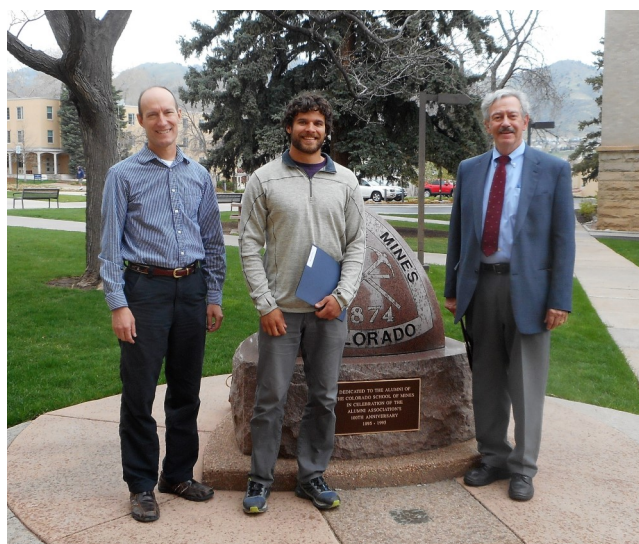




# The Colorado Professional Geologist



American Institute of Professional Geologists—Colorado Section  
 Colorado Section email: [Colorado-aipg@outlook.com](mailto:Colorado-aipg@outlook.com)



Dr. Paul Santi, Matthew Tello, CSM Graduate Student (Center), Ron Prichett  
 AIPG Siok Scholarship Winner 2019



Ron Prichett, Pengfei Hou, CSM Graduate Student (Center), Dr Lesli Wood  
 Rex Monahan Scholarship Winner 2019

## 2019 Colorado Section Scholarship Award Winners

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## Call for Articles

*The Colorado Section of AIPG newsletter welcomes submission of technical or informational articles for publication. Articles may be submitted via e-mail to the editor at: [summitdatasvcs@msn.com](mailto:summitdatasvcs@msn.com) (Microsoft Word format is preferred.)*

*James Russell  
1909 Sage Circle, Golden, CO 80401*

Contact James at 303-278-4456  
for additional information.

## Change of email:

Change of email notices and other contact information changes for the CPG should be sent directly to:

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(The National Office maintains the address list for all.)

Letters, articles, announcements, ads, etc. must be received by the Editor by the **end of the fourth full week of the month preceding publication**. Letters, articles, ads, announcements, etc. accepted on a space available basis. Submission of articles, etc. via e-mail is the preferred method. Copy can be accepted in most PC formats, but DOC or DOCX are preferred. Call or e-mail James Russell for details on submission of copy or advertising at 303-815-3901, [summitdatasvcs@msn.com](mailto:summitdatasvcs@msn.com).

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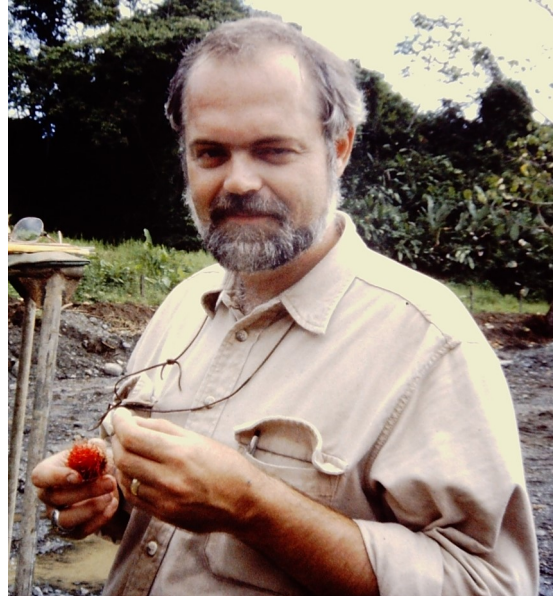
The opinions expressed are those of the authors and not the Colorado Section officers unless clearly stated otherwise.

**Back issues:** available in PDF at <https://www.dropbox.com/home/CO%20AIPG>

# Editor's Remarks

**James Russell**

In this issue we have an assortment of items that may be of interest to our membership. These items include: 1) results from our scholarship awards, 2) news about the most recent 2019 Colorado Science and Engineering Fair, 3) an article about effecting changes in the Colorado Section and AIPG, 4) legislative update, 5) an article on addressing bias and ethical issues in AIPG communications, 6) an article about applying geospatial technologies for data sharing and outreach and 7) an article on contaminants in the environment.



## Scholarships Awarded

On May 1 Pengfei Hou, a graduate student CSM received the Rex Monahan scholarship. Pengfei Hou is a graduate student CSM working on his Ph.D. in sedimentology and stratigraphy. Matthew Tello, a fellow graduate student at CSM received National's Siok Graduate Scholarship.

Congratulations!

## Annual Field Trip Announcement

**June 29**

This year we are going to visit the Argo Tunnel/Mill, Clear Creek County and the Hidee Mine, Gilpin County. The combined cost is estimated at \$48/person. Further information will be forthcoming. Watch the Section's weekly newsletter for further details.

## Call for Articles

If you have any articles that you would like to share, please let me know (your editor).

## **2019 Colorado Science and Engineering Fair**

### **Thomas Van Arsdale**

On April 11<sup>th</sup>, two judges (Stephanie Ashley and Ron Pritchett), representing the Colorado Section – AIPG, attended the finals of the 2019 Colorado Science and Engineering Fair competition, held on the Colorado State University campus in Fort Collins. This was the fifth year the Section has been involved with the Fair and the judges were excited to see what the students had accomplished. Suffice it to say, the judges were quite impressed with a number of projects.

The process to whittle-down the number of projects to a manageable number to judge began in early March when the competing abstracts were made available. A total of 136 abstracts from both the Junior Division (grades 6-8), and the Senior Division (grades 9-12), were reviewed within the categories of: Earth and Space Sciences; Energy; Environmental Sciences; Engineering; and Chemistry. From those 136 abstracts, each judge chose a number of abstracts for consideration. The judges' choices were then collated to ascertain the projects most commonly chosen. This process resulted in four projects within the Junior Division, and five projects within the Senior Division.

On April 11,<sup>th</sup> the judges reviewed each of the nine projects and met with the individual student(s) to discuss his/her/their project in detail. Of the participants interviewed, the Colorado Section - AIPG awarded a "Certificate of Excellence in the Geosciences" to two students in each division. A cash award was also sent to each Division winner (\$100) and runner-up (\$50).

The winner of the Junior Division was Owen Doherty, a seventh grader from Branson School, located in the southeastern Colorado town of Branson. Owen lives on a sixth-generation cattle ranch, and his project dealt with the prevention (minimalization) of soil erosion. He tested four different methods using a self-built model of a 35 degree slope, which is quite extreme, especially for southeastern Colorado (having worked as a field geologist for 11 years I can say without hesitation that dealing with 35 degree slopes can wear-you-out in a hurry!). Owen tested two mechanical methods (trench and berm) and two non-mechanical methods (residue cover and residue cover with animal impact). As he stated in his abstract, "Residue cover is the application of hay or straw over the area susceptible to erosion. Residue cover with animal impact mimics cattle walking on that hay and pressing some of it into the soil with their hooves." His work was well presented and his findings showed that the non-mechanical methods were the most effective at reducing soil displacement.

The Junior Division runner-up was Alexandra Flint, an eighth grader from Peak-to-Peak Charter School, located in Lafayette. Alexandra's project concerned, "Examining Electric Charges as a Method for Cleaning Microplastics from the Oceans." As she succinctly stated, "Microplastics make up 94% of the plastic in the Great Pacific Garbage Patch. Cleaning these plastic fragments from the oceans could be critical to the survival of marine ecosystems." Her research involved creating a saline environment, and demonstrated that placing electrodes 20 millimeters apart caused, "the optimal level of attraction." What was particularly endearing was her commitment... "In the future, I would like to take this discovery to a larger scale and analyze its effects on other types of plastic material."

The Senior Division winner was Madeleine Nagle, an eleventh grader from Fairview High School in Boulder. Her research dealt with the, "Radiation at Rocky Flats National Wildlife Refuge." As she correctly stated, "There has been significant backlash since Rocky Flats National Wildlife Refuge opened to the public in September 2018. The concern is that the radiation levels are still too high to be safe for public access, despite extensive cleanup efforts." What was most impressive to the judges was that Madeleine did not simply use scary, inflammatory words to create a "social emergency" amongst the residents, but rather used scientific methods to test the conditions and safety of the area (the alarmists could have done the same, but did not...why?). Madeleine's conclusion was, "that Rocky Flats Wildlife Refuge is largely safe."



Max Warnock, an eleventh grader from Poudre Global Academy in Fort Collins, was the runner-up in the Senior Division. His work, “Spatial Analysis of the Glaciers in Grand Teton National Park Between 1994 and 2015,” was truly exceptional in that he correlated temperature and “snow water equivalent” (SWE) from five weather stations nearest to the glaciers. His research predicts that, “If the rates of temperature increase and SWE decrease ‘in a linear fashion,’ these glaciers will be gone by 2090.

The annual state science fair is a big deal! All the students attending the Ft. Collins fair are winners from their respective regions. Many people support these students - parents, teachers, friends and coaches. It was fun to see the excitement and enthusiasm, and a little sad to see a few students passed-over at this level, though they learned important lessons, too. Among all the students an astonishing amount of work was dedicated to these projects. There is obviously a strong influence from the teachers of these talented students, yet we also found a fair amount of individual thinking and discovery. The accompanying pictures reveal the energy of the place and the bright-eyed optimism among the students. We were encouraged by the intelligence and care from these students - it is good to support and guide them as we look toward a future that will demand critical thinking and adaptation.

## **Effecting Changes in the Colorado Section and AIPG**

**David M. Abbott, Jr.**

Do wish that the Colorado Section and AIPG nationally would endorse different legislation or policies or engage in different activities? Has some presentation gotten your juices going for or against? Do something about this. Each of us has ideas about what the Section and Institute can and should be doing.

These varied ideas are not necessarily mutually exclusive. But to effect changes that you’d like to see, you need to let the leadership and membership know what you think. You can do this by writing letters to the Editor of either the *Colorado Professional Geologist* or the national *Professional Geologist*. An even better way of changing the Section is to run for office.

Members periodically grouse that only one person is nominated for a particular Section office. This is because filling a slate with at least one candidate per office is a perennial problem. Volunteer to run for one of the Section offices. The time commitment for serving is not extensive for most offices. You’ll be expected to attend Section ExCom meetings, which last about an hour starting at 7 AM on the first Tuesday of the month. It is possible to attend these meetings by phone so it doesn’t matter where in the state you live. Even if you don’t run for office or don’t win, you can always attend the meetings, either in person or by phone. The President or Secretary will be happy to send you each month’s agenda, which includes the call-in number. Attending meetings will give you a more in depth understanding of what is going on. You can contribute your thoughts and ideas.

## **Addressing Bias and Ethical Issues in AIPG Communications**

**Jessica Davey, YP-0413**

Ethical choices and biases constantly surround us. Some are more obvious than others. How do we make certain, as members of AIPG, that we are being unbiased in our decisions and actions and follow our inner code of ethics as well as the AIPG Code of Ethics?

According to the Harvard Business Review, “Most of us believe that we are ethical and unbiased. We imagine we’re good decision makers, able to objectively size up a job candidate or a venture deal and reach a fair and rational conclusion that’s in our, and our organization’s, best interests. But more than two decades of research confirms that, in reality, most of us fall woefully short of our inflated self-perception” (Banaji, Bazerman, & Chugh, 2003).

And from Cornell University, “Implicit bias includes attitudes and beliefs (positive or negative) about other people, ideas, issues, or institutions that occur outside of our conscious awareness and control, which affect our opinions and behavior. Everyone has implicit biases—even people who try to remain objective (e.g., judges and journalists)—that they have developed over a lifetime. However, people can work to combat and change these biases” (Cornell University Library, 2019).

A comment was made in the April 2019 Colorado Section Monthly Email that I feel provides a learning opportunity in ethics and bias: “Life is messy - may we agree? Being born is hard on our mothers. Growing to adulthood requires abundant food and transformed materials won at great cost to our fathers.” In my opinion, this comment displays an inherent bias in assuming that women become mothers and take care of their children while men become fathers and are the breadwinners of the family. While I agree that this fits the stereotype of a family from the previous century, this is far from reality for many families today. Prudential Insurance Company conducted a survey of 3,000 Americans between the ages of 25 and 70 and found that 54 percent of women are the primary breadwinners in their family; 30 percent are married breadwinners who are generating more than half their household income (Prudential, 2018). In these changing times, it is now publicly acceptable for women to hold professional roles outside of the home, which was looked down upon in the past.

The comment in question displays an implicit bias that women are caregivers and men are breadwinners. The comment also violates the AIPG Code of Ethics Standard 4.4: “A respectful and fruitful working environment is fundamental for maintaining a high level of professionalism. Therefore, discrimination or harassment, either sexual or of any other kind, is unacceptable because it offends the dignity of persons and seriously undermines the atmosphere of trust essential to the work of all geologists. Such actions should be denounced immediately to authorities. It is unprofessional and unethical to condone any kind of discrimination or harassment or to disregard complaints of harassment from colleagues or staff. AIPG’s Anti-harassment policy provides more explicit examples of acceptable and unacceptable behavior” (AIPG, 2017).

Inherent discrimination lies behind the claim that women are caregivers and men are breadwinners. Expressing opinions such as this can have long-term negative impacts on both the person making the comment as well as those on the receiving end. The use of metaphors and generalizations should be carefully weighed, as they are often misinterpreted and taken out of context from the author’s intent. In my opinion, it is in the best interest of AIPG and our Colorado Section to do our best to avoid making broad-sweeping, unfounded personal statements such as this one.

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# Bill Summary for AIPG 2019

Ron W. Pritchett

President - Colorado Section AIPG - 2019

The following Bills from the 2019 Colorado legislative session (as of 5/14/2019) were identified by the Colorado Section Legislative/Regulatory Committee - Ann Vasko, Logan MacMillan, and our lobbyist, Betsy Murray. Comments and links were prepared by Ron Pritchett.

## **SB19-181: Protect Public Welfare Oil and Gas Operations**

**Status: 4/16/2019: [Governor Signed](#)**

In March your AIPG Board sent a special request to the Colorado Section, urging members to contact their Senators and Representatives for a "No" vote. Written testimony was sent to the Bill sponsors. The Bill clearly impedes oil and gas development, usurping ongoing work of the Colorado Oil and Gas Conservation Commission. Changing the mission of the COGCC from "fostering" petroleum development to administering permits implies less guidance for operators from the COGCC institution. Added uncertainty does not encourage prosperity development (and school funding) from petroleum resources. Now that the Bill has been signed to law, the COGCC issued a "[Guidance](#)" letter while operators wait on new rules. SB-181 favors large operators that have infrastructure and permits in-place (like Occidental/Anadarko and the pooling advantage along the land-grant [Railroad Strip](#).) Meanwhile, predictions of decreased drilling activity translate to [severe revenue and job losses](#). A petition movement may put an [alternative Bill](#) up for vote in Year 2020.

## **HB19-1113: Protect Water Quality adverse Mining Impacts**

**Status: 4/4/2019: [Governor Signed](#)**

Mining operators in Colorado will now put "sufficient and secure" bonds in-place to ensure remediation. Restoration after mining is right and beneficial; the Bill puts all active miners in the water business, too.

## **SB19-016: Method to distribute severance tax money**

**Status: 4/01: [Governor Signed](#)**

[Severance tax in Colorado](#) affects all mined materials and oil and gas operations. The Colorado Section [position on Severance Taxes](#) was sent to Bill sponsors to remind them of the original intent of severance taxes, generally to aid local communities dealing with changes due to resource development. SB19-016 changes timing of distribution of tax receipts. Because Legislators have enjoyed [robust revenue in recent years](#), dominantly from petroleum operations, government business tends to become dependent on the revenue. Ironically, the passage of SB-181 (above) may change the revenue stream.

## **HB19-1264: Conservation Easement Tax Credit Modifications**

**Status 5/3/2019: "Concur-Repass"**

This Bill extends a sunset date for [conservation easements](#) and the oversight commission, to July 1st, 2026. Property owners enjoy a tax credit, and a third-party "conservancy" enjoys a monitoring role of land use. The problem: lands are withdrawn from natural resource development "in perpetuity." Current landowners may favor permanent loss of resources from the third-dimension of property; future landowners may desire a right to work the land, discovering the multiplying effects of wealth from the ground, in addition to their protected views. Perhaps we can persuade our legislators to strike the words "*in perpetuity*" from future conservation easements.

Political desires and physical reality clash in the drive to eliminate carbon dioxide from the energy-supply mix. Despite Colorado mandates to shift toward "renewable" energy sources as wind and solar, the [promise to do](#) so at a lower consumer cost becomes strained. HB 19-1313 presumes the fundamental concept - moving away from fossil fuel generated electricity - is best for people and the planet, and our Legislators sense that the voting public agrees. Science provides contrary evidence, [summarized here](#) by geologists Lee Ger-

Gerhard and M. Ray Thomasson. Political desire, in contrast to a scientific record, has spawned the following Bills for our Governor's consideration. Dr. Tim Ball writes about the [disconnect between temperature and CO2 in the geologic record](#), facts ignored by political opportunists. If the following Bills serve to actually reduce harmful pollutants, people of Colorado will be well served. If the following Bills dedicate tax money to lowering CO2 emissions, the money will be wasted.

**HB19-1261: Climate Action to Reduce Pollution**

**Status 5/13/2019: "Sent to the Governor"**

**SB19-096: Collect Long Term Climate Change Data**

**Status 5/3/2019: "Concur-Repass"**

**HB19-1314: Just transition from coal-based energy and an appropriation**

**Status 5/3: "Concur-Repass"**

**HB19-1188: Greenhouse Gas Pollution in Fiscal Notes**

**Status 5/3/2019: "Concur-Repass"**

Political desires and physical reality clash in the drive to eliminate carbon dioxide from the energy-supply mix. Despite Colorado mandates to shift toward "renewable" energy sources as wind and solar, the [promise to do](#) so at a lower consumer cost becomes strained. HB 19-1313 presumes the fundamental concept - moving.

**HB19-1313: Electric Utility Plans to Further Reduce Carbon Dioxide Emissions**

**Status 5/2/2019: Senate Committee on appropriations refer amended to Senate Committee of the Whole**

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**Status 5/3: "Concur-Repass"**

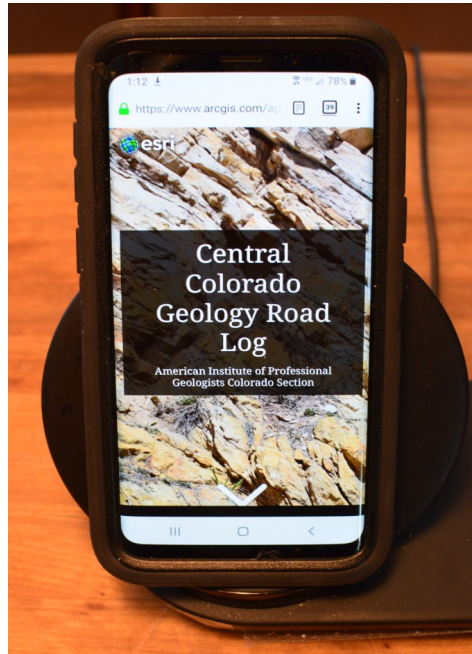
**HB19-1188: Greenhouse Gas Pollution in Fiscal Notes**

**Status 5/3/2019: "Concur-Repass"**



# Geological Data Sharing and Outreach Using Geospatial Technology (Part 1)

James Russell, CPG



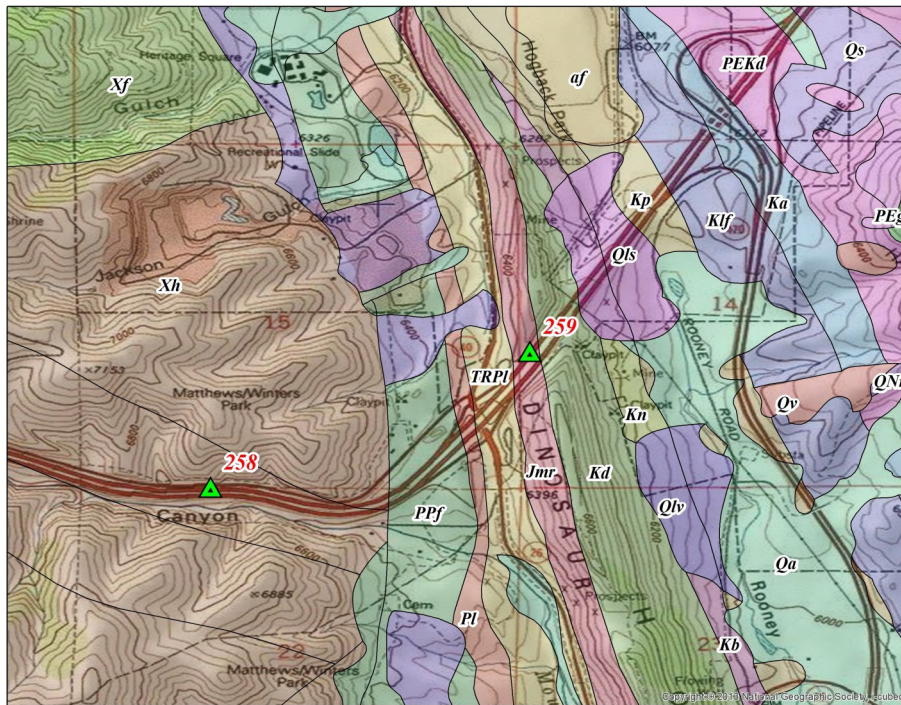
*(coming soon to a cell phone near you!)*

## Background

What on earth is meant by Geospatial Technology? Geospatial is defined as ‘of or relating to the relative position of things on the earth's surface’. Most people use some form of geospatial technology every day without knowing what goes on in the background. Typical applications include address locators, highway mapping applications, real estate and hotel websites, Google Maps or Google Earth, and many more. All these applications use spatially enabled databases to locate something on the ground and provide data about or in the vicinity of a location. Geospatial technology is now fully integrated into our lives and provides information that would have taken many hours or days of effort before the advent of ‘the cloud’. Geospatial applications rely upon a Geographic Information System (GIS) that include databases and vector/raster mapping data operating in the background. The U.S. Government started development of a national GIS in the 1980’s (GRASS) and by the 1990’s GRASS was used by federal US agencies, universities, and private companies. By the 1990’s several GIS software companies made inroads into federal, state, and county governments. Today ESRI (GIS) and Autodesk (CAD) dominate the geospatial business.

## GIS/Geospatial Technology Today

For more than two decades digital data analysis software has been a mainstay of the geologist. Software for oil, gas, and mineral wells have been available for logging and analysis. New and more powerful personal computers have made tools for geostatistical reserve modeling common in our profession. While these software applications have a geographic component and can manipulate and analyze data in three dimensions, geospatial software such as ArcGIS can be used to explore and examine data on a larger scale. GIS can be used more as a tool for project development than as a mechanism to calculate a value



**Golden Geology (From Road Log App displayed on a tablet)**

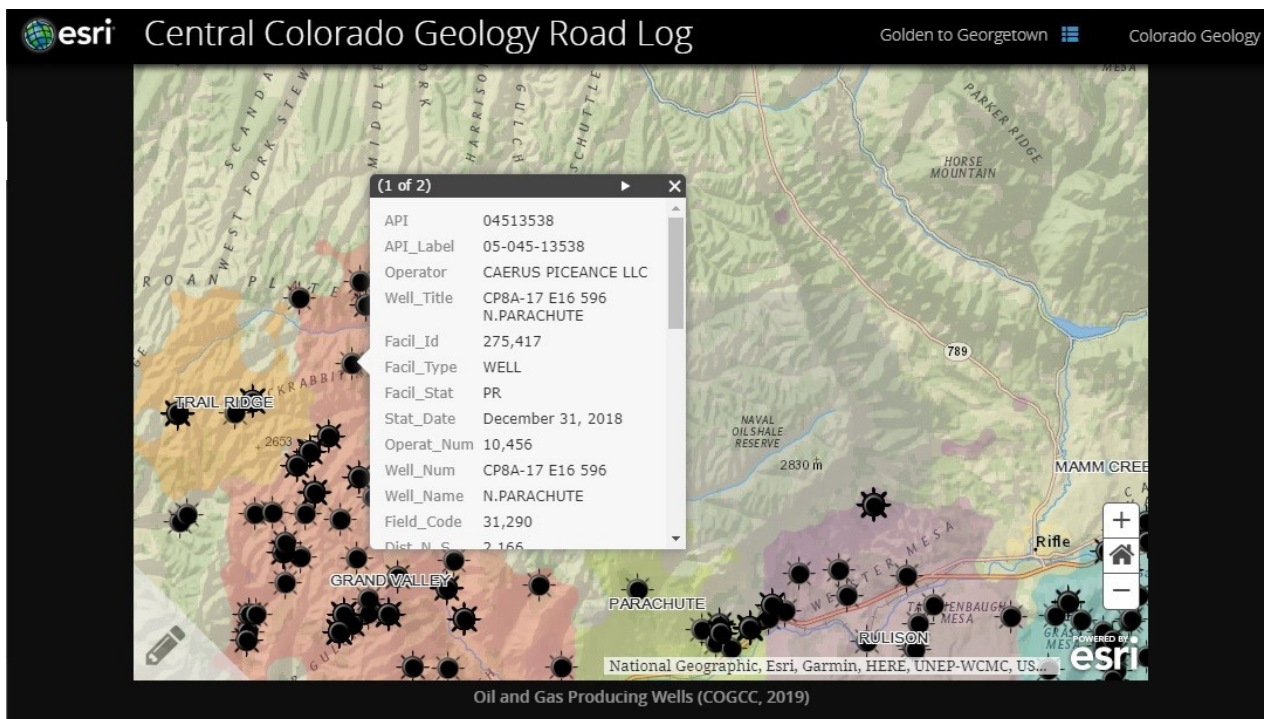
at a specific location. Information such as land ownership, access rights, environmental restrictions, and other constraints to project development are vital to success of a project. Many new geospatial technologies and tools are being used for a whole range of diverse projects.

For decades GIS applications were primarily developed for desktop use. Today the direction of geospatial applications and the underlying server databases is in the cloud. Software as a service for geospatial applications is becoming common but it does require a cell connection to the cloud. GIS is not just mapping but very sophisticated data analysis applications. We, as geologists now end up in remote locations without cell coverage. How do we access and run these applications? It took a while for GIS companies to realize this situation and design software to be used in a disconnected manner. Data can be collected and then downloaded when the field worker is in range of a cell tower.

## **New Geospatial Applications and How to Use Them for Free**

Sharing data and geospatial information within an organization is much more efficient than in years past. Many large natural resource companies have already implemented these technologies into their workflow. For smaller organizations, the cost of entry to these technologies has fallen and geospatial software and applications are now affordable to many. Geospatial apps can be easily built for cell phones, tablets, and laptops with freely available geologic data and hosted in the cloud for free. ESRI is the primary GIS and geospatial application software company that provides geospatial technology to all levels of users and organizations. Their ArcGIS Online site is a cloud-based application development system.

If you are not a member of an ArcGIS Online organization, you can create a public account with an ArcGIS login or create a public account with a social login to access ArcGIS Online. An ArcGIS public account is a free account for personal, noncommercial use and is available for individuals to create and share content with limits on usage. If you have an ESRI account as it is automatically a public account and you can use it to sign in (ESRI, 2019). A commercial account that comes with an ArcGIS software license includes extended file capacity.



### **Interactive Map Showing Producing Oil and Gas Wells (COGCC, 2019) (You click on a well and get well data on your cell phone)**

There are all sorts of 'how-to' ESRI and YouTube videos to learn the details of creating your own ArcMap Cascade Mapbook apps. Most of the work involves copying and pasting text and pictures into the app.

Geologists are always concerned about data/observation collection, but technologies now exist to share this information with others efficiently. Geospatial data sharing is now the new refrain of the geospatial world. Getting the right information into the hands of managers in a timely manner is very important to the success of a project.

Sharing geological information with the public in the form of an app is a good outreach method. A new cell phone/tablet/laptop ArcMap Cascade Mapbook app is in development that takes a standard geological road log of central Colorado and reworks it into a user-friendly digital version with photographs, maps, and other interesting information. It should be available in the next month or two and is free to all. There is no software to download, only an internet connection. This app is a work in progress and will change with input from others. The summer newsletter will have further details about access to this application.



## Emerging Contaminants in the Environment (PFAS and 1,4-dioxane) – Challenge of Understanding Their Significance in Drinking Water When the Science is Lagging and Unsettled

Louis P Bull<sup>1</sup> CPG, PHG, PG

*1 – Director, Groundwater and Technical Programs, Waste Management, Denver, Colorado*

An emerging contaminant is defined as a chemical or material characterized by its newly perceived, potential, or real threat to human health or the environment. However, many of these contaminants lack published health standards and are not formally regulated as our knowledge is typically evolving due to new science, detection capabilities, and developing treatment technologies. Polyfluoroalkyl Substances (PFAS) are a class of compounds that have been produced for many decades but are now “emerging” as their widespread presence in the environment becomes more fully appreciated and their potential threats gain increasing attention. PFAS are carbon chains surrounded by fluorine (F) atoms with different endings (referred to as fluorochemicals or fluorinated substances), which are found in clothes, non-stick pans, stain-resistant fabrics like carpets, foams, medical garments, and other industry and consumer products. These compounds have been detected globally in lakes and rivers, oceans, soil, air, plants, and animals. PFAS compounds are created and enter the environment through manufacturing processes, industrial use, and the life cycle of common consumer products. Understanding and managing PFAS is a challenge that touches all sectors of the economy and represents a societal concern that we all need to work together to effectively manage.

Two of the most widely used and studied PFAS are Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS). Although the US EPA has not yet regulated any PFAS under the Safe Drinking Water Act, they did establish a drinking water health advisory (HA) for PFOA+PFOS of 70 parts per trillion (ppt) in 2016. Although the HA for PFOS+PFOA is an advisory level, it is not an enforceable standard and applies only to drinking water. It is noteworthy that PFOA and PFOS were phased out domestically years ago, with studies showing that concentrations of these compounds in human blood has been decreasing as a result. Nevertheless, many States are now establishing groundwater protection standards such as maximum contaminant levels (MCLs) for PFOA and PFOS based on the drinking water HA level or proposing legislation to develop surface water standards at concentrations much less than the HA. The challenge with establishing proper standards for PFAS is that scientific and toxicological knowledge of these compounds is lagging. Different PFAS (e.g. long-chain vs. short-chain) can present very different potential health concerns and significant uncertainty remains on the toxicology of the thousands of compounds that comprise the PFAS category. As such, the scientific community (including industry, regulators, and academia) needs to address environmental protection of PFAS exposures on a national scale as part of an overall assessment to maximize individual States’ ability to formulate reasonable policymaking decisions. For meaningful policy development, it is critical that all stakeholders work in concert to develop a legislative and regulatory framework for the compounds at State and federal levels by “following the science.”

Another emerging contaminant that has been studied for years but whose health impacts in drinking water continue to be strongly debated is 1,4-dioxane. This compound is used as a solvent in many products including adhesives, cleaning agents, detergents, lacquers, and varnishes. In addition, 1,4-dioxane is used as a manufacturing agent in the production of plastics, rubber, insecticides, and herbicides. Recent toxicological studies have demonstrated that 1,4-dioxane is a thresh-

hold versus linear carcinogen (i.e., In 2010, US EPA used the default linear low-dose cancer evaluation approach when determining health risks). Recent studies suggest that US EPA was premature in assuming a linear low-dose cancer evaluation approach for 1,4-dioxane, which resulted in a calculated health protective level at 0.35 parts per billion (ppb). Recent scientific investigations by Dourson et al. (2014<sup>1</sup>, 2017<sup>2</sup>) have addressed significant data gaps in information used by USEPA (2010) in their toxicological evaluation. As such, the conventional wisdom that 1,4-dioxane poses a health risk in drinking water at very low levels (part per billion - ppb) continues to be challenged in many States. It is important to note that several States have regulations/guidance levels well above the US EPA determined health protective level of 0.35 ppb that was published in 2010. These factors combined with the technical discussion regarding the current state of scientific understanding regarding 1,4-dioxane's toxicological properties makes this "emerging contaminant" problematic since the health impact (through its primary pathway - ingestion) of this compound is unsettled within the scientific community.

As emerging contaminants are identified by the US EPA and other regulatory and environmental protection stakeholders, determining their sources is difficult considering the prevalence of these compounds in the environment. In other words, the source of PFAS and 1,4-dioxane are nearly ubiquitous as these compounds are present in many industrial, commercial, and consumer goods (e.g. health care products, shampoos, etc.). Understanding the source and "background concentrations" of these contaminants should be an important factor in establishing reasonable regulatory standards.

It is increasingly important for the technical community to consistently ask a few critical questions when addressing the environmental and public health significance of emerging contaminants.

- Does perception of environmental concern of an emerging contaminant match the technical evidence?
- If toxicological evidence supports a higher protection standard, should regulators be flexible and allow existing standards to be adjusted as scientific understanding progresses?
- How do industry and other stakeholders best track and manage technical and toxicological updates for emerging contaminants?
- Should regulators be keeping up to speed with updates in toxicology?

Proposed answers to these questions should be thoroughly vetted in the scientific community and re-vetted on a routine basis so that regulatory standards reflect the best available scientific information. Doing so will help the regulatory community put proper context on future environmental assessments and response actions for these contaminants and continue to educate the public regarding true health risks of these compounds.

1- Dourson, M., J. Reichard, P. Nance, H. Burleigh-Flayer, A. Parker, M. Vincent, and E.E. McConnell. 2014. Mode of action analysis for liver tumors from oral 1,4- dioxane exposures and evidence-based dose response assessment. *Regul Toxicol Pharmacol*. 68: 387–401. Available online at: <https://www.sciencedirect.com/science/article/pii/S0273230014000129>.

2 - Dourson, M.L., Higginbotham, J., Crum, J., Burleigh-Flayer, H., Nance, P., Forsberg, N.D., Lafronconi, M. and Reichard, J., 2017. Update: Mode of action (MOA) for liver tumors induced by oral exposure to 1,4-dioxane. *Regul Toxicol Pharmacol*, 88: 45-55. Available online at: <https://www.sciencedirect.com/science/article/pii/S0273230017300429>.





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