The Chemical Hazards in Mardi Gras Beads & Holiday Beaded Garland

A report by Healthystuff.org
in collaboration with VerdiGras

Jeff Gearhart and Karla Peña

DECEMBER 5, 2013

HealthyStuff.org

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Verdi gras

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ECOLOGY CENTER

The Ecology Center is a Michigan-based nonprofit environmental organization that works for a safe and healthy environment where people live, work and play.

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SUMMARY OF FINDINGS

This report by Healthystuff.org summarizes the findings of the screening of 87 Mardi Gras bead necklaces, bracelets and other accessories and provides recommendations for communities, Carnival and Mardi Gras enthusiasts.

Over 60% of the products tested (56 of 87) had concentrations of lead above 100 ppm. For assessment purposes, the U.S. Consumer Product Safety Commission (CPSC) limits lead in children's product to 100 ppm.

The highest amount of lead detected was 29,864 ppm in a green, round bead necklace

More than half (58%) of the products tested (51 of 87) had concentrations of bromine above 400 ppm, suggesting the use of brominated flame retardants (BFRs).

45% had BFR levels in the range of 1-2% (10,000-20,000 ppm) by weight

About 63% (55 of 87) had levels of chlorine above 3,500 ppm, suggesting the use of either PVC or chlorinated flame retardants (CFRs).

Based on our testing we estimate that a single year's inventory of beads used during Mardi Gras may contain up to 900,000 pounds of hazardous flame retardants and 10,000 pounds of lead.

The interior of Mardi Gras beads were tested and found to contain hazardous substances as high as the exterior coating of the beads.

Electron microscope images of the morphology of the beads show fragments of material that appear to be used as filler in the production of the beads. Many of these fragments have halogenated flame retardants in them, including:

deca-brominated diphenyl ether (decaBDE)

tetrabromobisphenol A(TBBPA)

The overall elemental composition of bead plastics is similar to the elemental composition of electronic waste and other plastic waste streams. Flame retarded plastics from a variety of sources are likely being recycled into bead production.

A Mardi Gras football contained about 29% phthalates by weight including Bis (2-ethylhexyl) phthalate (280,000 ppm), a phthalate banned by CPSC.

INTRODUCTION

Carnival Season in New Orleans begins on the Twelfth Night (Epiphany) after Christmas and continues until Mardi Gras, the day before Ash Wednesday and Lent. It is estimated that throughout Carnival season from Twelfth Night to Mardi Gras over 25 million pounds of beads i.e. "Mardi Gras beads" are thrown by Carnival Krewe's during parades each year in New Orleans, Louisiana (Flock, 2012). Mardi Gras beads come in all shapes, sizes and colors. This cultural tradition dates from the mid-19th century.

Large volumes of Mardi Gras beads go into landfills or are left behind in streets or on fences. Recent studies, for example, have shown that Mardi Gras beads contain hazardous substances like lead. The potential of these hazardous substances to leach out of the beads and into the environment is what is leading community activists to advocate for a greener and sustainable Carnival and Mardi Gras festivity.

One study surveyed the potential exposure of lead from Mardi Gras beads and street side dust and soil from the Mardi Gras parade route using X-ray Fluorescence (XRF) and Inductively Coupled Plasma Emission Spectrometry (ICPS). The study warned about the lead contamination of soils along the curbs of the parade routes and recommended cleaning children's hands with hand wipes to prevent lead exposure. This study by Mielke et al. (2012) included a sample size of 26 Mardi Gras beads and found that beads containing between 5 to 159 ppm (parts per million) of lead with a median of 31 ppm. For assessment purposes, the U.S. Consumer Product Safety Commission (CPSC) limits lead in children's product to 100 ppm, while the American Academy of Pediatrics, an organization of the nation's pediatricians, recommends 40 ppm as a limit. Despite the relatively small amounts of lead detected in the Mardi Gras beads (just over 10% measured over 100 ppm), the authors cautioned that the large volume of beads pose a potential hazard to human and environmental health. The documentary film Mardi Gras Made in China, by David Redmon and Ashley Sabin, similarly makes the case that Mardi Gras beads contain hazardous substances and that workers producing Mardi Gras beads in China are exposed to these hazards.

Several community organizations in Louisiana are interested in greening Carnival and Mardi Gras festivities. One organization, VerdiGras, promotes the reuse and recycling of Mardi Gras beads. VerdiGras is also concerned with the hazardous substances that Mardi Gras beads contain and collected a variety of beads and Mardi Gras related products for Healthystuff.org to test for chemical hazards.

HealthyStuff.org uses a High Definition X-Ray Fluorescence (HD XRF), a testing device that can screen consumer products for hazardous substances. For this study, Healthystuff.org tested the Mardi Gras beads collected by VerdiGras. Healthystuff.org also purchased holiday beaded garlands to evaluate whether the composition of other beaded products are similiar to Mardi Gras beads. The following report provides the results of the HD XRF screening of the Mardi Gras beads and holiday beaded garlands. The results show that Mardi Gras beads contain a wide range of hazardous substances, including metals such as lead (Pb) and Cadmium (Cd); phthalate plasticizers; brominated flame retardants (BFR's); and chlorinated flame retardants (CFR's). The holiday beaded garlands similarly had high levels of heavy metals and halogens.

HEALTHYSTUFF.ORG METHODOLOGY

High Definition X-ray Fluorescence manufactured by X-Ray Optical Systems

Healthystuff.org uses a High Definition X-ray Fluorescence device(HD XRF), an elemental analysis technique with Doubly Curved Crystal optics that enhances measurement intensities by capturing X-rays from a divergent source and redirecting them into an intense focused beam on the surface of the product. The major benefit of HD XRF is that monochromatic excitation eliminates the X-ray scattering background under the fluorescence peaks, greatly enhancing detection performance. The HD XRF uses monochromatic excitation energies of 7, 17, and 33 KeV. The instrument also features a small spot size of 1 mm, which allows the examination of small features in samples.

This analytical approach results in detection limits in the parts-per-million (ppm) range for many elements of interest in a variety of materials. The elemental composition of the materials reveals the presence of potentially hazardous chemicals, such as metals, and also allows researchers to infer the possible presence of toxic chemicals or materials, including brominated flame retardants (BFRs), polyvinyl chloride (PVC) and by inference, the possibility of phthalate plasticizers.

There were a total of 87 Mardi Gras products tested, including bead necklaces, bracelets, and toys. The Mardi Gras products were gathered by Holly and Kirk Groh from VerdiGras. Mardi Gras beads come in all shapes and sizes, therefore several parts of a single bead necklace were tested. In cases where the coating of the bead was chipped, the bead was sampled both with the coating and without the coating. There were a total of 197 components or areas of the bead necklaces that were tested.

A total of 19 holiday beaded garlands were purchased from retailers and screened by the same methodology.

Additional analysis was conducted on eight beads by Particle Induced X-ray Emission (PIXE) spectroscopy, Scanning Electron Microscope/Energy Dispersive Spectrometry(SEM/EDS) and digested and analyzed by Gas Chromatography/ Mass Spectrometry (GC/MS). Replicate beads from these 8 samples were mechanically sliced in half and non-destructively measured by PIXE and SEM/EDS to independently confirm the XRF findings of metal and halogen content throughout the bead.

Three of the Mardi Gras products (non bead necklaces) were analyzed for phthalates by STAT Analysis Corporation using U.S. EPA Test Method SW8270C.

RESULTS

Table 1 summarizes the results of the study. Over 60% of the products tested (56 of 87) had contents of lead above 100 ppm. The products with the highest levels of lead were primarily the bead necklaces. For example, one necklace (MG02) had five components sampled with three components containing levels of lead above 1,000 ppm. The highest level of lead detected was 29,864 ppm in NMG 18, a green round bead necklace that also had high levels of bromine (615,792 ppm) and chlorine (25,144 ppm).

In addition to lead, we detected high levels of bromine and chlorine in the samples. More than half of the products (51 of 87) had levels of bromine above 400 ppm, suggesting the use of brominated flame retardants (BFRs). About 45% of the products (39 of 87) had levels of bromine between 10, 000 – 20,000 ppm. The highest levels of bromine were found in the bead necklaces. About 63% (55 of 87) of the products contained levels of chlorine above 3,500 ppm, suggesting the use of chlorinated flame retardants (CFRs).

In order to provide an estimate the quantity of flame ratardants and lead contained in the 25 million pounds of beads used annually in New Orleans we calculated the average percent weight of flame retardants (2.05% for BFRs & 1.63% for CFRs)and lead (0.039 %) in our sample set. This percentage was multiplied by 25 million pounds. We estimate that up to 920,000 pounds of mixed chlorinated and brominated flame retardants and 9,750 pounds of lead may in the beads used annually for Mardi Gras.

Appendix II summarizes the results for the holiday beaded garlands. The holiday beaded garlands contain levels of lead and halogenated flame retardants similar to the Mardi Gras beads.

Figure 1 shows the three Mardi Gras products that were sent to an external lab for phthalate testing. One of the samples, MG Football, contained 28% (280,000 ppm) of DEHP, 0.09% (940 ppm) of DEP, 0.15% (1,500 ppm) of DINP, and 0.52% (5,200 ppm) of DIBP. This product contained a total of 29% by weight of phthalates (Table 2).
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Figure 1. Images of the Mardi Gras products sent to an external lab for phthalate testing.

MG Kiss Me I'm Irish Ball

MG Plastic Necklace

MG Football

Table 2. Mard Gras accessories with phthalates (results in ppm).

Product	Bis (2-ethylhexyl) phthalates (DEHP)	Diethyl phthalates (DEP)	Diisononyl phthalates (DINP)	Diisobutyl phthalates (DIBP)	Total
MG Football	280,000	940	1,500	5,200	29%
MG Plastic Necklace	430	Non-detect	Non-detect	71	0%
MG Kiss Me I'm Irish Ball	140	Non-detect	Non-detect	Non-detect	0%

Table 1. Max levels detected for Mardi Gras beads and related products (results in ppm)

Product	As	Br	Cd	Cl	Cr	Hg	Pb	Sb	Sn
MG Football	0	181	0	294,963	0	0	0	0	0
MG Green plastic cup	0	0	0	622	0	0	0	0	0
MG Kiss Me I'm Irish Ball	0	30	0	254,441	0	0	0	0	0
MG LED Toy	0	22	0	0	766	0	0	0	0
MG Plastic Necklace	0	13	0	358,538	0	0	0	81	421
MG Red plastic cup	0	0	0	215	0	0	0	0	0
MG Stuffed Car Toy	0	17	0	691	0	0	0	200	0
MG01 Multicolored and multishaped bead necklace	20	29,289	47	34,830	520	0	162	15,402	627
MG02 Multicolored and multishaped bead necklace with medallion	0	1	0	0	1,946	0	2,019	219	72
MG03 Green bead necklace	14	9,639	26	11,946	76	0	149	3,513	153
MG04 White round bead necklace	0	4	0	38,803	0	0	0	180	53
MG05 White round bead neckalce	0	4	0	26,252	0	0	0	0	0
MG06 Purple round bead necklace	0	8,566	26	7,945	33	0	140	2,772	114
MG07 Silver round bead necklace	38	14,845	20	17,624	72	0	190	4,526	142
MG08 White round bead necklace	0	5	0	0	0	0	0	91	0
MG09 Green round bead necklace	52	17,253	15	11,686	177	0	213	6,240	234
MG10 Silver round bead necklace	23	13,087	85	7,560	60	0	193	4,371	205
MG11 Silver round bead necklace	14	26,298	31	12,322	56	0	151	9,451	282
MG12 White round bead necklace	0	219	22	1,842	17	0	37	89	0
MG13 Pearl round bead necklace	0	3	0	662	0	0	0	0	0
MG14 Silver round bead necklace	42	15,804	16	16,203	109	0	333	4,392	201
MG15 White round bead necklace	0	7	0	29,089	0	0	0	115	38
MG16 White round bead necklace	0	20	0	1,422	0	0	0	128	0
MG17 Gold round bead necklace	70	13,431	44	16,318	267	0	532	5,057	272
MG18 Multicolored and multishaped bead rope	1,901	442,243	852	115,018	398	0	8,589	209,730	3,050
MG19 Multicolored and multishaped necklace	32	10,873	20	13,071	126	0	265	4,241	150
MG20 Gold round bead necklace with medallion	14	12,282	16	10,473	211	0	118	2,976	125
MG21 Silver round bead necklace	31	10,228	38	28,912	56	0	303	3,966	218
MG22 Silver round bead necklace	47	15,446	35	22,943	84	0	252	4,945	259
MG23 Yellow necklace with large rubber light-up bead	0	3	0	351	0	0	0	182	82
MG24 Purple round bead necklace with medallion	0	2	0	0	17	0	0	0	0

Product	As	Br	Cd	Cl	Cr	Hg	Pb	Sb	Sn
MG25 Rubber toy	0	4	0	486	0	0	0	0	0
MG26 Silver multishaped necklace	10	11,612	21	12,606	73	0	185	3,971	172
MG27 Multicolored and multishaped bead bracelet	0	16,210	28	6,810	303	0	207	5,039	211
MG28 Multicolored round bead necklace	35	14,573	36	49,504	357	0	195	3,406	151
MG29 Gold oval bead necklace	0	17,324	28	11,593	34	0	504	6,105	216
MG30 Multicolored and multishaped oval bead necklace	0	0	0	0	0	0	0	94	0
MG31 Green round bead necklace with medallion	35	9,749	26	16,440	118	0	383	4,020	232
MG32 Rubber toy	0	6	0	1,735	0	0	0	86	44
MG33 Multicolored and multishaped bead bracelet	0	26	0	256	1,135	14	8,963	0	0
MG34 Necklace with medallion	0	0	0	588	0	0	0	80	0
MG35 Spear	0	2,296	975	510,208	0	0	9,969	23,309	20,720
MG36 Ring	0	0	0	0	0	0	1,016	54	0
MG37 White boot	0	4	0	0	0	0	0	0	59
MG38 Glow in the dark bracelet	0	0	0	389	0	0	0	63	0
MG39 Hand clapper toy	0	0	0	0	0	0	0	0	0
MG40 Orange coin	0	2	0	0	4	0	3	0	54
MG50 Silver coin	0	3	0	1,789	32	0	7	0	15
MG51 Green flower	0	182	0	1,033	23	0	133	166	0
MG60 Multicolored and multishaped necklace	32	15,725	19	9,987	82	0	165	4,799	206
MG80 Magenta round bead necklace	7	10,117	38	8,373	81	0	168	2,456	139
MG81 Pink round bead necklace	71	293	0	23,467	24	0	875	54	58
MG82 Silver round bead necklace	14	13,857	45	10,617	56	0	157	5,380	214
MG83 Green round bead necklace	24	15,011	15	10,038	117	0	304	4,382	133
MG84 Magenta round bead necklace	38	15,690	14	13,243	127	0	373	3,679	117
MG85 Bead necklace with medallion	105	13,866	107	10,332	92	0	274	5,482	263
MG86 Purple round bead necklace with medallion	20	11,910	25	12,776	60	0	182	4,131	196
MG87 Gold round necklace with medallion	22	10,477	10	8,315	229	0	118	3,148	117
NMG 01 Gold round bead necklace	0	25,757	23	4,395	59	0	7,806	207	129
NMG 02 Gold round bead necklace	19	11,913	23	5,301	58	0	3,797	148	143
NMG 03 Gold round bead necklace	39	14,573	97	10,580	116	0	3,538	161	262
NMG 04 Blue round bead necklace	32	12,059	21	17,552	49	0	3,171	115	215
NMG 05 Gold round bead necklace	0	59	0	973	32	0	0	0	0
NMG 06 Green round bead necklace with medallion	0	202	0	347	0	0	0	0	49
NMG 07 Green round bead necklace	21	14,805	21	3,129	69	0	5,712	195	162
NMG 08 Gold round bead necklace	15	9,207	0	4,822	102	0	2,766	99	79

Product	As	Br	Cd	Cl	Cr	Hg	Pb	Sb	Sn
NMG 09 Green round bead necklace	45	11,112	15	10,384	98	0	2,549	102	227
NMG 10 Green round bead necklace	70	11,811	18	8,204	79	0	4,612	164	154
NMG 11 Green multishaped necklace	0	232	0	370	50	0	0	28	28
NMG 12 Green round bead necklace	12	9,146	13	3,797	58	0	2,548	100	101
NMG 13 Multicolored and multishaped bead necklace	0	0	0	146	0	0	0	0	0
NMG 14 Green round bead necklace	38	10,283	19	8,806	207	0	3,244	145	243
NMG 14A Gold multishaped bead necklace	68	18,429	13	6,263	86	0	4,275	97	244
NMG 15 Green round bead necklace	0	2,331	0	2,047	263	0	605	0	18
NMG 16 Multicolored and multishaped bead necklace	34	12,182	23	8,596	53	0	3,402	189	226
NMG 17 Gold oval bead necklace	41	10,353	10	7,652	119	0	2,754	117	242
NMG 18 Green round bead necklace	0	615,792	79	25,144	780	0	29,864	805	4,823
NMG 19 Green round bead necklace	34	16,792	26	14,945	63	0	4,577	214	298
NMG 20 Gold multishaped bead necklace	60	15,371	27	9,787	92	0	4,177	167	290
NMG 21 Green round bead necklace	30	10,638	256	11,538	160	0	3,299	146	209
NMG 22 Gold round bead necklace	39	15,304	257	11,821	94	0	4,201	223	262
NMG 23 Green round bead necklace	33	14,528	19	8,438	106	0	4,129	162	251
NMG 24 Green oval bead necklace	0	114	0	1,056	0	0	0	0	17
NMG 25 Gold round bead necklace	46	13,202	20	2,747	35	0	3,953	146	146
NMG 26 Gold multishaped bead necklace	32	14,384	24	11,638	96	0	4,150	164	331
NMG 27 Multicolored and multishaped bead necklace	0	1	0	231	0	0	0	0	0
NMG 28 Green multishaped bead necklace	17	13,172	22	5,895	197	0	4,732	235	154

Mulitiple hazardous substances found in a Mardi Gras bead rope

A bead rope (Figure 2. MG 18) had nine components sampled and all contained levels of lead above 100 ppm. Two of the components had levels of lead above 8,000 ppm. The bead rope also contained high levels of other chemicals including arsenic, bromine, cadmium, and chlorine (Table 3).

Figure 2. MG 18 Multicolored and multi-shaped bead rope

Table 3. Components tested for MG18 Multicolored and multishaped bead rope and selected elements (results in ppm).

Component Tested	As	Br	Cd	Cl	Pb
Small magenta round bead	1,862	442,243	662	94,813	8,589
Small magenta round bead	1,901	433,648	852	115,018	8,092
Large green round bead	44	20,285	20	19,521	200
Large gold round bead	53	19,808	25	12,462	436
Large purple round bead	22	14,639	23	14,051	229
Large violet round bead	26	12,615	21	8,947	214
Large silver round bead	28	12,199	23	7,979	237
Small green round bead	16	10,108	20	3,998	286
Small gold round bead	13	5,763	30	2,219	103

The interior of mardi gras beads

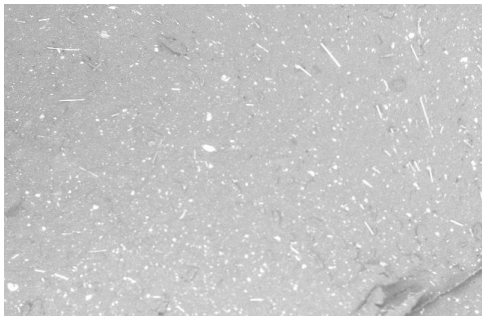
We tested the interior of a small sample of beads and found high levels of heavy metals and halogens. MG 10, for example, has between 1 to 1.3% of bromine by weight in the interior and exterior of the bead (Table 5).

Table 5. Elements of concern detected in the exterior and interior of mardi gras beads (results in ppm)

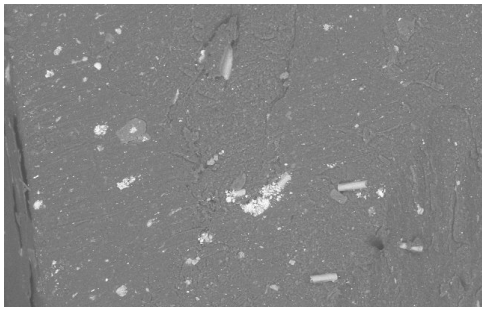
Product Name	Description	As	Br	Cd	Cl	Cr	Hg	Pb	Sb	Sn
MG05 White round bead neckalce	Exterior Max	0	4	0	26,252	0	0	0	0	0
	Interior Edge	0	3	0	0	0	0	0	250	70
	Interior Center	0	1	0	0	0	0	0	0	0
MG06 Purple round bead necklace	Exterior Max	0	8,566	26	7,945	33	0	140	2,772	114
	Interior Edge	0	7,310	43	4,814	9	0	124	4,259	310
	Interior Center	0	8,373	21	9,586	34	0	138	3,015	127
MG10 Silver round bead necklace	Exterior Max	23	13,087	85	7,560	60	0	193	4,371	205
	Interior Edge	29	13,142	85	8,204	31	0	182	4,255	213
	Interior Center	32	13,914	86	10,849	45	0	183	4,749	197
MG13 Pearl round bead necklace	Exterior Max	0	3	0	662	0	0	0	0	0
	Interior Edge	0	6	0	0	0	0	0	632	198
	Interior Center	0	0	0	0	0	0	0	0	0
MG16 White round bead necklace	Exterior Max	0	20	0	1,422	0	0	0	128	0
	Interior Edge	0	10	0	0	0	0	0	417	167
	Interior Center	0	0	0	0	0	0	0	0	0
MG29 Gold oval bead necklace	Exterior Max	0	17,324	28	11,593	34	0	504	6,105	216
	Interior Edge	0	13,271	25	7,591	18	0	110	5,665	258
	Interior Center	11	17,864	19	11,618	57	0	147	5,089	132
MG81 Pink round bead necklace	Exterior Max	71	293	0	23,467	24	0	875	54	58
	Interior Edge	0	200	0	21,208	0	0	494	217	138
	Interior Center	20	260	0	25,130	42	0	630	0	46
MG83 Green round bead necklace	Exterior Max	24	15,011	15	10,038	117	0	304	4,382	133
	Interior Edge	36	14,036	16	15,769	129	0	281	4,568	124
	Interior Center	33	15,741	15	14,253	109	0	328	3,985	109
MG84 Magenta round bead necklace	Exterior Max	38	15,690	14	13,243	127	0	373	3,679	117
	Interior Edge	46	16,516	24	14,346	113	0	340	3,922	114
	Interior Center	24	15,435	26	14,274	112	0	313	4,392	141

The interior of mardi gras beads

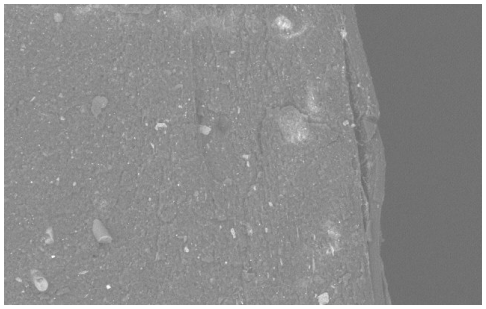
Figure 3. SEM images of bead interiors



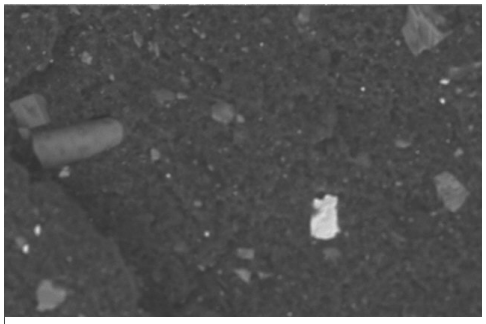
MG 10 at 40 X magnification



MG 29 at 250 X magnification



MG 29 at 400 X magnification



MG 10 at 1000 X magnification

The SEM images in Figure 3 show the heterogeneous morphology of the bead interior. Carbon atoms appear on the back-scattered electron images as grey or black, while heavier elements such as metals and halogens appear as lighter colors. While there is a polymer substrate to each bead, there are "pockets" of heavy elements scattered throughout the material examined.

Replicate bead samples dissolved in dichloromethane and analyzed by GC/MS identified a range of hazardous flame retardants, including:

deca-brominated diphenyl ether (decaBDE)

tetrabromobisphenol A(TBBPA)

MG 10

MG 29

DISCUSSION

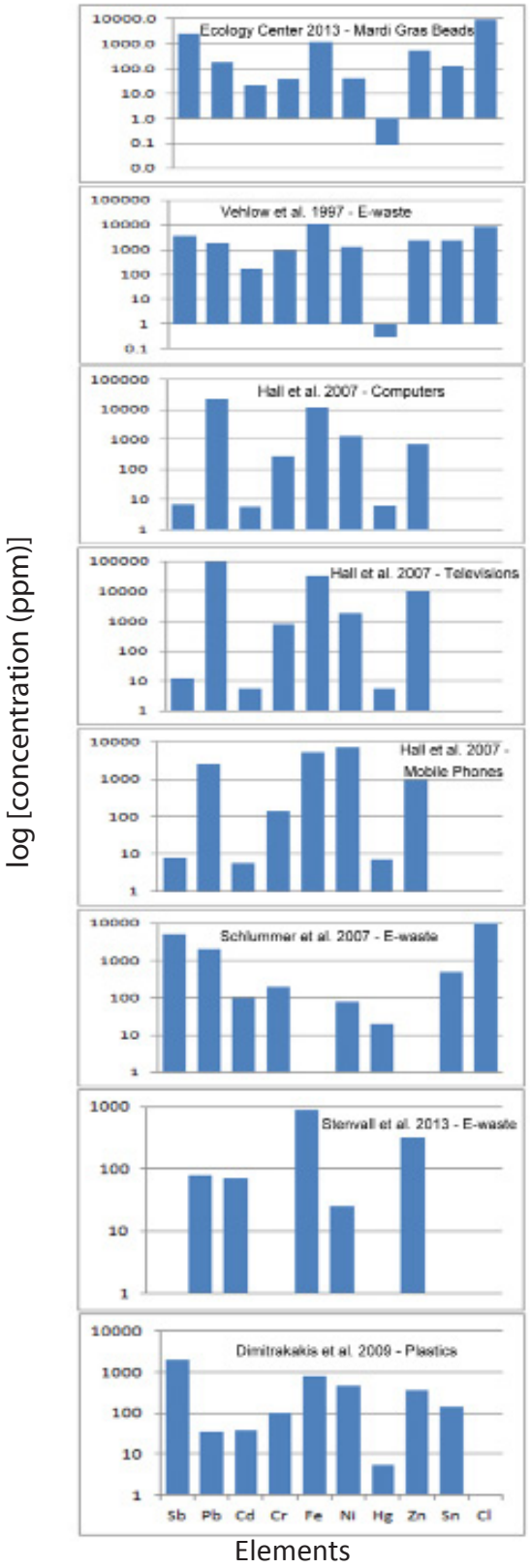
We compared the results of this study with the Consumer Product Safety Improvement Act (CPSIA) standards for lead and phthalates in children's products. The CPSC (2013) requires that children's products contain no more than 100 ppm of total lead content and CPSC (2011) has permanently banned three types of phthalates (DEHP, DBP, BBP) in any amount greater than 0.1 percent (1,000 ppm) in children's toys. Also banned, on an interim basis as more studies are completed, three phthalates (DINP, DIDP, DnOP) in any amount greater than 0.1 percent (1,000 ppm) in childcare articles. Our study indicates that Mardi Gras beads contain a range of hazardous substances that exceed the CPSIA regulation. The Mardi Gras football, for example, contained 28% DEHP, a phthalate banned by CPSIA. Given that this is a level deemed illegal in children's products, this suggests that Mardi Gras beads with phthalates at that level can pose a potential hazard to the environment and human health.

The study confirmed the presence of a variety of halogenated flame retardants in the bead substrate material of both used (Mardi Gras) and new (Holiday Garland) beaded products. The overall elemental composition of these beads also is similar to the elemental composition of electronic waste and other plastic waste streams. Finally, the morphology of the bead interiors, as shown by electron microscope images, clearly indicates heterogeneous, large particles of material embedded in the plastic matrix. While further investigation is needed to fully characterize the large amounts of halogens found in the plastics, these results indicate it is likely that waste, flame retarded plastic from a variety of sources are being recycled into bead production.

Despite the small sample size, this research shows the need for an in-depth analysis of the environmental impacts of Mardi Gras beads. As long as Mardi Gras beads hang on fences or are left behind in the streets as litter, they can release these hazards into the environment over time. Mardi Gras products are not regulated as children's products, but children frequently come into contact with them.

E-Waste & Beads

Figure 4. Elements in E-Waste and Mardi Gras Beads



Our tests have shown Mardi Gras beads to contain lead, antimony, chromium, cadmium, nickel, trace levels of mercury, and several flame retardants; which have been shown in studies to be common elements in electronic waste (e-waste) (Hall et al., 2007; Schulmer et al., 2007; Dimitrakakis et al., 2009; Nnorom & Osibanjo, 2009). Figure 4 shows the log concentration (in ppm) of several different elements measured in the Mardi Gras beads, and the log concentration (in ppm) of the same elements measured in e-waste in numerous studies. The similar concentrations of several elements of concern suggest that it is likely that recycled e-waste and its contaminants are used as recycled content in the manufacturing of Mardi Gras beads.

RECOMMENDATIONS

As a precautionary measure, Healthystuff.org recommends the following for Carnival and Mardi Gras enthusiasts:

TAKE PRECAUTIONS

Whether your Mardi Gras beads are sourced nationally or internationally, they may contain hazardous substances. Do not allow children (or adults) to put beads in their mouths. Wash your hands after handling the beads.

SEEK DISCLOSURE

If possible, before purchasing, customers should require manufacturers of Mardi Gras products to disclose full product information.

PURCHASE SAFER PRODUCTS WHERE POSSIBLE

Krewes should seek beads that are tested and demonstrated by suppliers to be free of chemicals of concern.

COLLECT AND REUSE

Mardi Gras beads have the potential to leach heavy metals and halogens into the environment. When Mardi Gras beads are exposed to heat or rain, over time, they may release some of these hazardous substances into the environment. When possible, collect and reuse Mardi Gras beads. People regularly handling beads are advised to wear gloves.

CHANGE MANUFACTURING

Manufacturers of Mardi Gras beads should adopt stringent chemical policies that assure that products do not contain chemicals of concern.

GOVERNMENT OVERSIGHT

The CPSC and EPA should conduct an immediate investigation to determine the extent of chemical hazards in beaded consumer products. Sample data from the study has been provided to CPSC.

REGULATORY REFORM

Many of the chemical hazards identified are in products because the primary U.S. law governing chemicals in products, the Toxic Substance Control Act (TSCA), is ineffectual in protecting the public. Consumers and retailers should support a progressive, modernization of TSCA.

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APPENDIX I

CHEMICALS OF CONCERN

HealthyStuff.org focused on a subset of chemicals that are detected by the HD XRF technology: lead (Pb), cadmium (Cd), chlorine (Cl), arsenic (As), bromine (Br), mercury (Hg), chromium (Cr), tin (Sn), and antimony (Sb). These chemicals of concern (COC) have been linked, in animal and some human studies, to acute allergies and long-term health impacts such as birth defects, impaired learning, liver toxicity, and cancer.

LEAD

Lead is a heavy metal that continues to be used in a wide variety of consumer products. Lead is often used as a stabilizer in PVC products and for pigmentation in paint, rubber, plastics, and ceramics (ATSDR, 2007). Scientists have found there is no safe level of lead for children - even the smallest amount affects children's ability to learn (CDC, 2005; Lanphear et al. 2005; Gilbert et al. 2006). Children are more vulnerable than adults to lead (ATSDR 2007). Lead impacts brain development, causing learning and developmental problems including decreased IQ scores, shorter attention spans, and delayed learning (Gilbert et al., 2006). Nationwide, 535,000 children already have lead levels of concern (CDC, 2013). In addition to neurological damage, excessive amounts of lead can cause muscle weakness, anemia, and kidney damage (ATSDR 2007). While no conclusive proof that lead is a human carcinogen exists, laboratory testing in rats resulted in the development of kidney tumors in the animals. Additionally, the EPA has listed lead as a probable human carcinogen (ATSDR, 2007).

CADMIUM

Cadmium is a heavy metal used as a stabilizer in PVC and in coatings and pigments in plastic and paint (CDC, 2012). Cadmium enters soil, water, and air from mining, industry, and burning coal and household wastes (CDC, 2012). Cadmium binds to soil particles that can easily be absorbed by plants and animals. Exposure to cadmium is associated in animal studies with developmental effects, including possible decreases in birth weight, delayed sensory-motor development, hormonal effects, and altered behavior (Schantz et al., 2001). Cadmium can cause adverse effects on the kidney, lung, and intestines and is classified as a known human carcinogen, associated with lung and prostate cancer (Huff et al., 2007; CDC, 2012). Exposure to cadmium can result in bone loss and increased blood pressure (Gallagher et al., 2008).

HALOGENATED FLAME RETARDANTS

Flame retardants are added to variety of consumer products to prevent fire, save lives and to reduce the economic cost of fires (Birnbaum and Staskal, 2004). However, studies have indicated that several types of flame retardants, particularly some halogenated flame retardants (HFRs), can persist and bioaccumulate, and have adverse effects on animal and human health.

HFRs are widespread contaminants globally, having been detected in air, water and soil, as well as fish, birds, mammals and humans. (Shaw et al., 2010) HFRs are released to the environment throughout their life cycles, including during product manufacture, use, disposal and recycling. Since many of these chemical are additive (i.e. they are not chemically reacted or bound to the substrate), they are released to the environment. Products function as a reservoir of these chemicals, and over time and through use can be released into the environment for decades. Exposure to some HFR's has been associated with a wide range of impacts on animals and humans including immunotoxicity, reproductive toxicity, endocrine disruption, effects on fetal and child development, thyroid and neurological function and cancer. (Birnbaum et al., 2004; Costa et al., 2007 Shaw et al., 2009)

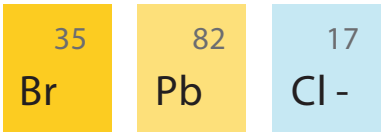
Brominated flame retardants (BFRs) are a subset of halogenated flame retardants which contain elemental bromine. The most widely used BFRs are polybrominated diphenyl ethers, or PBDEs; tetrabromobisphenol A (TBBPA); and hexabromcyclododecane (HBCD). The overall volume of BFRs produced has doubled between 2001 and 2008, from 200,000 to 410,000 metric tons annually. (Fink et al., 2008)

Another important group of halogenated flame retardants are chlorinated flame retardants (CFRs). The most common chlorinated flame retardants in current use include TDCPP, [tris(1,3-dichloro-2-propyl) phosphate] also called TDCP or chlorinated Tris; TCEP or tris(2-chloroethyl) phosphate; TCPP or tris(1-chloro-2-propyl) phosphate, Dechlorane Plus, and chlorinated paraffins (Hoh et al., 2006; Stapleton et al., 2010).

While XRF testing cannot directly identify molecular structure of organic chemicals, detecting bromine at levels greater than 400 ppm and chlorine at level greater than 3,550 ppm has been used to infer the presence of halogenated flame retardants (Stapleton et al., 2011).

POLYVINYL CHLORIDE (PVC) AND PHTHALATES

Detection of chlorine in a material at levels greater than 10% by weight indicates the material is likely to contain PVC (polyvinyl chloride). PVC is of concern to the environment and public health during all phases of its life cycle – production, use, and disposal. Because PVC is an inherently brittle material, it requires additives to make it flexible and to impart other desired properties. When chlorinated plastics like PVC are burned, highly toxic dioxins and furans can be formed. One group of additives commonly found in PVC products are phthalates.



Phthalates are a group of industrial chemicals that add flexibility and resilience to many consumer products. Phthalate plasticizers are not chemically bound to PVC, but can leach, migrate, or evaporate into indoor air and atmosphere, foodstuff, and other materials. Phthalates have endocrine-disrupting properties, meaning that they can disturb normal hormonal processes, often at low levels of exposure (EPA, 2007). Human exposure can occur by eating and drinking foods that have been in contact with containers and products that contain phthalates, by breathing air that contains phthalate vapors (CDC, 2013), and through dermal exposure (Heudorf, 2007). Infants and children are exposed to phthalates when mouthing plastic toys or using a plastic eating containers (EPA, 2007). The two most common phthalates used in children's products are Bis (2-ethylhexyl)phthalate (DEHP) and Diisononyl phthalate (DINP).

Other common phthalates found in consumer products are Dimethyl phthalate (DMP), Di-n-butyl phthalate (DBP), Diethyl phthalate (DEP), Diisobutyl phthalate (DIBP), and Di-n-octylphthalate (DNOP). Of particular concern are DEHP, benzylbutyl phthalate (BBP), DBP, and DEP. Both DEHP and BBP are primarily used as plasticizers in polyvinyl chloride (PVC)-based plastics, as well as other flexible plastics, and found in tablecloths, furniture, vinyl flooring, shower curtains, wallpapers, garden hoses, inflatable swimming pools, plastic clothing such as raincoats, children's toys, automobile upholstery and tops, medical tubing, and blood storage bags. DEP and DBP are used in non-plastic consumer items as fixatives, detergents, lubricating oils, and solvents and can be found in carpets, paints, glue, insect repellents, time release capsules, and personal care products such as soap, shampoo, hair spray, nail polish, deodorants, and fragrances.

OTHER ELEMENTS: ARSENIC, MERCURY, CHROMIUM, TIN AND ANITMONY

Arsenic is an element that can be present in both organic and inorganic compounds. Inorganic arsenic is a known human carcinogen. There is strong evidence that it is linked to lung, skin, and bladder cancer (ATSDR, 2007). Inorganic arsenic may also cause skin irritation, skin color changes, blood disorders, cardiovascular diseases, and hormone disruption (ATSDR, 2007).

Mercury is a metallic element. Its compounds are often used in inks, adhesives, and as a catalyst in reactions to form polyurethanes (ATSDR, 1999). Mercury can exist in different forms and some forms are more toxic than others, like methylmercury which is particularly hazardous to the developing brain. The main pathway of exposure to methylmercury is from eating contaminated fish. However, the use of mercury in products may risk the potential exposure of workers to this compound and its release to the environment when the product is discarded.

Chromium (Cr) is found in several forms in commercial products. It is used primarily as an elemental component in alloys and in stainless steel. Two forms, Cr (III) and Cr (VI), can also be used as pigments. Cr (III) is used in leather tanning and Cr (VI) in wood preservatives. Chromium compounds can also be used in textiles and as catalysts (ATSDR, 2012). Some Cr (VI) compounds are considered known carcinogens as a result of increased lung cancer among exposed workers (ATSDR, 2012). Laboratory studies indicate that Cr (VI) may cause birth defects and reproductive problems, particularly in males (ATSDR, 2012).

Tin can be combined with other chemicals to form compounds that are used in toothpaste, perfumes, soaps, food additives and dyes (ATSDR, 2005). Tin in the form of organotins are used as stabilizers in plastics, food packages, plastic pipes, pesticides, paints, and pest repellents (ATSDR, 2005). Exposure can occur by eating food or drinking from tin-lined cans, as well as breathing air or dust that contains tin. Exposure to high levels of inorganic tin may cause symptoms including stomach aches, liver and kidney problems, respiratory problems, neurological problems, and anemia (ATSDR, 2005).

Antimony is used as a catalyst in the production of polyesters and in combination with brominated flame retardants to increase fire resistance. Everyone is exposed to low levels of antimony in the environment. Acute (short-term) exposure to antimony by inhalation in humans results in effects on the skin and eyes. Respiratory effects, such as inflammation of the lungs, chronic bronchitis, and chronic emphysema, are the primary effects noted from chronic (long-term) exposure to antimony in humans via inhalation. Human studies are inconclusive regarding antimony exposure and cancer, while animal studies have reported lung tumors in rats exposed to antimony trioxide via inhalation. EPA has not classified antimony for carcinogenicity (EPA, 2000)

In our testing, we found both lower levels of antimony (160-700 ppm range) that are consistent with polyester applications, as well as higher levels (2,000-5,000 ppm range) that may be consistent with flame retardant applications. In either case, it is possible that antimony is released from the plastic material.

APPENDIX II

HOLIDAY BEADED GARLANDS

Test results for holiday garland beads

The results of the screening of the holiday beaded garlands are summarized in table 1.

About 74% (14 of 19) of the beaded garlands had bromine levels above 400 parts per million (ppm), suggesting the use of BFRs.

About 42% (8 of 19) of the beaded garlands had chlorine levels above 3,500 ppm, suggesting the use of CFRs.

Over two thirds (12 of 19) of the beaded garlands had levels of lead exceeding 100 ppm. The highest level of lead was 4,161 ppm found in a beaded garland purchased at Lowe's.

Table 1. Max levels detected of select elements of concern (in parts per million) in holiday beaded garlands.

Product	Brand	Retailer	As	Br	Cd	Cl	Cr	Hg	Pb	Sb	Sn
Beaded Garland (Gold)	Merry Brite	CVS	33	9,945	11	8,219	100	0	11	2,799	130
48ft Bead Garland (Aqua)	Home Accents Holiday	Home Depot	15	8,369	9	6,915	75	0	135	1,718	53
48ft Bead Garland (Silver)	Home Accents Holiday	Home Depot	47	18,331	0	5,754	117	0	301	2,202	67
48ft Bead Garland (Red)	Home Accents Holiday	Home Depot	46	8,961	10	11,317	415	0	477	2,845	78
8ft Garland (Red Wood Beads #0477343)	Holiday Living	Lowe's	0	66	0	0	0	0	0	0	0
8ft Garland (Gold Shiny #0477326)	Holiday Living	Lowe's	31	18,782	6,178	20	47	0	160	6,191	211
8ft Garland (Pink, Aqua, Silver & Red #0477223)	Holiday Living	Lowe's	25	18,230	21	2,624	68	0	172	5,803	173
8ft Garland (Gold Matte #0477223)	Holiday Living	Lowe's	19	26,031	38,100	9	47	0	190	5,430	141
8ft Garland (Green, Red & Gold #0477326)	Holiday Living	Lowe's	13	13,826	17	2,221	29	0	192	4,239	193
8ft Garland (Red #0477326)	Holiday Living	Lowe's	31	19,580	13	5,377	221	0	224	5,343	147
8ft Garland (White & Silver #0477223)	Holiday Living	Lowe's	23	22,742	32,694	31	56	0	278	6,922	213
8ft Garland (Gold #0477223)	Holiday Living	Lowe's	30	483,757	526	39,593	476	0	4,161	243,200	4,475
Winter Pioneer Beaded Garland (Gold)	Target Brands, Inc	Target	0	0	0	0	14	0	0	71	0
5ft Glass Garland	Decor	Target	13	2	0	938	779	0	96	0	59
Beaded Garland (Aqua)	Decor	Target	73	8,834	11	7,325	102	0	133	2,471	159
Beaded Garland (Gold)	Home Elements	Walgreens	6	6,547	0	488	20	0	43	13,233	0
Beaded Garland (Red, Green & Gold)	Home Elements	Walgreens	62	9,893	0	8,489	143	0	370	2,190	80
Beaded Garland (Red)	Holiday Time	Walmart	0	205	0	302	129	0	5	57	0
Beaded Garland (Gold)	Holiday Time	Walmart	0	386	0	590	9	0	14	109	0

Beaded Garland (Red, Green Gold)
Brand/Retailer: Home Elements, Walgreens

48 ft Bead Garland (Red)
Brand/Retailer: Home Accents Holidays, Home Depot

8 ft Garland (White & Silver #0477223)
Brand/Retailer: Holiday Living, Lowe's

8 ft Garland (Red Wood Beads #0477223)
Brand/Retailer: Holiday Living, Lowe's