

Dental Amalgam Program Implementation

Scott Caldwell
City of Boulder
IPT Field Specialist

June 28, 2012

CIPCA

Denver, CO

Mercury (Hg)

- Naturally occurring element
- Liquid at room temperature and pressure
- Density: $13,570 \text{ kg/m}^3$ Atomic Weight: 200.59
- Hg dissolves to form amalgams with gold, zinc, and other metals



How is Mercury Used?

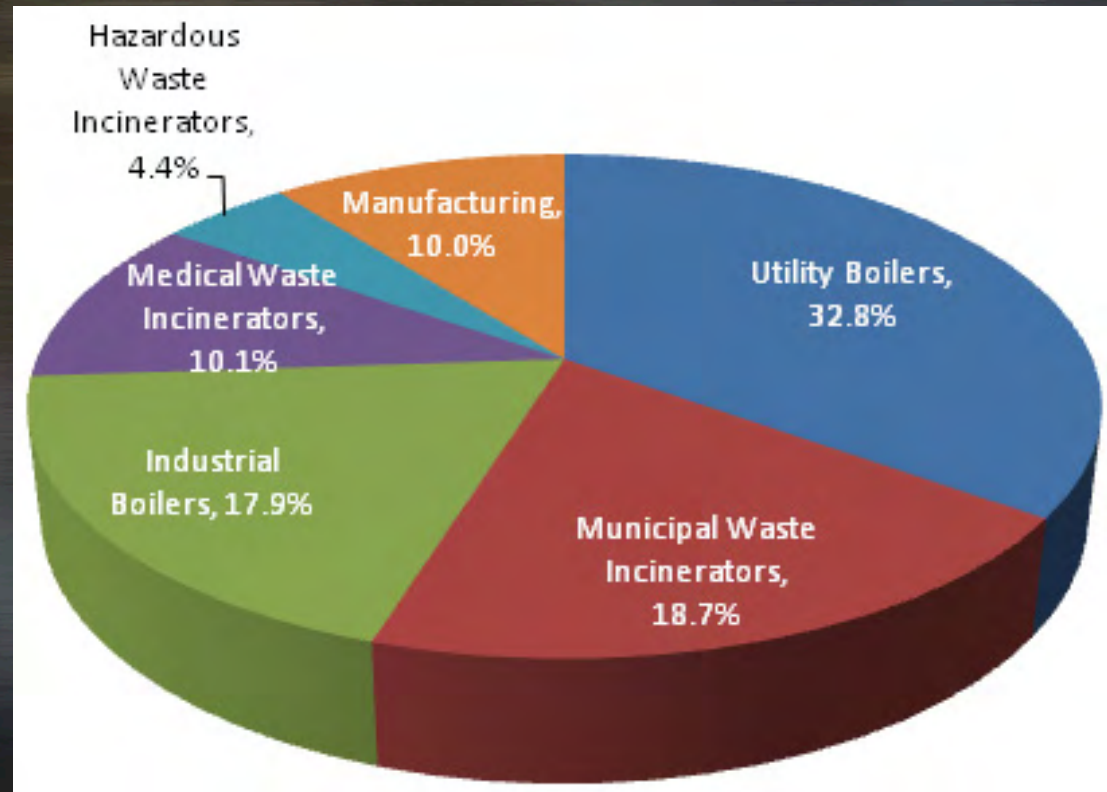
- Manufacturing and Production
 - Gold and Silver mining
 - Chlorine and Caustic soda
 - Batteries
 - Fluorescent lighting
 - Electronic switches
 - Dental amalgams
 - Pesticides



Atmospheric Sources of Mercury Pollution

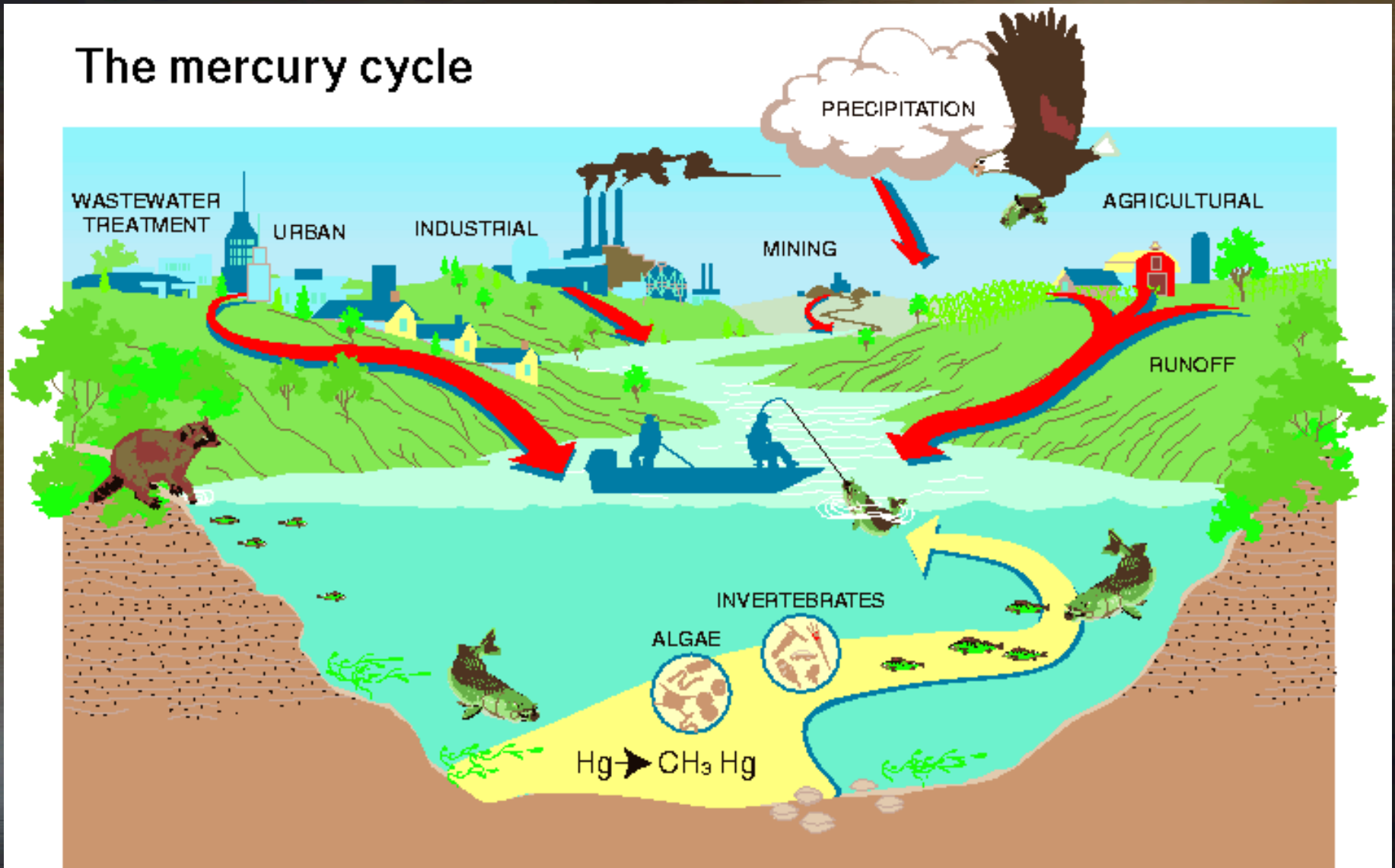
- Burning of Fossil Fuels
- Byproducts of Manufacturing
- Consumer Product Waste
- Agricultural Run-off
- Mining Waste
- Natural Sources
- Dentistry

Graph comes from the EPA's Mercury Study Report to Congress dated 1997 and includes the top 6 sources for air pollution



Mercury Cycle

The mercury cycle



(Illustration by Connie J. Dean, U.S. Geological Survey)

Mercury in the Environment

- Transformation
 - $\text{Hg} \rightarrow \text{CH}_3\text{Hg}^+$ (MeHg) by microbial process
- Bioaccumulation
 - Hg transported across the lipid membrane of unicellular organisms
 - MeHg is reactive and thus retained in plankton
- Biomagnification
 - Efficient transfer between aquatic species
 - MeHg is efficiently assimilated through higher levels of the food chain

City of Boulder, Colorado

- Why did the City of Boulder start a Hg program?
 - To fulfill obligations of an approved pretreatment program as outlined in 40 CFR Part 403*
 - In response to reduced permit levels for Hg
 - 2003 permit limit of 12 ng/L
 - In response to measured discharges that exceeded or were close to new permit levels

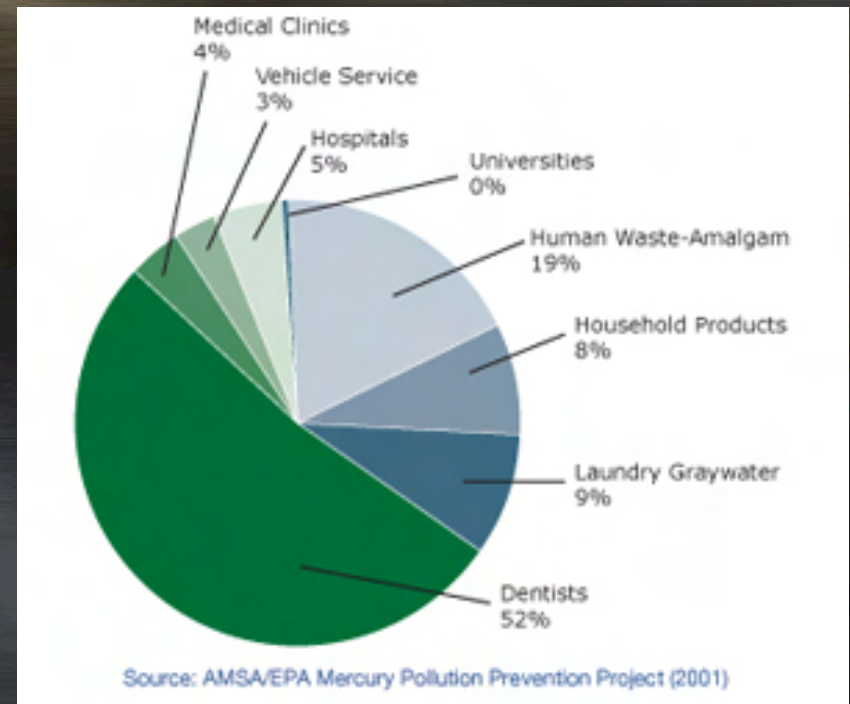
*§ 403.2(b): To prevent the introduction of pollutants into the POTWs which will pass through the treatment works or otherwise be incompatible with such works

Getting Started

- Determine Hg sources
 - Atmospheric – We are located near a coal burning power plant
 - Dental – sampling from offices showed they could be contributing nearly 100% of Hg to our POTW

- Education outreach and a new sampler

- Surveys from dentists
- Educational material
- Voluntary program



Sampling Results

| | Flow gal/day | Ag Ug/l | Ag g/day | Cu Ug/l | Hg Ug/l | Hg g/day* | Zn** Ug/l |
|--------------------|-----------------|------------|-------------|------------|------------|--------------|--------------|
| Discharge Limit | | 100 | | 1200 | 7 | | 5400 |
| Clinic A | 1300 | 22.4 | 0.11 | 218.5 | 38 | 0.19 | 26.7 |
| Clinic A | 1300 | 9.5 | 0.05 | 88.8 | 11 | 0.05 | 28.8 |
| Clinic A | 1300 | 51.9 | 0.26 | 181.2 | 140 | 0.69 | 94.8 |
| Clinic A | 1300 | 4.4 | 0.02 | 76.2 | 9.6 | 0.05 | 19.3 |
| Clinic B | 1500 | 29.5 | 0.17 | 406.7 | 5.8 | 0.03 | 69.1 |
| Clinic B | 1500 | 66.5 | 0.38 | 75.3 | 7.5 | 0.04 | 87.7 |
| Clinic B | 1500 | 31.0 | 0.18 | 94.0 | 24 | 0.14 | 43.1 |
| Clinic B | 1500 | 19.7 | 0.11 | 61.8 | 43 | 0.24 | 34.7 |

Sampling Results

| | Flow gal/day | Ag Ug/l | Ag g/day | Cu Ug/l | Hg Ug/l | Hg g/day* | Zn** Ug/l |
|--------------------|-----------------|------------|-------------|------------|------------|--------------|--------------|
| Discharge Limit | | 100 | | 1200 | 7 | | 5400 |
| Clinic C | 600 | 4211 | 9.55 | 109.1 | 160 | 0.36 | 54.6 |
| Clinic C | 600 | 529 | 1.20 | 124.1 | 16 | 0.036 | 35.0 |
| Clinic C | 600 | 590.5 | 1.34 | 139.6 | 110 | 0.25 | 42.0 |
| Clinic C | 600 | 223.1 | 0.51 | 123.7 | 38 | 0.09 | 32.9 |
| Clinic D | 2400 | 1.2 | 0.01 | 68.3 | 3.8 | 0.03 | 67.1 |
| Clinic D | 2400 | 529 | 4.80 | 39.8 | 0.39 | 0.004 | 22.7 |
| Clinic D | 2400 | 47.4 | 0.43 | 41.5 | 3.1 | 0.03 | 31.5 |
| Clinic D | 2400 | 979.1 | 8.88 | 59.3 | 2.3 | 0.02 | 42.4 |
| Average | 1450 | 459.1 | 2.52 | 119.3 | 37.3 | 0.20 | 45.8 |

*flow, gal/day x concentration, mg/l x 3.78L/gal = mg/day x 1g/1000mg = grams/day

**Samples were also analyzed for As, Mo, Ni, Pb, and Se and were all nondetects

New Sampler



New Regulations

- 2007: Rules Concerning Treatment and Disposal of Amalgam Wastewater
 - Title 11, Chapter 3, B.R.C. 1984
 - Legal authority pursuant to Sections 11-1-3 and 11-3-24
 - BMPs!

Dentist John Bishop checks on a patients teeth at Bishop and Takemoto Dentistry in Boulder



Photo by Marty Caivano, Boulder Daily Camera

BMPs

- Require the installation of ISO 11143 amalgam separator unless granted a waiver
- Annual Certification by mail
- Record Keeping



Yearly Schedule

- December – review and edit list of dentists
 - Phone book
 - State/City lists – I will demonstrate this using DORA
 - Online searches
 - Business licenses
- January
 - Call dentists for verification
 - Mail merge
 - Cover letter
 - Surveys
 - Address labels

Starting your list

- <http://www.google.com/>
 - DORA Colorado
 - Divisions of Registrations
 - Download a List of Licensed Professionals
 - Click the following link:
 - https://www.doradls.state.co.us/lic_database_req.php
 - Select License Type – Dentist
 - Select License Status – Active
 - Submit
 - DEN#####.zip file - Download

Surveys

- Important information to collect
 - All practicing dentists
 - Type of practice
- List of BMP requirements
 - Chair side traps and secondary filter on vacuums
 - Non-oxidizing, non-chlorine disinfectants and neutral line cleaners
 - Recycling of all bulk Hg and none goes in the garbage
 - Make and model of separator
 - Record Keeping

Yearly Schedule

● January

- Enter survey information as it comes in
 - Linko and Excel
- Start performing any necessary inspections

● February

- Survey due date February 15th annually
- Call offices that are late
 - First step of ERP
- Fax / E-mail additional surveys if needed

Yearly Schedule

- March
 - Final phone calls
 - One week prior to 30 day reporting limit as stated in ERP
 - Notice of Violation
 - Prefer to avoid this
 - Usually not needed as long as good communication has been established
 - Final remaining inspections for the year
 - Assuming that most have already been done in the past
 - Inspection Reports
 - Confirmation letters and Waivers
 - This might get bumped to April

Time Costs

- December

- Review of dental list
 - 1 – 2 days
- Verification phone calls (if you do them in Dec.)
 - 1 – 2 days

- January

- Mail merge materials
 - Print smart to avoid collating
 - 1 – 2 days

Time Costs

- January

- Form review and entry

- Linko: 5 minutes per practice
- Excel: 1 minute per practice for updates
 - Why the redundancy?

- Inspections

- 1 hour
 - Accounts for drive time
 - Accounts for wait time
 - Accounts for more drive time
- Inspections take 5 to 10 minutes

Inspections

- What to bring with you
 - Field Notebook
 - Relevant code sections
 - Flashlight!
 - You will find yourself in crawl spaces and dark closets
 - Use to check sludge levels
 - Identification
 - Camera
 - Photographs make nice additions to inspection reports

Logistics and Scheduling

- Keep these things in mind:
 - Not all offices open everyday
 - Offices are spread throughout the service area
 - Make time for driving
 - 5 to 6 inspections will take the majority of a day
- Review database prior to leaving
 - This may speed things up
 - Can fill certain things out in your inspection logs
 - Name, Address, Phone number, etc.

Inspections

- What to look for
 - Correct plumbing sequence
 - Sludge levels
 - Maintenance records
 - Waste manifests



Inspections

- Low Sludge Level



- High Sludge Level



Inspections

- X-Ray processing unit
 - Traditional development?
 - Where does spent fixer go?
 - How are chemicals stored?
 - Digital radiography?



Treated prior to discharge

Stored for off-site disposal

Amalgam Separators

- How do they work?
 - Air water separator
 - Heavy particulate “trap”
 - You may hear this referred to as a filter or collection container
 - Water is re-introduced to air flow and exits the separator
 - Heavy particulates are left behind

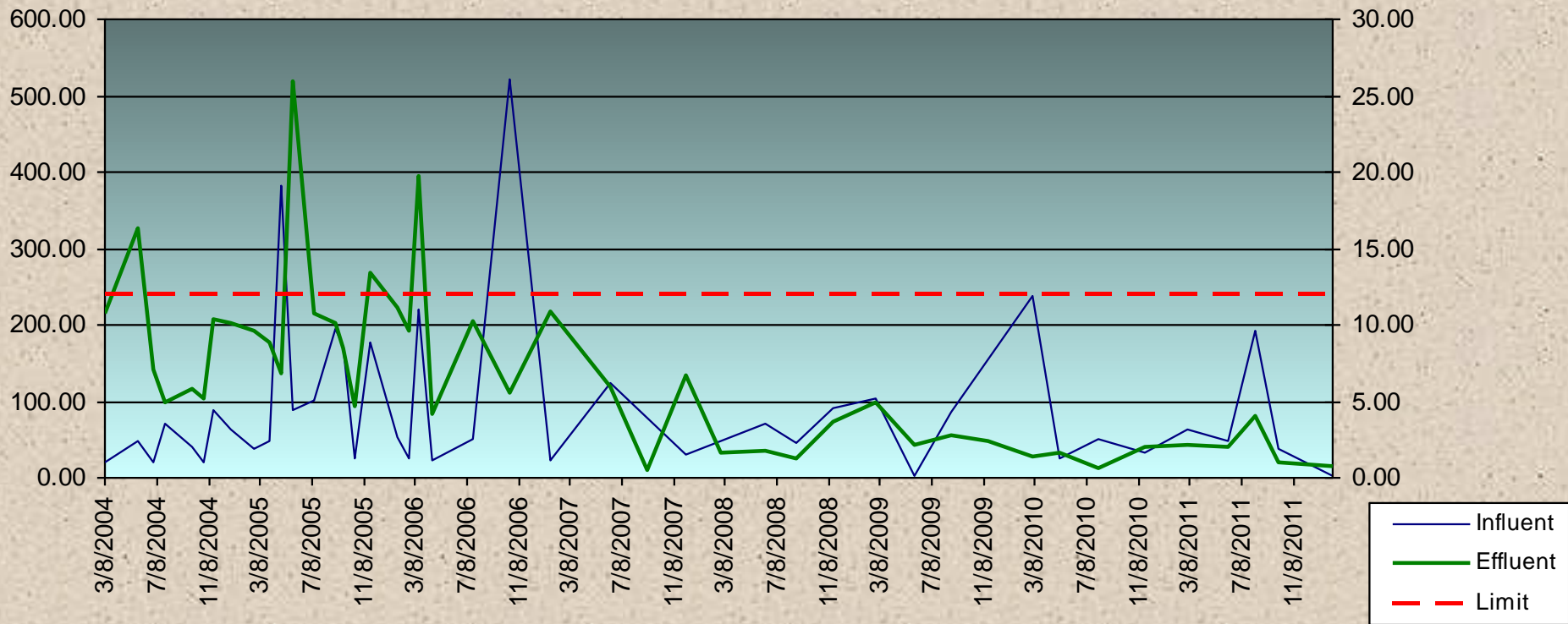
Amalgam Separators

- The upper chamber is where the water and air is separated
- The lower part is where the solids settle from the water and is called a collection container
- The collection container shows the “fill line” and can be replaced as scheduled or necessary



Results

Influent and Effluent Hg results (ng/L)
Effluent on secondary axis



Contact Information

Scott Caldwell
City of Boulder / IPT
4049 75th Street
Boulder, Colorado 80301

E: caldwells@bouldercolorado.gov

O: 303-413-7363

C: 303-330-7048