-classification

Carc. Cat 3; R40 = Limited evidence of a carcinogenic effect and no classification for mutagenicity is appropriate, especially for the pigments Yellow 34 and Red 104.

5. SAFE HANDLING OF LEAD CHROMATE PIGMENTS

All lead compounds lead chromate pigments are classified Repr.Cat.1: R 61. The pigments and preparations containing 0.5 % or more of lead have to be labeled with skull-and-crossbones. They may not be supplied to private consumers and may only be supplied to persons who have been adequately informed about the hazards. Low workplace concentration limits and biological substance tolerance values protect the workers. The pigment industry and their consumers have learned to handle lead chromate pigments in a safe manner.

Annexes

1. Analytical report BASF, No. 00L00228; Project No.: 99/0755/60/2
2. Report on Solubility of different chromate pigments in water; 16.07.2004
3. Toxicological studies, tables 1 – 5; genotoxicity and carcinogenicity
4. Y. Odagiri et al., 1989: Micronucleus tests in mice on four chrome-containing-pigments, ; Jpn. J. Ind. Health, 31
5. Y. Odagiri et al., 1993: Micronucleus test on chromates in mouse bone marrow; Hen'igensei Shiken, 2; No. 1, 11 - 18
6. Literature not mentioned in the ECB website



NEWS RELEASE

DATE: June 5, 2008

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Safety of Synthetic Turf Validated by NJ Test Results

Atlanta, Ga. (June 5, 2008) – Synthetic turf test results released by the New Jersey Department of Health and Senior Services (NJDHSS) on June 3rd confirmed lead chromate levels are well below that necessary to cause harm to children and athletes using the popular playing field surfaces.

“Our industry is proud of its unblemished record of human health and environmental safety since synthetic turf was first introduced more than 40 years ago,” says Rick Doyle, President of the Synthetic Turf Council. “We are actively sharing information and cooperating with the NJDHSS, Consumer Product Safety Council (CPSC) and U.S. Environmental Protection Agency to ensure the continued safety of the public.”

Lead chromate has been used in a number of synthetic turf fields to extend the life of its colorfastness. Testing three fields in New Jersey with elevated lead levels, the NJDHSS focused on the bioaccessibility of synthetic turf, which it defines as “the fraction of a substance in a material that is soluble and made available for absorption” by the body. Findings validated the Synthetic Turf Council’s position, based on science and expert opinion, that lead chromate’s extremely low bioavailability prevents it from being readily absorbed by the human body.

Key Findings

From its tests, the NJDHSS reported that the amount of lead chromate contained in fibers from the three fields available for absorption in the intestine, which is where food altered by stomach acid is absorbed by the blood and lymphatic systems, ranged from 2.5% to 11%. We used the most extreme scenario, 11%, to calculate the amount of turf that would have to be ingested to equal the federal standard of 600 parts per million. In practical terms, it is very unlikely for a child to be at risk from synthetic turf:

- According to calculations made by forensic toxicologist Dr. David Black, a 50 lb. child would have to ingest over 100 lbs. of synthetic turf to be at risk of absorbing enough lead to equal the minimum threshold of elevated blood lead. That level is even more unreachable than Dr. Black’s original worst case bioaccessibility, which was based on ingesting 23 lbs. of turf.
- The Consumer Product Safety Commission's guidance states that young children "should not chronically ingest more than 15 micrograms of lead per day from

consumer products." Putting these test results in perspective, polymer and fiber engineering specialist Dr. Davis Lee calculated that a child playing on the three New Jersey fields would have to wipe his fingers on the turf and put them in his mouth 750 times in a day to receive enough lead to equal the CPSC threshold level.

- Dr. David Black performed the same tests as the NJDHSS, using the same protocol during late May, which showed an average bioaccessibility of 4%. The results of the two tests are similar and validate the safety of synthetic turf, including the synthetic turf NJDHSS reported to contain concentrations of lead chromate of between 3,400 and 4,700 part per million.

Continuous Improvement:

The industry continues to develop new technologies to enhance the safety and playability of synthetic turf. Over the past four decades, the product has made significant improvements. For example, more than 90% of the colored fibers used in synthetic turf today contain lead chromate levels below the federal standard. Even so, our industry is voluntarily developing pigment formulations that continue to reduce lead chromate levels while maintaining high levels of quality and performance.

About the Synthetic Turf Council:

Based in Atlanta, the Synthetic Turf Council was founded in 2003 to serve as an objective resource assisting buyers and end users with the selection, use, and maintenance of synthetic turf systems in sports field, golf, and landscape applications. The organization actively collects reputable studies and research, as well as official statements by governmental agencies and sports organizations, which address the impact of synthetic turf sports fields. STC members produce and install most of the synthetic turf sports fields in North America. Membership includes builders, landscape architects, testing labs, maintenance providers, manufacturers of synthetic turf and infill, installation contractors and other specialty service companies. For more information, visit www.syntheticurfCouncil.org.

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§ 1500.213

the invoice or bill of sale covering such shipment of delivery; or

(2) General and continuing, in which case, in its application to any shipment or other delivery of an article, it shall be considered to have been given at the date such article was shipped or delivered, or caused to be shipped or delivered, by the person who gives the guaranty of undertaking.

(b) The following are suggested forms of guaranty or undertaking referred to in section 5(b)(2) of the act.

(1) *Limited form for use on invoice or bill of sale.*

(Name of person giving the guaranty or undertaking)
hereby guarantees that no article listed herein is misbranded within the meaning of the Federal Hazardous Substances Act.
(Signature and post-office address of person giving the guaranty or undertaking)

(2) *General and continuing forms.*

The article comprising each shipment or other delivery hereafter made by _____
(Name of person giving the guaranty or undertaking)
to, or on the order of _____
(Name and post-office address of person to whom the guaranty or undertaking is given)

is hereby guaranteed, as of the date of such shipment or delivery, to be, on such date, not misbranded within the meaning of the Federal Hazardous Substances Act.
(Signature and post-office address of person giving the guaranty or undertaking)

(c) The application of a guaranty or undertaking referred to in section 5(b)(2) of the act to any shipment or other delivery of an article shall expire when such article, after shipment or delivery by the person who gave such guaranty or undertaking, becomes misbranded within the meaning of the act.

§ 1500.213 Presentation of views under section 7 of the act.

(a) Presentation of views under section 7 of the act shall be private and informal. The views presented shall be confined to matters relevant to the contemplated proceeding. Such views may be presented by letter or in person by the person to whom the notice was given, or by his representative. In case such person holds a guaranty or undertaking referred to in section 5(b)(2) of the act applicable to the article on

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which such notice was based, such guaranty or undertaking, or a verified copy thereof, shall be made a part of such presentation of views.

(b) Upon request, reasonably made, by the person to whom a notice appointing a time and place for the presentation of views under section 7 of the act has been given, or by his representative, such time or place, or both such time and place, may be changed if the request states reasonable grounds therefor. Such request shall be addressed to the office of the Consumer Product Safety Commission that issued the notice.

§ 1500.214 Examinations and investigations; samples.

When any officer or employee of the Commission collects a sample of a hazardous substance for analysis under the act, the sample shall be designated as an official sample if records or other evidence is obtained by him or any other officer or employee of the Commission indicating that the shipment or other lot of the article from which such sample was collected was introduced or delivered for introduction into interstate commerce, or was in or was received in interstate commerce, or was manufactured within a Territory not organized with a legislative body. Only samples so designated by an officer or employee of the Commission shall be considered to be official samples:

(a) For the purpose of determining whether or not a sample is collected for analysis, the term "analysis" includes examinations and tests.

(b) The owner of a hazardous substance of which an official sample is collected is the person who owns the shipment or other lot of the article from which the sample is collected.

§ 1500.230 Guidance for lead (Pb) in consumer products.

(a) *Summary.* (1) The U.S. Consumer Product Safety Commission issues this guidance to manufacturers, importers, distributors, and retailers to protect children from hazardous exposure to

lead in consumer products.¹ The Commission identifies the major factors that it considers when evaluating products that contain lead, and informs the public of its experience with products that have exposed children to potentially hazardous amounts of lead.

(2) To reduce the risk of hazardous exposure to lead, the Commission requests manufacturers to eliminate the use of lead that may be accessible to children from products used in or around households, schools, or in recreation. The Commission also recommends that, before purchasing products for resale, importers, distributors, and retailers obtain assurances from manufacturers that those products do not contain lead that may be accessible to children.

(b) *Hazard.* Young children are most commonly exposed to lead in consumer products from the direct mouthing of objects, or from handling such objects and subsequent hand-to-mouth activity. The specific type and frequency of behavior that a child exposed to a product will exhibit depends on the age of the child and the characteristics and pattern of use of the product. The adverse health effects of lead poisoning in children are well-documented and may have long-lasting or permanent consequences. These effects include neurological damage, delayed mental and physical development, attention and learning deficiencies, and hearing problems. Because lead accumulates in the body, even exposures to small amounts of lead can contribute to the overall level of lead in the blood and to the subsequent risk of adverse health effects. Therefore, any unnecessary exposure of children to lead should be avoided. The scientific community generally recognizes a level of 10 micrograms of lead per deciliter of blood as a threshold level of concern with respect to lead poisoning. To avoid exceeding that level, young children should not chronically ingest more than 15 micrograms of lead per day from consumer products.

¹This guidance is not a rule. It is intended to highlight certain obligations under the Federal Hazardous Substances Act. Companies should read that Act and the accompanying regulations in this part for more detailed information.

(c) *Guidance.* (1) Under the Federal Hazardous Substances Act (FHSA), 15 U.S.C. 1261(f)(1), household products that expose children to hazardous quantities of lead under reasonably foreseeable conditions of handling or use are “hazardous substances.” A household product that is not intended for children but which creates such a risk of injury because it contains lead requires precautionary labeling under the Act. 15 U.S.C. 1261(p). A toy or other article intended for use by children which contains a hazardous amount of lead that is accessible for children to ingest is a banned hazardous substance. 15 U.S.C. 1261(q)(1)(B). In evaluating the potential hazard associated with products that contain lead, the Commission staff considers these major factors on a case-by-case basis: the total amount of lead contained in a product, the bio-availability of the lead, the accessibility of the lead to children, the age and foreseeable behavior of the children exposed to the product, the foreseeable duration of the exposure, and the marketing, patterns of use, and life cycle of the product.

(2) Paint and similar surface coatings containing lead have historically been the most commonly-recognized sources of lead poisoning among the products within the Commission’s jurisdiction. The Commission has, by regulation, banned paint and other similar surface coatings that contain more than 0.06% lead (“lead-containing paint”), toys and other articles intended for use by children that bear lead-containing paint, and furniture articles for consumer use that bear lead-containing paint. 16 CFR Part 1303. In recent years, however, the Commission staff has identified a number of disparate products—some intended for use by children and others simply used in or around the household or in recreation—that presented a risk of lead poisoning from sources other than paint. These products included vinyl miniblinds, crayons, figurines used as game pieces, and children’s jewelry.

(3) In several of these cases, the staff’s determination that the products presented a risk of lead poisoning resulted in recalls or in the replacement of those products with substitutes, in

addition to an agreement to discontinue the use of lead in future production. The Commission believes that, had the manufacturers of these lead-containing products acted with prudence and foresight before introducing the products into commerce, they would not have used lead at all. This in turn would have eliminated both the risk to young children and the costs and other consequences associated with the corrective actions.

(4) The Commission urges manufacturers to eliminate lead in consumer products to avoid similar occurrences in the future. However, to avoid the possibility of a Commission enforcement action, a manufacturer who believes it necessary to use lead in a consumer product should perform the requisite analysis before distribution to determine whether the exposure to lead causes the product to be a “hazardous substance.” If the product is a hazardous substance and is also a children’s product, it is banned. If it is a hazardous household substance but is not intended for use by children, it requires precautionary labeling. This same type of analysis also should be performed on materials substituted for lead.

(5) The Commission also notes that, under the FHSA, any firm that purchases a product for resale is responsible for determining whether that product contains lead and, if so, whether it is a “hazardous substance.” The Commission, therefore, recommends that, prior to the acquisition or distribution of such products, importers, distributors, and retailers obtain information and data, such as analyses of chemical composition or accessibility, relevant to this determination from manufacturers, or have such evaluations conducted themselves.

[63 FR 70649, Dec. 22, 1998]

§ 1500.231 Guidance for hazardous liquid chemicals in children’s products.

(a) *Summary.* The U.S. Consumer Product Safety Commission issues this guidance to manufacturers, importers, distributors, and retailers to protect children from exposure to hazardous chemicals found in liquid-filled children’s products, such as rolling balls,

bubble watches, necklaces, pens, paperweights, keychains, liquid timers, and mazes.¹ The Commission identifies the major factors that it considers when evaluating liquid-filled children’s products that contain hazardous chemicals, and informs the public of its experience with exposure to these hazardous chemicals to children. To reduce the risk of exposure to hazardous chemicals, such as mercury, ethylene glycol, diethylene glycol, methanol, methylene chloride, petroleum distillates, toluene, xylene, and related chemicals, the Commission requests manufacturers to eliminate the use of such chemicals in children’s products. The Commission also recommends that, before purchasing products for resale, importers, distributors, and retailers obtain assurances from manufacturers that liquid-filled children’s products do not contain hazardous liquid chemicals.

(b) *Hazard.* During reasonably foreseeable handling or use of liquid-filled children’s products, hazardous chemicals may become accessible to young children in a manner that places children at risk. Young children are exposed to the chemicals from directly mouthing them or from handling such objects and subsequent hand-to-mouth or hand-to-eye activity. The specific type and frequency of behavior that a child exposed to a product will exhibit depends on the age of the child and the characteristics and pattern of use of the product. The adverse health effects of these chemicals to children include chemical poisoning from ingestion of the chemicals, pneumonia from aspiration of the chemicals into the lungs, and skin and eye irritation from exposure to the chemicals. The chemicals may also be combustible.

(c) *Guidance.* (1) Under the Federal Hazardous Substances Act (FHSA), products that are toxic or irritants and that may cause substantial injury or illness under reasonably foreseeable conditions of handling or use, including reasonably foreseeable ingestion by children, are “hazardous substances.”

¹This guidance is not a rule. It is intended to highlight certain obligations under the Federal Hazardous Substances Act. Companies should read that Act and the accompanying regulations in this part for more detailed information.

NEWS from CPSC

U.S. Consumer Product Safety Commission

Office of Information and Public Affairs

Washington, DC 20207

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CPSC Hotline: (800) 638-2772
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CPSC Staff Finds Synthetic Turf Fields OK to Install, OK to Play On

WASHINGTON, D.C. - The U.S. Consumer Product Safety Commission (CPSC) staff today released its evaluation of various synthetic athletic fields. The evaluation concludes that young children are not at risk from exposure to lead in these fields.

CPSC staff evaluation showed that newer fields had no lead or generally had the lowest lead levels. Although small amounts of lead were detected on the surface of some older fields, none of these tested fields released amounts of lead that would be harmful to children.

Lead is present in the pigments of some synthetic turf products to give the turf its various colors. Staff recognizes that some conditions such as age, weathering, exposure to sunlight, and wear and tear might change the amount of lead that could be released from the turf. As turf is used during athletics or play and exposed over time to sunlight, heat and other weather conditions, the surface of the turf may start to become worn and small particles of the lead-containing synthetic grass fibers might be released. The staff considered in the evaluation that particles on a child's hand transferred to his/her mouth would be the most likely route of exposure and determined young children would not be at risk.

Although this evaluation found no harmful lead levels, CPSC staff is asking that voluntary standards be developed for synthetic turf to preclude the use of lead in future products. This action is being taken proactively to address any future production of synthetic turf and to set a standard for any new entrants to the market to follow.

As an overall guideline, CPSC staff recommends young children wash their hands after playing outside, especially before eating.

A [Video News Release](#) will feature b-roll of synthetic turf in use, on-site and laboratory testing, and soundbites in English and Spanish.

Video Feed Satellite Coordinates

Wednesday, July 30, 2008
2:30 PM – 3:00PM ET
Galaxy 25
Transponder 13
C-Band
Downlink Freq: 3960V

Thursday, July 31, 2008
10:30 AM – 11:00AM ET

Galaxy 3
Transponder 21
C-Band
Downlink Freq: 4120H

For Technical Information, DURING FEED ONLY, contact Daniel Conboy at (800) 920-6397 x 221.

[Send the link for this page to a friend!](#) The U.S. Consumer Product Safety Commission is charged with protecting the public from unreasonable risks of serious injury or death from more than 15,000 types of consumer products under the agency's jurisdiction. Deaths, injuries and property damage from consumer product incidents cost the nation more than \$800 billion annually. The CPSC is committed to protecting consumers and families from products that pose a fire, electrical, chemical, or mechanical hazard. The CPSC's work to ensure the safety of consumer products - such as toys, cribs, power tools, cigarette lighters, and household chemicals - contributed significantly to the decline in the rate of deaths and injuries associated with consumer products over the past 30 years.

To report a dangerous product or a product-related injury, call CPSC's hotline at (800) 638-2772 or CPSC's teletypewriter at (800) 638-8270, or visit CPSC's web site at www.cpsc.gov/talk.html. To join a CPSC email subscription list, please go to <https://www.cpsc.gov/cpsclist.aspx>. Consumers can obtain this release and recall information at CPSC's Web site at www.cpsc.gov.



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September 22, 2008

Mr. Gregory V. Ulirsch, M.S., Ph.D.
Technical Project Officer, Superfund Site Assessment Branch
Agency for Toxic Substances and Disease Registry/DHAC
1825 Century Center
Atlanta, GA 30345

Dear Mr. Ulirsch:

This Letter Health Consultation (LHC) has been completed for the Ironbound Athletic Field B (IAFB) located along Saint Charles Avenue in Newark, Essex County, New Jersey. Information for this LHC was obtained through discussions with personnel from the Newark Department of Health and Human Services and provides an update to the January 16, 2008 LHC prepared for the recreational field.

Statement of Issues

This LHC was prepared in response to a request by the Agency for Toxic Substances and Disease Registry (ATSDR) for a status update of remedial actions implemented for the IAFB. This document also includes a re-evaluation of potential exposure pathways and health risks to area residents to lead from the lead-based synthetic turf fibers and synthetic-based dust present on the surface of the IAFB.

Background

In July 2007, a Letter of Technical Assistance (LTA) was prepared in response to a United States Environmental Protection Agency (USEPA) Region 2 request that the NJDHSS evaluate potential health risks posed by contaminants detected at the Tidewater Baling site located at 26 Saint Charles Avenue in Newark, Essex County, New Jersey. Recommendations within the LTA included evaluating whether lead contamination was present at the adjacent IAFB. Assessment of the IAFB by the NJDHSS and USEPA in August and November 2007, respectively, indicated lead in surface dust of the field at average concentrations of 1,280 to 3,742 milligrams per kilogram (mg/Kg) or 49 to 133 micrograms of lead per square foot ($\mu\text{g Pb/ft}^2$). Lead in synthetic surface fibers of the field was determined to contain high concentrations of lead at an average of 3,500 to 4,800 mg/Kg. Further evaluation of data from both assessments indicated the source of the lead concentrations in surface dust originated primarily from the deterioration of the lead-containing synthetic fibers of the field surface.

This city-owned field is used by area residents for various recreational activities. During three separate site visits conducted by ATSDR and NJDHSS in 2007, representatives from these agencies observed a small group of young children (estimated age range 3 to 6 years), under adult supervision, playing on the field surface and making hand contact with both the synthetic field and exposed soil surfaces (located at the field perimeter). On October 31, 2007, the City of Newark closed the Ironbound Athletic Field B for public use by recommendation of the ATSDR and NJDHSS.

A health consultation was completed by the NJDHSS in January 2008 categorizing the IAFB as a **Public Health Hazard** to users of the field due to elevated lead concentrations in surface dust. The recommendation included maintaining field closure to area residents until measures are taken to reduce or eliminate the lead dust exposure hazard present on the field surface where it no longer creates a hazard to public health.

Discussion

Following the October 2007 field closure, the City of Newark engaged their environmental consultant to determine the correct measures to implement for the removal and disposal of the synthetic field. City of Newark supplied information indicated the synthetic field surface was an AstroTurf product called AstroTurf XL and was approximately ten years old at the time of the field closure.

On February 21, 2008, a public meeting was held and was attended by the NJDHSS, US EPA, City of Newark, the Ironbound Community Corporation, contractors to the City of Newark and area residents. The NJDHSS provided a presentation regarding the findings of the January 2008 LHC, the basis for recommending closure of the IAFB, future recommendations to the City of Newark, and the NJDHSS and ATSDR's involvement in planned investigation of lead in synthetic turf products.

In April 2008, the synthetic field surface was removed under contractor oversight using dust suppression control to minimize disturbance of lead containing dust on the field surface. Information provided by the City of Newark indicated that airborne lead was not present above method detection limits in perimeter air samples collected during the removal of the synthetic turf product from the field indicating dust suppression control methods implemented were sufficient. Synthetic materials associated with the field were transported off-site to an approved disposal facility.

In June 2008, a new synthetic field surface was installed at the IAFB. Information provided by the City of Newark regarding test data from samples collected from the new synthetic turf product, specifically surface fibers, indicates lead concentrations were less than 4 mg/Kg. These concentrations are less than the USEPA Residential Soil Guidance Value of 400 mg/Kg in soil and the US Consumer Products Safety Commission acceptable lead content in consumer products of ≤ 600 parts per million (mg/Kg); therefore, this material is not considered to be an exposure concern regarding lead. Additionally, based on the lead concentrations in the fibers of the new synthetic turf product, if this field surface deteriorates over time and creates a synthetic-based dust, the resulting lead concentrations in this dust would not be of concern.

Conclusions

Based on this review, the remedial actions implemented at the IAFB, the ATSDR and NJDHSS categorize the current and future recreational use of the athletic field as a *No Public Health Hazard* as the lead dust exposure hazard has been removed from the field. Elimination of this lead dust hazard was accomplished by the removal of the former high lead-containing synthetic turf product which was deteriorating creating the lead dust hazard and replacement with a synthetic turf product containing lead concentrations at levels which would not pose a health hazard.

Recommendations

Future recommendations are for the City of Newark to keep abreast of developing information regarding the current and future studies being conducted by federal and state agencies regarding potential health-related issues from the use of synthetic turf products. Concerns raised in the United States by both the public and governmental agencies has generated focused interest in continued study of physical and chemical health-related issues pertaining to synthetic turf products, including lead. Specifically regarding recommendations to the IAFB, there are no further actions recommended.

Please contact me at 609-588-7497, Glenn.Pulliam@doh.state.nj.us or alternately, Ms. Leah Graziano, Associate Regional Representative, ATSDR Region II at 732-906-6932, Escobar.Leah@epamail.epa.gov to discuss the findings of this letter.

Yours truly,



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c: Gregory Ulirsch, Technical Project Officer, ATSDR
Arthur Block, Senior Regional Representative, ATSDR Region II
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Edward Putnam, Assistant Director, NJDEP
Robert Dooley, Department of Engineering, City of Newark
Marsha McGowan, Department of Health and Human Services, City of Newark

References

[ATSDR] Agency for Toxic Substances and Disease Registry. 2006. Toxicological profile for Lead. US Department of Health and Human Services, Atlanta, Georgia.

[ATSDR] Agency for Toxic Substances Disease Registry. Letter Health Consultation for Ironbound Athletic Field, Newark, Essex County, New Jersey. January 16, 2008.

[USEPA] United States Environmental Protection Agency. Ironbound Athletic Field Artificial Turf Investigation, Newark, New Jersey. December 14, 2007.

[NJDHSS] Glenn Pulliam, New Jersey Department of Health and Senior Services and Robert Dooley, Department of Engineering, City of Newark, personal communication, September 16 & 19, 2008.

Weston Solutions, Inc. Summary Report Ironbound Athletic Field to Robert Dooley, Department of Engineering, City of Newark. July 11, 2008.

CPSC Staff¹ Analysis and Assessment of Synthetic Turf “Grass Blades”

CPSC staff identified synthetic turf products for analysis of total lead content and accessible lead. Staff obtained samples of turf that had been left over after installation or that became available when a field was dismantled. Staff also visited in-service synthetic turf fields, and used portable X-ray Fluorescence (XRF) testing equipment to detect the presence of lead in the product, as well as a portable field wiping apparatus to measure the exposure potential to the lead.

The staff considered that exposure to the lead present in some synthetic turf products could occur if some of the lead gets on children’s hands, perhaps when synthetic grass blades break or become worn and release small particles of lead-containing material. The lead on the children’s hands may then get transferred from their hands to their mouths through normal hand-to-mouth activity during or after playing on the field.

Analytical Methods

Lead Content

Small pieces of synthetic grass blades were dissolved in concentrated nitric acid using a microwave digestion. The digested sample solutions were then analyzed for lead content using inductively coupled plasma atomic emission spectroscopy.

Accessible Lead (Wipe Sampling)

Products found to contain lead were tested for accessibility of the lead; *i.e.*, whether children using the product could be exposed to the lead that is present.

Staff adapted the approach for estimating exposure to lead from contact with lead-containing synthetic turf fields from the approach used to assess children’s exposure to arsenic from playing on playground structures built using chromated copper arsenate (CCA) pressure-treated wood (Appendix A).

The wipe testing methodology developed for testing pressure-treated wood was used to measure transfer of lead from synthetic grass blades, with one modification. Ghost Wipe™ was used in place of the polyester cloth wipe used in the wipe sampling for wood. Ghost Wipe™ is a commercially available wiping material, 15 cm x 15 cm, pre-moistened with deionized water, and sold in individually sealed packets. Company literature indicates that the Ghost Wipe™ meets all ASTM E1792-96E² specifications for sampling materials for lead in surface dust.

The general method involves attaching a Ghost Wipe™ to a 1.1 kg weighted disk, 8 cm in diameter, installed in a device built to provide a standardized and consistent surface wiping. The disk is dragged down a 50-cm length of turf sample for 10 back and forth strokes. The wipe is then removed for analysis.

¹ These comments are those of the CPSC staff, have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

² ASTM Standard E1792-96E, “Standard Specification for Wipe Sampling Materials for Lead in Surface Dust,” ASTM International, West Conshohocken, PA, www.astm.org.

Results

Several of the products obtained by staff contained lead in the synthetic grass with concentrations ranging from 0.09 percent lead by weight to 0.96 percent. The testing showed that lead content varied between synthetic turf installations, and also within a field depending on color.

The data show that wiping of the surface of lead-containing synthetic turf with firm pressure results in transfer of some lead or lead-containing material to the wipe medium (Ghost Wipe™).

Exposure Assessment and Results

If it is assumed that transfer of lead-containing residue from the surface of synthetic turf has similar characteristics to transfer of arsenic-containing residue from wood (Appendix A) (*i.e.*, that the amount of residue collected does not increase infinitely, but plateaus at some point during play), then the amount of lead that might collect on the hands of children as they play on turf fields can be estimated from laboratory studies of synthetic turf.

As discussed in Appendix A, the experimental wipe method using polyester cloths overestimated the amount of residue that might be transferred to a person's bare skin by a factor of between five and 13 times, depending on whether a wet or dry cloth was used. Although the relationship between surface residue removal by a Ghost Wipe™ and bare skin has not been fully characterized, preliminary tests indicate that the Ghost Wipe™ overestimates to a similar degree the transfer of material from the turf surface to bare hands.

The staff believes that dividing the results obtained through use of using Ghost Wipes™ by five is a reasonable approximation of the amount of lead-containing material that may transfer to children's hands.

The exposure assessment described above concerns the accessibility of the lead. Another important point to consider is the bioavailability of the lead, which relates to the amount of lead that is absorbed by the body. The staff assumed, in this case, that the bioavailability of lead from the material that transfers to skin from contact with lead-containing synthetic turf is the same as the bioavailability of lead from food and drink in the epidemiological studies of lead exposure.

The staff's approach, based on the assessment of exposure to arsenic in pressure-treated wood, is that during play, lead-containing residue is transferred to a child's hands and then a portion of that "handload" is transferred to the mouth during the day. The staff practice for assessing whether exposure to a product would result in excessive lead exposure is to assume that about half of the residue that collects on a child's hands ends up in their mouths (*i.e.*, transfer efficiency is 50 percent).

The staff used the wipe-testing data to estimate transfer of lead to children's hands during contact with a synthetic turf surface during play. Each wipe value was divided by five to correct the overestimation of transfer using the Ghost Wipe™, and divided by two to account for the amount of lead that is transferred from the hands to the mouth.

CPSC staff recognizes a level of 10 micrograms of lead per deciliter of blood (10 µg/dL) as a level of concern with respect to lead poisoning. To prevent children from exceeding this level, the staff suggests that chronic ingestion of lead from consumer products should not exceed

15 µg lead/day³. This value was determined from epidemiological studies of ingestion of lead through food and drink (as discussed above with respect to bioavailability).

The results (Table 1) for this set of tested synthetic turf fields show no case in which the estimated exposure for children playing on the field would exceed 15 µg lead/day.

Study Limitations

This assessment is subject to a number of limitations including the accuracy of the wipe sampling method for estimating exposure to lead-containing residue from touching or other contact with the synthetic turf surface; the accuracy of the assumptions about the capacity of bare skin to collect surface residues during a typical play event at a field; and the accuracy of the assumptions related to hand-to-mouth transfer of lead-containing residues. Further, the staff did not make adjustments in its assessment to account for the non-uniformity of lead content of synthetic turf fields; *i.e.*, some fields had striped areas that contained lead that constitute only a small part of the total playing surface of the field that otherwise had no detectable lead levels. Children playing on such fields might have some contact with the lead-containing striped areas, but most of their contact with the surface would be expected to be with the other parts of the turf (not lead-containing). Finally, the bioavailability of lead from synthetic turf may not be the same as it is for the food and drink exposures that were the basis of the dose-response assessment used to determine the staff's recommended 15 µg/day exposure limit for lead.

³ 16 C.F.R. § 1500.230. Codified Guidance Policy for Lead in Consumer Products (63 FR 70648; December 22, 1998).

Appendix A

The staff's previous assessment⁴ of children's exposure to arsenic from playing on playground structures built using chromated copper arsenate (CCA) pressure-treated wood informed the current approach to analysis of synthetic turf surfaces and the assessment of potential exposure to the lead contained in the turf "grass" fibers. Lessons learned from the CCA studies include:

- 1) Development of a treated wood sampling method: A saline-wetted polyester cloth wipe was attached to a 1.1 kg weighted disk, 8 cm in diameter. The disk was dragged down a 50-cm length of wood for 10 back and forth strokes. When compared to results of residue transfer using volunteers with bare hands, the polyester cloths picked up approximately 13 times more residue; the experimental values were multiplied by a conversion factor of 0.076 to get human skin equivalent handloadings. When the polyester cloths were used dry, they picked up, on average, about 5 times more residue than the volunteer's bare hands did.
- 2) Understanding of some of the characteristics of treated wood surface residues: Removal of surface residue arsenic correlated with several experimental design features including the material used to wipe the surface, whether the material was wetted or dry, the amount of force applied during wiping, and the area wiped. A key observation was that the amount of dislodged residue did not necessarily simply increase with changes in method that would likely remove more residue. Rather, the amount of dislodged residue approached a plateau, *i.e.*, it appeared that the transfer of material depended on the capacity of the transfer medium (whether the skin of hands of volunteers or wipes made of cloth or other materials) to collect residue, which was not infinite.
- 3) Understanding of the nature of children's contact with playground structures and potential exposure to surface residues: The data, in conjunction with activity analysis of children playing on playgrounds, led to the conclusion that despite the large variability in children's playground activities and time spent at a playground, their hands would likely collect surface residues from the wood structures they happened to touch fairly quickly in a play session—what the staff termed "maximum handloading". For the exposure and risk analysis, then, the staff assumed that a child's hands would become contaminated with an amount of arsenic as determined by the experimental study of residue transfer. Data from cloth wipes were adjusted for the finding that the cloth wipes always picked up more residue from the wood surfaces than the bare skin of volunteers.

⁴ Briefing Package, Petition to Ban Chromated Copper Arsenate (CCA)-Treated Wood in Playground Equipment (Petition HP 01-3), February 4, 2003.

Table 1. Turf Sample Exposure Results and Health Hazard Evaluation

Firm	Description	Subsample	Lead content (%)	Wipe Sampling Result (μg) *	Estimated daily ingestion of lead (μg) †‡
1	Green, installed 1999; removed 2008	1	0.54	65.8	6.6
		2	0.56	98.7	9.9
		3	0.55	39.9	4.0
		Average		68.1	6.8
1	Green, indoor field; installed 2000; in use		0.88	14.3	1.4
1	Green; new, 2008	1	0.1	1.2	0.12
		2	0.09	1.2	0.12
		3		0.9	0.09
		Average		1.1	0.11
1	Green; new, 2008	1	0.42	1.3	0.13
		2	0.47	0.4	0.04
		3		0.4	0.04
		Average		0.7	0.07
2	Green and other colors; installed 2005; in use		nd	nt	neg
2	Green; unused sample sent to lab for analysis		nd	nt	neg
2	Green; unused sample sent to lab for analysis		nd	nt	neg
2	Green; unused sample sent to lab for analysis		nd	nt	neg
2	Green; unused sample sent to lab for analysis		trace	nt	neg
2	Green; unused sample sent to lab for analysis		nd	nt	neg
2	Red; unused sample sent to lab for analysis		nd	nt	neg
2	Yellow stripes; field in use	Sideline,1	0.53	0.9	0.09
		Sideline,2		0.5	0.05
		Midfield		2.4	0.24
3	Green with yellow stripes; installed 2007; in use	Green	nd	nt	neg
		Yellow,18	0.96	0.7	0.07
		Yellow,19		1.4	0.14
		Yellow,20		0.8	0.08
		Yellow, Average		1.0	0.1
4	Green; white stripes; installed 2004; in use		nd	nt	neg

Note: nd = none detected; nt = not tested; neg = negligible

* Amount of lead collected on Ghost Wipe™ during wipe testing; if multiple wipes were conducted on a sample, the result of the first wipe is shown; all values are total lead removed during wipe.

† Laboratory wipe results divided by 5 to account for differences in lead residue removal efficiency of the Ghost Wipe™ and bare skin. The factor of 5 was taken from the staff's CCA studies; a similar trend was found in limited hand sampling of synthetic grass blades. Staff assumes that half of the residue that collects on a child's hands will be transferred to the mouth and ingested. Thus, the estimated daily ingestion of lead is the Ghost Wipe™ result divided by 5 divided by 2.

‡ The estimated daily ingestion of lead is an estimate of exposure for children playing on a synthetic turf field. Each estimate in this analysis may be compared to the 15 µg/day level that CPSC staff suggests not be exceeded in order to prevent young children from exceeding the 10 µg/dL blood lead level of concern.