

Fireworks

A report on fireworks pollutions and public health impacts

June 2010

Background

FIREWORKS CONTAIN TOXINS

- Perchlorate (rocket fuel): disrupts production of thyroid hormones
- Heavy metals:
 - Strontium (red): damage bone marrow, cause anemia and prevent blood from clotting correctly, birth defects in animals
 - Aluminum (white): brain, lung damage, Alzheimer's
 - Copper (blue): jump-starts the formation of dioxins when perchlorates in the fireworks burn; Human carcinogen; disrupt hormone production and glucose metabolism.
 - Barium (green): vomiting, diarrhea, breathing trouble, changes in blood pressure, numbness around the face, general muscle weakness and cramps; changes in heart rhythm, paralysis or death.
 - Rubidium (purple): skin irritation; replace calcium in bones.
 - Cadmium (various): lung, stomach, kidney disease; damage to bones
- Particulates: cause asthma, respiratory diseases

FIREWORKS CAUSE ENVIRONMENTAL PROBLEMS

- High levels of perchlorate in local bodies of water after fireworks displays (US EPA scientist Richard T. Wilkins et al, "Perchlorate Behavior in Municipal Lake Following Fireworks Displays, "Environ. Sci. Technol. 2007,41,3966-3971 2007)
- Perchlorate gets in fish (J. -W. Park et al, Food Chain Transfer of Perchlorates in largemouth bass, *Micropterus salmoides*, Bull. Environ. Contam. Toxicol. (2005) 74:56-3

FIREWORKS CAUSE HEALTH PROBLEMS

- Perchlorate in groundwater and drinking water disrupts thyroid hormones
- Heavy localized air pollution that can affect an entire city
- Asthma attacks and 4th of July fireworks displays?
- Debris handled by children
- People fish the lagoon and eat those fish

Research

PERCHLORATE AND HUMAN HEALTH IMPACT

There are significant research gaps on perchlorate--as there are with any emerging contaminants of concern. However, this doesn't mean there is no problem and no precautions can be taken. As you probably know from your reading so far, concern about this chemical has been increasing for several years now among environmental and public health scientists. The debate about appropriate perchlorate standards was used as a case study in the recent CA nano policy advisory team I was part of (see attached, p. 23-24 for a brief summary of the issues).

In recent years scientists and regulators have been debating whether the proposed EPA standards (15 ppb) are protective enough for fetuses and infants in particular--see: http://yosemite.epa.gov/ochp/ochpweb.nsf/content/110308_2.htm and also the attached letter. Several states have set drinking water standards much lower than this--2, 6, 5 ppb for MA, CA, and NJ. Just recently the Wisconsin DHS proposed a revision of the NR 140 perchlorate standards for groundwater (7 ppb (enforcement standard) and .7 (preventive action limit)) to 1 ppb (enforcement standard) and 0.1ppb (preventive action limit).

The attached EST article found perchlorate levels in surface water after fireworks shows of up to 44.2 ppb. I know that over time perchlorate levels can be attenuated by various processes, and the levels that reach groundwater from one show are likely miniscule. However, over time, with many fireworks shows being done all over Madison over the years, this can add up.

I couldn't locate any data on perchlorate in Madison drinking water, but it is undoubtedly there since it is found pretty much in drinking water everywhere, which is increasingly being raised as an important public health issue. In 2009 a bill was introduced in the U.S. House of Reps to amend the Safe Drinking Water Act to require a primary drinking water regulation for perchlorate: <http://www.govtrack.us/congress/billtext.xpd?bill=h111-3206>

heavy metals, dioxin and particulates and human health impact

Just as importantly, there are several other contaminants of concern (numerous metals, dioxins, etc) and fine/ultrafine particulates related to fireworks--e.g.:

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VH3-4TB77GM-5&_user=10&_coverDate=12%2F31%2F2008&_rdoc=1&_fmt=high&_orig=search&_sort=d&_docanchor=&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=9427b1b8ab217a4ef7f54bc1bb96e490
<http://iopscience.iop.org/1748-9326/4/3/034006/fulltext>

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V74-3X3TCV1-6&_user=10&_coverDate=09%2F30%2F1999&_rdoc=1&_fmt=high&_orig=search&_sort=d&_docanchor=&_view=c&_searchStrId=1355603169&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=89f6e3fe642411349f67621d7908ebf9
Fireworks smoke contains particulates and the other contaminants above, which are breathed by people at the shows. Particulate levels during and immediately after shows can be many orders of magnitude higher than background, creating significant risks for asthmatics and others with respiratory problems--e.g.:
<http://www.ingentaconnect.com/content/acaai/aaai/2000/00000085/00000006/art00018>

PUBLIC POLICY

Environmental and public health departments have issued warnings on this in several states/localities:

<http://www.airquality.utah.gov/fireworks.htm>

<http://www.mde.state.md.us/ResearchCenter/Publications/General/eMDE/vol2no3/fireworks.asp>

<http://www.thenewstoday.info/2009/12/24/pho.warns.the.public.of.the.effects.of.firecrackers.html>

More....plus various newspaper articles:

<http://www.telegraph.co.uk/science/3814165/Fallout-from-firework-displays-aggravates-asthma-claim-scientists.html>

PREVENTIVE PUBLIC HEALTH APPROACH RATIONALE

Given these studies and numerous data gaps, a preventative public health approach would involve taking some relatively simple preventative and communication actions for fireworks shows and getting more monitoring data on perchlorate in various media. While there are many potential sources of perchlorates, fireworks are one source that can be addressed relatively easily at the local/county level (unlike, say, rocket fuel from military etc). We think the following should be done:

ENVIRONMENTAL IMPACT

Moreover, perchlorate and other contaminants of course also fall onto land and water during and after the shows and build up there and enter the food chain. E.g., perchlorate builds up in fish (see citations in EST article; also see attached article) that many people eat-- according to this article, levels can reach several thousands of parts per billion in head area (with some anglers, such as Hmong, eat) and hundreds of ppb in fillets, which all anglers eat as you know.

- Waterfowl nest there
- Waterfowl deal with explosions, fireworks and emergency vehicles all around the lagoon and island
- Paper shell casings from fireworks are everywhere in Warner Park after R&B
 - They contain heavy metals and explosive residue
 - Eaten by birds and pets

Local Impacts

INDEPENDENCE DAY FIREWORKS CELEBRATION IN MADISON CITY PARKS

- Warner (Rhythm & Booms)
 - The City of Madison permits, contracts and partially sponsors this event
- Elver

- The City of Madison permits contracts and puts on this event.
- Numerous neighborhood fireworks displays
 - The City of Madison permits these events

COMMENTS ON THE CITY OF MADISON CONTRACT WITH MADISON FIREWORKS FUND, INC. (PURVEYOR OF RHYTHM & BOOMS)

- The contract makes no mention of the type of fireworks to be used or any prohibition of the use of perchlorate in fireworks.
 - Since perchlorate is a known toxin that contaminates drinking water and affects human, animal and ecological health, the City should not sanction its use.
- The contract states "Clean up from the fireworks shooter shall be completed by Tuesday following the event."
- "Clean up" is not defined.
 - The reality is that tens of thousands of pieces of fireworks (casings, shells, etc.) litter Warner Park for months after the event. These fireworks fragments contain perchlorate and heavy metals. We assume that the weather and sun break down the paper casings over time, thus releasing the toxins into the soil.
 - Children handle the paper casings all summer long
 - Wildlife likely ingest them (perhaps this is form of goose management?).
 - There are undoubtedly similarly amount of fireworks remnants that end up in Warner park lagoon.

Recommendations

1) MONITORING

- Levels of perchlorates, other metals & particulates in the air during fireworks shows
- Monitoring perchlorate levels before/after fireworks shows to see how much these events add to contamination of soils, surface water, etc (which will eventually seep into groundwater, etc).
- Monitoring a range of fish from Madison lakes to find out how much perchlorate is in them now and if there is any increase in fish in areas around fireworks shows after the shows.
- Test Warner Park lagoon for perchlorate and heavy metals the day after Rhythm & Booms
 - Perchlorate fireworks will contaminate bodies of water near where fireworks are shot off. R&B fireworks are shot off in an island IN THE LAGOON. Toxins deposited in the water will end up in the fish. Many people fish the lagoon and connected Warner beach and eat the fish they catch. There can be no doubt there will contamination. Knowing the level of contamination will help define the scope of the problems and need for corrective action.

- Determine emergency room admissions the night of and the day after Rhythm & Booms and Elver fireworks displays to determine if there is a correlation with asthmatic attacks.

2) LESS TOXIC FIRWORKS

- Recommending that firework companies use alternatives to perchlorate fireworks. (They exist; they're just not as cheap as toxic-laden fireworks from China.)

3) CLEANUP

- Requiring that fireworks debris be thoroughly cleaned up after fireworks shows--e.g., see MA recommendations (attached), which would be a good template. This seems like a relatively easy, no-brainer. (We know about this because we walk in Warner Park regularly and see the debris from fireworks is littered all over the park for months after the shows. Elver Park is probably the same.)

4) PUBLIC HEALTH INFORMATION

- Communicating with people who attend these shows, particularly asthmatics and people with other respiratory and/or cardiovascular problems, that there are heightened risks during these shows of asthma attacks, etc., and they may want to stay further away from them or watch them from afar. At the very least, asthmatics should know to bring their inhalers to shows (especially children). Public health agencies in various communities around the country issue warnings just before the Independence Day fireworks "season" and these warnings are faithfully reproduced in local media.
- Since the City of Madison permits and sponsors fireworks displays at Warner Park and Elver Park, Public Health show be advising the City of its obligation to provide for public safety.
- Test Warner Park lagoon for perchlorate and heavy metals the day after Rhythm & Booms
 - JUSTIFICATION: It is well established that perchlorate fireworks will contaminate bodies of water near where fireworks are shot off. R&B fireworks are shot off in an island IN THE LAGOON. Toxins deposited in the water will end up in the fish. Many people fish the lagoon and connected Warner beach and eat the fish they catch. There can be no doubt there will contamination. Knowing the level of contamination will help define the scope of the problems and need for corrective action.
- Determine emergency room admissions the night of and the day after Rhythm & Booms and Elver fireworks displays to determine if there is a correlation with asthmatic attacks.

The main source for these recommendations is the Massachusetts Department of Environmental Protection:

Fireworks Best Environmental Management Practices

Although the environmental impacts from the use of perchlorate-containing

fireworks have not been fully defined, MassDEP believes it is prudent for fireworks contractors to take the following reasonable steps to minimize potential problems:

- Request low (or no) perchlorate containing fireworks. This may require that you make inquiries with your suppliers and/or manufacturers.
- Institute rigorous "housekeeping" practices. It appears that the deposition of unburned aerial shell fragments and other pyrotechnic debris may be the primary mechanism by which groundwater becomes contaminated by perchlorate. Fireworks companies or display sponsors should remove all visible shell debris encountered during the search at first light.
- Dispose or manage "duds" and "misfires" appropriately; all "duds" or "misfires" must be removed from the site and disposed of in accordance with applicable codes and manufacturers instructions. Contain and/or promptly address runoff in cases where water is used to douse duds or misfired materials.
- Be aware of the existence of surrounding drinking water supplies and stay as far away from them as possible. Of particular concern are Fireworks displays within the recharge areas of public drinking water supply wells (i.e., "Zone II" and "Interim Wellhead Protection" areas).

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The Madison Environmental Justice Organization educates the community about environmental justice issues, facilitates the community's ability to address these issues, and supports environmental justice for the benefit of the general public.

Our local air and water pollution has a disproportionate impact on the poor and minorities which is not being addressed by our institutions or our community as a whole.

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