

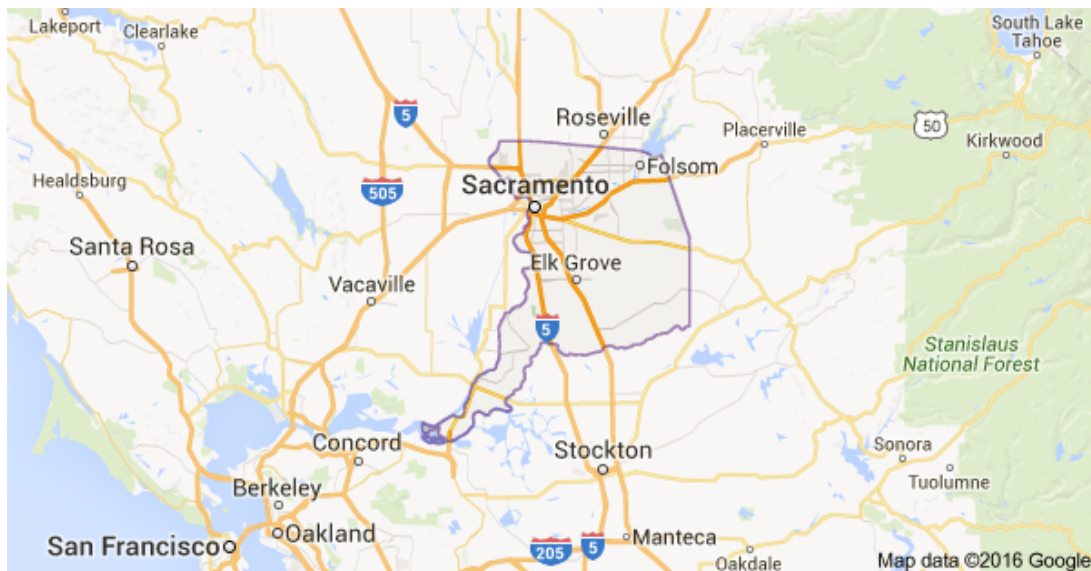
A Local Forensic Laboratory's Perspective on Trace Evidence Databases

Edward "Chip" Pollock
Sacramento County District Attorney's Office
Laboratory of Forensic Services



Sacramento County Crime Lab

- ▶ Laboratory provides service to approximately 1.5 million residents (Source: U.S. Census Bureau Report, 2015)
- ▶ Laboratory service area covers approximately 994 square miles
- ▶ Laboratory employs 39 Forensic Scientists
- ▶ Laboratory provides complete trace evidence services
- ▶ Laboratory additionally offers advanced trace evidence capabilities to our local agencies; as well as, agencies within California and states outside of California



Trace Evidence Databases of Interest from a Local Laboratory's Perspective

- ▶ Glass Databases
- ▶ Automotive Paint Databases
- ▶ Tape Database



Trace Evidence Databases of Interest from a Local Laboratory's Perspective



- ▶ Glass Databases
 - ▶ Glass Refractive Index Database
 - ▶ Maintained by the Federal Bureau of Investigation (FBI)
 - ▶ Glass Metals (Glass) Database
 - ▶ Maintained by the Federal Bureau of Investigation (FBI)
 - ▶ Glass Reference Database
 - ▶ Maintained by Florida International University (FIU)
 - ▶ Sponsored by the Technical Support Working Group (TSWG) - U.S. Department of State and U.S. Department of Defense
- ▶ Automotive Paint Databases
- ▶ Tape Database

Trace Evidence Databases of Interest from a Local Laboratory's Perspective



- ▶ Glass Databases
- ▶ Automotive Paint Databases
 - ▶ Automotive Paint Data Query (PDQ)
 - ▶ Maintained by the Royal Canadian Mounted Police (RCMP)
 - ▶ National Automotive Paint File
 - ▶ Maintained by the Federal Bureau of Investigation (FBI)
 - ▶ European Collection of Automotive Paints (EUCAP)
 - ▶ Maintained by the French Police Lab
- ▶ Tape Database

Trace Evidence Databases of Interest from a Local Laboratory's Perspective



- ▶ Glass Databases
- ▶ Automotive Paint Databases
- ▶ Tape Database
 - ▶ National Forensic Tape File (NFTF)
 - ▶ Maintained by the Federal Bureau of Investigation (FBI)

Glass Databases

- ▶ Glass Refractive Index Database
- ▶ Glass Metals (Glass) Database
- ▶ Glass Evidence Reference Database



Glass Databases

- ▶ **Glass Refractive Index Database** (Source - NIST Forensic Database Trace Evidence Table, June 2013)
 - ▶ Refractive index measurement by Glass Refractive Index Measurement (GRIM) System
 - ▶ Data collected from glass reference samples from casework and research
 - ▶ Approximately 2600 entries
- ▶ Glass Metals (Glass) Database
- ▶ Glass Evidence Reference Database



Glass Databases

- ▶ Glass Refractive Index Database
- ▶ Glass Metals (Glass) Database (Source - NIST Forensic Database Trace Evidence Table, June 2013)
 - ▶ Elemental Composition of glass samples from casework and research
 - ▶ Elemental composition determined by Inductively Coupled Plasma - Optical Emission Spectroscopy (ICP-OES)
 - ▶ Approximately 2200 entries
- ▶ Glass Evidence Reference Database



Glass Databases

- ▶ Glass Refractive Index Database
- ▶ Glass Metals (Glass) Database
- ▶ Glass Evidence Reference Database
 - ▶ Approximately 700 glass samples provided by manufactures and distributors
 - ▶ Samples obtained from manufactures, distributors, and vehicle junkyards
 - ▶ Data collected was part of a research project
 - ▶ Elemental composition determined by Inductively Coupled Plasma - Mass Spectrometry (ICP-MS)
 - ▶ Database was designed to provide a frequency of occurrence of elemental composition for ~700 different glass samples originating from different sources



Automotive Paint Databases

- ▶ Automotive Paint Data Query (PDQ) Database
- ▶ National Automotive Paint File (NAPF)
- ▶ European Collection of Automotive Paints (EUCAP)



Automotive Paint Databases



- ▶ **Automotive Paint Data Query (PDQ) Database**
(Source - NIST Forensic Database Trace Evidence Table, June 2013)
 - ▶ Searchable database of chemical and color information of original automotive paints
 - ▶ Search results provide make/model/year information
 - ▶ Database contains foreign and domestic automotive paint samples
 - ▶ Majority of vehicles marketed in North America after 1973
 - ▶ Approximately 13,000 entries
 - ▶ RCMP entered into agreements with the German Forensic Institute and the Japanese National Police Agency to add samples to the database in 1998
 - ▶ Approximately 1500 samples added per year
 - ▶ Agencies performing forensic paint examinations participate in the PDQ database by agreeing to provide 60 automotive paint samples per year
- ▶ National Automotive Paint File (NAPF)
- ▶ European Collection of Automotive Paints (EUCAP)

Automotive Paint Databases

- ▶ Automotive Paint Data Query (PDQ) Database

- ▶ National Automotive Paint File (NAPF)

(Source - NIST Forensic Database Trace Evidence Table, June 2013)

- ▶ Physical collection of automotive paint color standards and full system paint panels
- ▶ Automotive manufactures provide the physical samples for vehicles available for purchase in North America
- ▶ Commercial vehicles are not included
 - ▶ Trucks
 - ▶ Buses
 - ▶ Motorcycles
 - ▶ Recreation Vehicles
- ▶ Approximately 14,000 automotive paint panels
- ▶ NAPF is not a database, but a physical sample collection
- ▶ European Collection of Automotive Paints (EUCAP)



Automotive Paint Databases

- ▶ Automotive Paint Data Query (PDQ) Database
- ▶ National Automotive Paint File (NAPF)
- ▶ European Collection of Automotive Paints (EUCAP)

(Source - NIST Forensic Database Trace Evidence Table, June 2013 and BKA)

- ▶ Data analysis is performed by the Federal Criminal Police Force of Germany (BKA)
- ▶ Over 25,000 original paint samples from 23 European and Japanese automotive manufactures
 - ▶ Some samples date back to 1973
- ▶ Cooperation with Canada and the U.S. there is infrared spectra on vehicles manufactured in North America
- ▶ ~5000 new coating systems are added to the database every year



Tape Database

▶ National Forensic Tape File (NFTF)

(Source - NIST Forensic Database Trace Evidence Table, June 2013)

- ▶ NFTF is used to aid with determining a possible manufacturer and/or product for duct tape
- ▶ Manufacturers provide tape samples
- ▶ Tape samples are analyzed and the data is put into SLICE
- ▶ Physical properties and/or chemical composition can be searched using SLICE (Spectral Library Identification and Classification Explorer) software to provide potential manufacturer/product candidates



National or Regional Databases



▶ National Database

- ▶ Automotive paint and tape databases may be more amenable to a national database strategy due to being distributed nationally
- ▶ Automotive paint and tapes are more vastly distributed
- ▶ Searchable national database could provide investigative leads
 - ▶ Make/Model/year vehicle information

▶ Regional Databases

- ▶ Glass database could be amenable to a regional database strategy due to being distributed more regionally
- ▶ Database can be searched to determine the relative frequency of occurrence within a particular region

Glass Database at Sacramento County Crime Lab

- ▶ Database is searchable
- ▶ Architectural Glass, Container Glass, Vehicle Glass, and Other Glass
- ▶ Glass Color
- ▶ Glass Thickness
- ▶ Refractive Index Measurement
- ▶ Tempered Glass or Non-Tempered Glass
- ▶ Laminated Glass or Non-Laminated Glass
- ▶ Elemental Profile by Laser Induced Breakdown Spectroscopy (LIBS)
 - ▶ 11 elemental ratios are entered
- ▶ Elemental Profile by Laser Ablation - Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS)
 - ▶ 18 elements are entered



Sacramento County Lab - Glass Database

Physical Properties								
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated	
A01	Architecture	Panes of replacement glass. CTS 2012 item 1, 4	<input type="checkbox"/>	Colorless	2.3	1.5203	<input type="checkbox"/>	
A02	Architecture	Replacement glass CTS 2012 item 2	<input type="checkbox"/>	Colorless	0.0	1.5214	<input type="checkbox"/>	
A03	Architecture	Fench Door #1, Pane 1, panel 1	<input type="checkbox"/>	Colorless	3.2	1.517	<input type="checkbox"/>	
A04	Architecture	Privacy Glass Hilton Garden Inn 2013	<input checked="" type="checkbox"/>	Dark Grey	3.9	1.5232	<input type="checkbox"/>	
A05	Architecture	Cardinal Glass Wisconsin April 15,1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>	
A09	Architecture	Cardinal Glass Wisconsin May 17,1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>	
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>	
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>	
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>	
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>	
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>	
C01	Container	Green gallo Bottle #173	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C02	Container	Amazing Grace Perfume Bottle	<input type="checkbox"/>	Colorless		1.5221	<input type="checkbox"/>	
C03	Container	Gallo Bottle #167	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C04	Container	Gallo Bottle #170	<input type="checkbox"/>	Green		1.5229	<input type="checkbox"/>	
C05	Container	Gallo Bottle #168	<input type="checkbox"/>	Colorless		1.5199	<input type="checkbox"/>	
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green		1.5203	<input type="checkbox"/>	
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green		1.5203	<input type="checkbox"/>	
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown		1.5217	<input type="checkbox"/>	
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green		1.5227	<input type="checkbox"/>	
C10	Container	Perrier water bottle	<input type="checkbox"/>	green		1.5228	<input type="checkbox"/>	
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless		1.5201	<input type="checkbox"/>	
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>	
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>	
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>	
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>	

Ex. Comparison of A12 to C12

Physical Properties								
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated	
A01	Architecture	Panes of replacement glass. CTS 2012 item 1, 4	<input type="checkbox"/>	Colorless	2.3	1.5203	<input type="checkbox"/>	
A02	Architecture	Replacement glass CTS 2012 item 2	<input type="checkbox"/>	Colorless	0.0	1.5214	<input type="checkbox"/>	
A03	Architecture	Fench Door #1, Pane 1, panel 1	<input type="checkbox"/>	Colorless	3.2	1.517	<input type="checkbox"/>	
A04	Architecture	Privacy Glass Hilton Garden Inn 2013	<input checked="" type="checkbox"/>	Dark Grey	3.9	1.5232	<input type="checkbox"/>	
A05	Architecture	Cardinal Glass Wisconsin April 15,1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>	
A09	Architecture	Cardinal Glass Wisconsin May 17,1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>	
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>	
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>	
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>	
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>	
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>	
C01	Container	Green gallo Bottle #173	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C02	Container	Amazing Grace Perfume Bottle	<input type="checkbox"/>	Colorless		1.5221	<input type="checkbox"/>	
C03	Container	Gallo Bottle #167	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C04	Container	Gallo Bottle #170	<input type="checkbox"/>	Green		1.5229	<input type="checkbox"/>	
C05	Container	Gallo Bottle #168	<input type="checkbox"/>	Colorless		1.5199	<input type="checkbox"/>	
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green		1.5203	<input type="checkbox"/>	
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green		1.5203	<input type="checkbox"/>	
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown		1.5217	<input type="checkbox"/>	
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green		1.5227	<input type="checkbox"/>	
C10	Container	Perrier water bottle	<input type="checkbox"/>	green		1.5228	<input type="checkbox"/>	
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless		1.5201	<input type="checkbox"/>	
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>	
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>	
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>	
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>	

Glass ID

Physical Properties								
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated	
A01	Architecture	Replacement glass. CTS 2012 item 1, 4	<input type="checkbox"/>	Colorless	2.3	1.5203	<input type="checkbox"/>	
A02	Architecture	Replacement glass CTS 2012 item 2	<input type="checkbox"/>	Colorless	0.0	1.5214	<input type="checkbox"/>	
A03	Architecture	Door #1, Pane 1, panel 1	<input type="checkbox"/>	Colorless	3.2	1.517	<input type="checkbox"/>	
A04	Architecture	Replacement Glass Hilton Garden Inn 2013	<input checked="" type="checkbox"/>	Dark Grey	3.9	1.5232	<input type="checkbox"/>	
A05	Architecture	Cardinal Glass Wisconsin April 15, 1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>	
A09	Architecture	Cardinal Glass Wisconsin May 17, 1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>	
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>	
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>	
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>	
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>	
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>	
C01	Container	Green Gallo Bottle #173	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C02	Container	Ang Grace Perfume Bottle	<input type="checkbox"/>	Colorless		1.5221	<input type="checkbox"/>	
C03	Container	Bottle #167	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C04	Container	Bottle #170	<input type="checkbox"/>	Green		1.5229	<input type="checkbox"/>	
C05	Container	Bottle #168	<input type="checkbox"/>	Colorless		1.5199	<input type="checkbox"/>	
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green		1.5203	<input type="checkbox"/>	
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green		1.5203	<input type="checkbox"/>	
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown		1.5217	<input type="checkbox"/>	
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green		1.5227	<input type="checkbox"/>	
C10	Container	Perrier water bottle	<input type="checkbox"/>	green		1.5228	<input type="checkbox"/>	
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless		1.5201	<input type="checkbox"/>	
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>	
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>	
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>	
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>	

A12

C12

Glass Type

Physical Properties								
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated	
A01	Architecture	Panes of replacement glass CTC 2012 item 4, 4	<input type="checkbox"/>	Colorless	2.3	1.5203	<input type="checkbox"/>	
A02	Architecture	Replacement glass CTC 2012 item 4, 4	<input type="checkbox"/>	Colorless	0.0	1.5214	<input type="checkbox"/>	
A03	Architecture	Fench Door	<input type="checkbox"/>	Colorless	3.2	1.517	<input type="checkbox"/>	
A04	Architecture	Privacy Glass	<input checked="" type="checkbox"/>	Dark Grey	3.9	1.5232	<input type="checkbox"/>	
A05	Architecture	Cardinal Glass	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>	
A09	Architecture	Cardinal Glass Wisconsin May 17, 1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>	
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>	
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>	
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>	
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>	
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>	
C01	Container	Green gallo Bottle #173	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C02	Container	Amazing Gallo Bottle	<input type="checkbox"/>	Colorless		1.5221	<input type="checkbox"/>	
C03	Container	Gallo Bottle	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C04	Container	Gallo Bottle	<input type="checkbox"/>	Green		1.5229	<input type="checkbox"/>	
C05	Container	Gallo Bottle	<input type="checkbox"/>	Colorless		1.5199	<input type="checkbox"/>	
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green		1.5203	<input type="checkbox"/>	
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green		1.5203	<input type="checkbox"/>	
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown		1.5217	<input type="checkbox"/>	
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green		1.5227	<input type="checkbox"/>	
C10	Container	Perrier water bottle	<input type="checkbox"/>	green		1.5228	<input type="checkbox"/>	
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless		1.5201	<input type="checkbox"/>	
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>	
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>	
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>	
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>	

Architecture

Container

Description

Physical Properties								
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated	
A01	Architecture	Panes of replacement glass. CTS 2012 item 1, 4	<input type="checkbox"/>	Colorless	2.3	1.5203	<input type="checkbox"/>	
A02	Architecture	Replacement				1.5214	<input type="checkbox"/>	
A03	Architecture	Fench Door				1.517	<input type="checkbox"/>	
A04	Architecture	Privacy Gla				1.5232	<input type="checkbox"/>	
A05	Architecture	Cardinal Gl				1.5188	<input type="checkbox"/>	
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>	
A09	Architecture	Cardinal Glass Wisconsin May 17, 1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>	
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>	
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>	
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>	
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>	
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>	
C01	Container	Green gallo Bottle #173	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C02	Container	Amazing Gallo	<input type="checkbox"/>	Colorless		1.5221	<input type="checkbox"/>	
C03	Container	Gallo Bottle	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C04	Container	Gallo Bottle	<input type="checkbox"/>	Green		1.5229	<input type="checkbox"/>	
C05	Container	Gallo Bottle	<input type="checkbox"/>	Colorless		1.5199	<input type="checkbox"/>	
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green		1.5203	<input type="checkbox"/>	
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green		1.5203	<input type="checkbox"/>	
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown		1.5217	<input type="checkbox"/>	
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green		1.5227	<input type="checkbox"/>	
C10	Container	Perrier water bottle	<input type="checkbox"/>	green		1.5228	<input type="checkbox"/>	
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless		1.5201	<input type="checkbox"/>	
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>	
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>	
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>	
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>	

French door #2, Panel 2, Pane 1

Old brown bottle

Tempered

Physical Properties									
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated		
A01	Architecture	Panes of replacement glass. CTS 2012 item 1-4	<input type="checkbox"/>	Colorless	2.3	1.5203	<input type="checkbox"/>		
A02	Architecture	Replacement glass CTS 2012 item 2	<input type="checkbox"/>	Colorless	0.0	1.5214	<input type="checkbox"/>		
A03	Architecture	Fench Door #1, Pane 1, panel 1	<input type="checkbox"/>	Colorless	3.2	1.517	<input type="checkbox"/>		
A04	Architecture	Privacy Glass Hilton Garden Inn 2013	<input checked="" type="checkbox"/>	Dark Green	3.9	1.5232	<input type="checkbox"/>		
A05	Architecture	Cardinal Glass Wisconsin April 15, 1998 FIU	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>		
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>		
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>		
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>		
A09	Architecture	Cardinal Glass Wisconsin May 17, 1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>		
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>		
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>		
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>		
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>		
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>		
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>		
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>		
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>		
C01	Container	Green gallo Bottle #173	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>		
C02	Container	Amazing Grace Perfume Bottle	<input type="checkbox"/>	Colorless		1.5221	<input type="checkbox"/>		
C03	Container	Gallo Bottle #167	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>		
C04	Container	Gallo Bottle #170	<input type="checkbox"/>	Green		1.5229	<input type="checkbox"/>		
C05	Container	Gallo Bottle #168	<input type="checkbox"/>	Colorless		1.5199	<input type="checkbox"/>		
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green		1.5203	<input type="checkbox"/>		
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green		1.5203	<input type="checkbox"/>		
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown		1.5217	<input type="checkbox"/>		
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green		1.5227	<input type="checkbox"/>		
C10	Container	Perrier water bottle	<input type="checkbox"/>	green		1.5228	<input type="checkbox"/>		
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless		1.5201	<input type="checkbox"/>		
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>		
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>		
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>		
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>		

Color

Physical Properties								
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated	
A01	Architecture	Panes of replacement glass CTS 2012 item 4, 4	<input type="checkbox"/>	Colorless	2.3	1.5203	<input type="checkbox"/>	
A02	Architecture	Replacement glass CTS 2012	<input type="checkbox"/>	Colorless	0.0	1.5214	<input type="checkbox"/>	
A03	Architecture	Fench Door #1, Pane 1, pane 1	<input type="checkbox"/>	Colorless	3.2	1.517	<input type="checkbox"/>	
A04	Architecture	Privacy Glass Hilton Garden	<input checked="" type="checkbox"/>	Dark Grey	3.9	1.5232	<input type="checkbox"/>	
A05	Architecture	Cardinal Glass Wisconsin Ap	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>	
A09	Architecture	Cardinal Glass Wisconsin May 17, 1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>	
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>	
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>	
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>	
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>	
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>	
C01	Container	Green gallo Bottle #173	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C02	Container	Amazing Grace Perfume Bottle	<input type="checkbox"/>	Colorless		1.5221	<input type="checkbox"/>	
C03	Container	Gallo Bottle #167	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C04	Container	Gallo Bottle #170	<input type="checkbox"/>	Green		1.5229	<input type="checkbox"/>	
C05	Container	Gallo Bottle #168	<input type="checkbox"/>	Colorless		1.5199	<input type="checkbox"/>	
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green		1.5203	<input type="checkbox"/>	
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green		1.5203	<input type="checkbox"/>	
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown		1.5217	<input type="checkbox"/>	
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green		1.5227	<input type="checkbox"/>	
C10	Container	Perrier water bottle	<input type="checkbox"/>	green		1.5228	<input type="checkbox"/>	
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless		1.5201	<input type="checkbox"/>	
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>	
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>	
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>	
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>	

colorless

brown

Thickness

Physical Properties							
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated
A01	Architecture	Panes of replacement glass. CTS 2012 item 1, 4	<input type="checkbox"/>	colorless	2.3	1.5202	<input type="checkbox"/>
A02	Architecture	Replacement glass CTS 2012 item 2	<input type="checkbox"/>		0.0		<input type="checkbox"/>
A03	Architecture	Fench Door #1, Pane 1, panel 1	<input type="checkbox"/>		3.2		<input type="checkbox"/>
A04	Architecture	Privacy Glass Hilton Garden Inn 2013	<input checked="" type="checkbox"/>		3.9		<input type="checkbox"/>
A05	Architecture	Cardinal Glass Wisconsin April 15, 1998 FIU Round ROBIN 3	<input type="checkbox"/>		0.0		<input type="checkbox"/>
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>
A09	Architecture	Cardinal Glass Wisconsin May 17, 1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>
C01	Container	Green gallo Bottle #173	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>
C02	Container	Amazing Grace Perfume Bottle	<input type="checkbox"/>			1.5221	<input type="checkbox"/>
C03	Container	Gallo Bottle #167	<input type="checkbox"/>			1.523	<input type="checkbox"/>
C04	Container	Gallo Bottle #170	<input type="checkbox"/>			1.5229	<input type="checkbox"/>
C05	Container	Gallo Bottle #168	<input type="checkbox"/>			1.5199	<input type="checkbox"/>
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green		1.5203	<input type="checkbox"/>
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green		1.5203	<input type="checkbox"/>
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown		1.5217	<input type="checkbox"/>
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green		1.5227	<input type="checkbox"/>
C10	Container	Perrier water bottle	<input type="checkbox"/>	green		1.5228	<input type="checkbox"/>
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless		1.5201	<input type="checkbox"/>
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>

3.3

4.6

0.0

0.0

Refractive Index

Physical Properties								
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated	
A01	Architecture	Panes of replacement glass. CTS 2012 item 1, 4	<input type="checkbox"/>	Colorless	2.3	1.5203	<input type="checkbox"/>	
A02	Architecture	Replacement glass CTS 2012 item 2	<input type="checkbox"/>		0.0	1.5214	<input type="checkbox"/>	
A03	Architecture	Fench Door #1, Pane 1, panel 1	<input type="checkbox"/>		0.2	1.517	<input type="checkbox"/>	
A04	Architecture	Privacy Glass Hilton Garden Inn 2013	<input checked="" type="checkbox"/>		0.9	1.5232	<input type="checkbox"/>	
A05	Architecture	Cardinal Glass Wisconsin April 15,1998 FIU Round ROBIN 3	<input type="checkbox"/>		0.0	1.5188	<input type="checkbox"/>	
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>	
A09	Architecture	Cardinal Glass Wisconsin May 17,1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>	
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>	
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>	
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>	
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>	
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>	
C01	Container	Green gallo Bottle #173	<input type="checkbox"/>	Green		1.523	<input type="checkbox"/>	
C02	Container	Amazing Grace Perfume Bottle	<input type="checkbox"/>			1.5221	<input type="checkbox"/>	
C03	Container	Gallo Bottle #167	<input type="checkbox"/>			1.523	<input type="checkbox"/>	
C04	Container	Gallo Bottle #170	<input type="checkbox"/>			1.5229	<input type="checkbox"/>	
C05	Container	Gallo Bottle #168	<input type="checkbox"/>			1.5199	<input type="checkbox"/>	
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green		1.5203	<input type="checkbox"/>	
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green		1.5203	<input type="checkbox"/>	
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown		1.5217	<input type="checkbox"/>	
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green		1.5227	<input type="checkbox"/>	
C10	Container	Perrier water bottle	<input type="checkbox"/>	green		1.5228	<input type="checkbox"/>	
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless		1.5201	<input type="checkbox"/>	
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>	
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>	
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>	
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>	

1.5172

1.5205

Laminated

Physical Properties								
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated	
A01	Architecture	Panes of replacement glass. CTS 2012 item 1, 4	<input type="checkbox"/>	Colorless	0.0	1.5203	<input type="checkbox"/>	
A02	Architecture	Replacement glass CTS 2012 item 2	<input type="checkbox"/>	Colorless	0.0	1.5214	<input type="checkbox"/>	
A03	Architecture	Fench Door #1, Pane 1, panel 1	<input type="checkbox"/>	Colorless	0.0	1.517	<input type="checkbox"/>	
A04	Architecture	Privacy Glass Hilton Garden Inn 2013	<input checked="" type="checkbox"/>	Dark Grey	0.0	1.5232	<input type="checkbox"/>	
A05	Architecture	Cardinal Glass Wisconsin April 15, 1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A06	Architecture	Cardinal Glass Wisconsin August 17, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A07	Architecture	Cardinal Glass Wisconsin August 31, 2001 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5188	<input type="checkbox"/>	
A08	Architecture	Cardinal Glass Wisconsin July 17, 1998 FIU ROUND ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.5187	<input type="checkbox"/>	
A09	Architecture	Cardinal Glass Wisconsin May 17, 1998 FIU Round ROBIN 3	<input type="checkbox"/>	colorless	0.0	1.519	<input type="checkbox"/>	
A10	Architecture	Upstairs Bathroom shower door 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5186	<input type="checkbox"/>	
A11	Architecture	Downstairs bathroom shower door #2 2004	<input checked="" type="checkbox"/>	colorless	4.6	1.5182	<input type="checkbox"/>	
A12	Architecture	french door #2, Panel 2, pane 1	<input type="checkbox"/>	colorless	3.3	1.5172	<input checked="" type="checkbox"/>	
A13	Architecture	French Door 2, panel 1, pane 1	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A14	Architecture	French door 2 panel 1 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A15	Architecture	French door 2 panel 2 pane 2	<input type="checkbox"/>	colorless	3.1	1.5172	<input type="checkbox"/>	
A16	Architecture	Replacement glass sheet 1 Orangevale glass 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5198	<input type="checkbox"/>	
A17	Architecture	Replacement glass, sheet 2, Orangevale glass co 12-4-14	<input type="checkbox"/>	colorless	3.1	1.5197	<input type="checkbox"/>	
C01	Container	Green gallo Bottle #173	<input type="checkbox"/>	Green	0.0	1.523	<input type="checkbox"/>	
C02	Container	Amazing Grace Perfume Bottle	<input type="checkbox"/>	Colorless	0.0	1.5221	<input type="checkbox"/>	
C03	Container	Gallo Bottle #167	<input type="checkbox"/>	Green	0.0	1.523	<input type="checkbox"/>	
C04	Container	Gallo Bottle #170	<input type="checkbox"/>	Green	0.0	1.5229	<input type="checkbox"/>	
C05	Container	Gallo Bottle #168	<input type="checkbox"/>	Colorless	0.0	1.5199	<input type="checkbox"/>	
C06	Container	Gallo Bottle #169	<input type="checkbox"/>	Yellow green	0.0	1.5203	<input type="checkbox"/>	
C07	Container	Gallo Bottle #166	<input type="checkbox"/>	Yellow Green	0.0	1.5203	<input type="checkbox"/>	
C08	Container	Brown Carnation Creamer Bottle	<input type="checkbox"/>	Brown	0.0	1.5217	<input type="checkbox"/>	
C09	Container	Broken Bottle unknown source	<input type="checkbox"/>	green	0.0	1.5227	<input type="checkbox"/>	
C10	Container	Perrier water bottle	<input type="checkbox"/>	green	0.0	1.5228	<input type="checkbox"/>	
C11	Container	Gallo Bottle #30	<input type="checkbox"/>	colorless	0.0	1.5201	<input type="checkbox"/>	
C12	Container	Old brown bottle	<input type="checkbox"/>	brown	0.0	1.5205	<input type="checkbox"/>	
C13	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.5082	<input type="checkbox"/>	
C14	Container	Old clear bottle	<input type="checkbox"/>	colorless	0.0	1.509	<input type="checkbox"/>	
M01	Manufacturer	PPG Fresno glass plant 05/22/04 2305	<input type="checkbox"/>	light blue	3.8	1.5178	<input type="checkbox"/>	

Sacramento County Lab - Glass Database

Physical Properties								
Glass ID	Glass Type	Description	Tempered	Color	Thickness	Refractive Index	Laminated	
017	Other	Portable Electronic Device abrisa glass stock	<input type="checkbox"/>	clear	1.9	1.4965	<input type="checkbox"/>	
018	Other	Portable Electronic Device android phone screen	<input type="checkbox"/>	clear	0.6	1.4964	<input type="checkbox"/>	
019	Other	Portable Electronic Device cat-l glass stock	<input type="checkbox"/>	clear	2.0	1.5012	<input type="checkbox"/>	
020	Other	Portable Electronic Device apple ipad screen "a" layer	<input type="checkbox"/>	clear	0.6	1.5105	<input type="checkbox"/>	
021	Other	Portable Electronic Device apple ipad screen "b" layer	<input type="checkbox"/>	clear	0.6	1.5174	<input type="checkbox"/>	
022	Other	Portable Electronic Device google phone	<input type="checkbox"/>	clear	0.7	1.4967	<input type="checkbox"/>	
023	Other	Table Topper CTS 2014 - items 1, 2, 3	<input checked="" type="checkbox"/>	colorless	2.9	1.5191	<input type="checkbox"/>	
024	Other	Pink Stained Glass from shop in Folsom CA	<input type="checkbox"/>	pink	2.7	0	<input type="checkbox"/>	
025	Other	Green stained glass from shop in Folsom	<input type="checkbox"/>	green	3.3	0	<input type="checkbox"/>	
026	Other	Blue stained glass from shop in Folsom	<input type="checkbox"/>	blue	3.1	0	<input type="checkbox"/>	
027	Other	Semitransparent Stained Glass from shop in Folsom	<input type="checkbox"/>	semitranspare	3.0	0	<input type="checkbox"/>	
028	Other	Purple stained glass from shop in Folsom	<input type="checkbox"/>	purple	3.0	0	<input type="checkbox"/>	
V01	Vehicle	Random Vehicle Glass	<input checked="" type="checkbox"/>	light blue	3.5	1.5231	<input type="checkbox"/>	
V02	Vehicle	2013 CTS Glass Proficiency. Item #2. 2009 Honda Fit replacement Windshield purchased 2013	<input type="checkbox"/>	light blue	2.1	1.5212	<input checked="" type="checkbox"/>	
V03	Vehicle	2013 CTS Glass Proficiency. Item #3,1. 2009 Honda Fit replacement Windshield purchased 2012	<input type="checkbox"/>	light blue	2.1	1.5223	<input checked="" type="checkbox"/>	
V04	Vehicle	Chevrolet Lumina Van Rear Window	<input checked="" type="checkbox"/>	light blue	4.2	1.5188	<input checked="" type="checkbox"/>	
V05	Vehicle	FIU Forensic Evidence Hands on Workshop Glass. 1st Round Robin 2008. Toyota PPG	<input type="checkbox"/>	Blue	2.2	1.523	<input checked="" type="checkbox"/>	
V06	Vehicle	Lamisafe S-376M314 DOT 376 (9-19-05 collected) AP Technologlass replacment windshield	<input type="checkbox"/>	light blue	2.2	1.5206	<input checked="" type="checkbox"/>	
V07	Vehicle	Ford Explorer Carlite M18F2	<input checked="" type="checkbox"/>	light blue	2.3	1.5205	<input type="checkbox"/>	
V08	Vehicle	Sek 615-DOT 615 outer pane M2 replacemen windshield	<input type="checkbox"/>	light blue		1.5196	<input checked="" type="checkbox"/>	
V09	Vehicle	Ford F-150 outer pane Solar Green 3/2012	<input type="checkbox"/>	light blue	2.4	1.5222	<input checked="" type="checkbox"/>	

Laser Ablation - ICP-MS Elemental Profile

Physical Properties		ICPMS Data																	
Glass ID	Li7	Mg25	Al27	K39	Ca42	Ti49	Mn55	Fe57	Rb85	Sr88	Zr90	Sn118	Ba137	La139	Ce140	Nd146	Hf178	Pb208	
A11	6.5	27743	2057	169	58640	512	123	759	0.7	46	39	127	21	2.4	4.7	1.9	1	0.7	
A13	3.7	23875	1110	411	59451	144	44	586	2.2	14	110	21	13	1.9	3.1	1.4	2.6	1.2	
A14	3.6	24865	1292	415.2	60109	154.3	39.2	621.3	2.2	14.6	111.3	18.4	13.3	2	3.1	1.5	2.8	1.1	
A15	3.8	25972	1333	450.7	64343	162.4	46.3	718.5	2.6	15.4	117.7	20	14.5	2	3.3	1.5	2.8	1	
A16	5.2	21583	1388	283.1	63808	245	14	485.9	1.6	50.7	37.3	41.5	123	1.9	17.7	1.48	0.9	2.2	
A17	5.4	25985	1670	397.1	65727	270.2	14	678.3	1.7	50.3	36.3	40	119.3	2.1	17.8	1.6	0.9	2.1	
C01	8	3446	15757	5864	75617	539	68	2028	42	84	67	17	494	4	8	3	1.6	38	
C02	6.1	371	106940	5508	828900	84	1210	43	43.1	179	114	0.54	16094	2.37	221.8	1.5	0	16.6	
C03	7.8	2869.4	15658	10992	78053	565.7	67.1	2067.5	42.6	87.3	67.2	10.5	511.6	4.1	7.9	3.1	1.7	35.4	
C04	8.5	3291.1	16081	3507.9	79292.9	924.5	96.7	2239.9	44.52	90.2	71.7	14.5	523.2	4.3	8.7	3.6	1.9	42.9	
C05	6.9	2046.2	16423	11345.4	80597.5	585.6	29.8	779.4	44.8	93.4	75.1	3.4	713	4	7.5	3.1	1.9	40.8	

LIBS - Elemental Ratio Profile

Physical Properties													ICPMS Data	LIBS Data
Glass ID	Na819 vs K766	Si288 vs Mg 28	Ca422 vs Na331	Al396 vs Ca	Sr407 vs Fe	Si390 vs Ca37	Fe358 vs Ti	K766 vs Ca850	Mg285 vs Al3C	Cr350 vs Fe35E	Ba493 vs Mg 51	Other element		
C02	1.55	24.45	4.59	0.65	44.2	0.65	0.05	5.87	0.03	1.29	992.24	Rb		
C03	1.33	7.35	5.39	0.68	0.81	0.55	0.85	5.92	0.1	0.82	3.56	Rb		
C04	1.28	5.8	4.65	0.93	1.07	0.71	1.3	9.1	0.08	0.83	2.43	rb		
C05	1.19	7.42	4.6	0.96	3.29	0.77	0.18	10.31	0.06	0.29	5.26			
C06	1.23	8.17	4.96	0.88	1.57	0.69	0.44	8.46	0.06	0.50	4.83			
C07	1.13	8.35	4.2	1.28	0.88	0.89	0.38	11.13	0.07	0.51	4.74	Rb		
C08	3.16	3.32	4.27	1.48	1.56	1.15	0.74	5.11	0.17	0.36	0.2	Mn		
C09	1.76	4.97	5.07	0.74	0.54	0.7	1.71	6.17	0.17	0.84	1.06			
C10	2.36	3.92	4.35	0.75	0.46	0.75	1.35	5.16	0.17	10.64	0.68	Li		
C11	1.24	6.64	4.05	1.93	1.52	1.17	0.25	12.8	0.06	0.27	4.15			
C12	1.49	8.87	3.1	1.08	5.02	0.66	0.41	11.03	0.03	0.00	7.21			
C13	11.79	2.06	2.45	0.46	2.39	1.86	0.21	2.69	2.41	0.00	0.1			
C14	4.86	6.27	2.76	0.51	4.28	1.06	0.22	4.33	0.34	0.00	0.52	Mn		

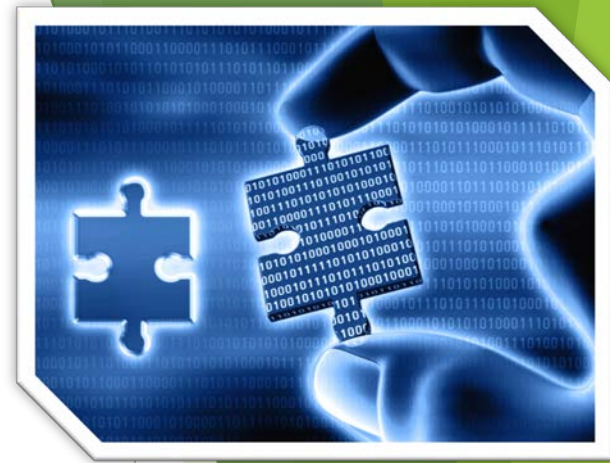
How We Are Going to Use Our Glass Database?

- ▶ Search the database based on establishing a specific search criteria
 - ▶ Color
 - ▶ Thickness
 - ▶ RI
 - ▶ LIBS Elemental Profile
 - ▶ LA-ICP-MS Elemental Profile
- ▶ Capable of searching the database to determine the potential number of random matches that correlate to the samples entered into our database
- ▶ Provide a relative frequency of occurrence to aid with a significance assessment



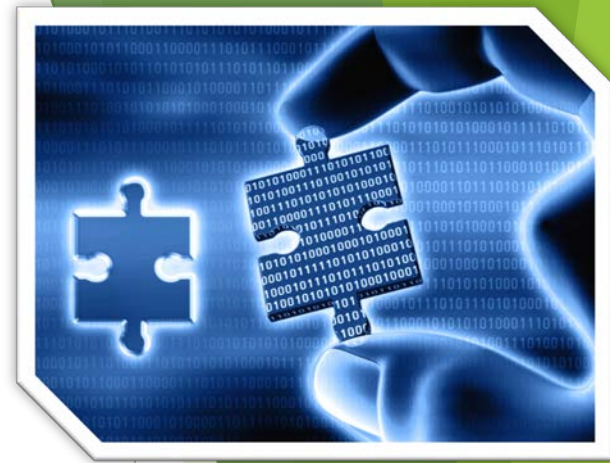
Trace Evidence Databases - Strengths

- ▶ Provide investigative leads in the absence of a comparative material
- ▶ Enhance the interpretation of data resulting from the examination of trace evidence
- ▶ Assist in the assessment of significance of a known vs. question sample comparison
- ▶ Allows historical data of a product to be stored and can monitor industry/product changes over time
- ▶ Database information can be shared between forensic laboratories



Trace Evidence Databases - Limitations

- ▶ Lack of a centralized depository for a national database
- ▶ No established criteria for what type of data is going to be entered into the database
- ▶ Databases can become outdated due to changes in analytical analysis techniques
- ▶ No established criteria for how to describe subjective data types
 - ▶ Glass color determination



Future Endeavors

- ▶ Participation in a NIJ-sponsored research project on Glass Evidence Interpretation
- ▶ Strengthening the Evaluation and Interpretation of Glass Evidence Using Statistical Analysis of Collection Sets and Databases of Refractive Index and Elemental Data (μ -XRF, ICP-MS and LA-ICP-MS)
 - ▶ Awarded to Florida International University - Almirall Research Group (NIJ-015-DN-BX-K049)
- ▶ Conduct development research to enhance current approaches to interpret data derived from forensic glass examinations, including assessment of significance

Acknowledge and Thank

- ▶ Anne Marie Shubert - Sacramento County District Attorney
- ▶ Jill Spriggs - Laboratory Director - Sacramento County District Attorney's Office - Laboratory of Forensic Services
- ▶ National Institute of Standards and Technology (NIST)



Thank You for Your Time...

Edward "Chip" Pollock
Sacramento County DA's Office - Laboratory of Forensic Services
Sacramento, CA
E-Mail: pollockc@sacda.org

