



**Colorado Department
of Public Health and
Environment**

**Laboratory Services Division
Annual Report 2008-09**

Rapid Detection Through Responsible Testing

The **mission** of the Laboratory Services Division is to protect the health, safety and environment of all Coloradans by providing accurate and timely laboratory analyses and information.

The **vision** of the division is to be recognized as an innovative and quality public health laboratory in the state of Colorado.

As a leader in the industry, the division will use advanced, leading-edge technology, employ a highly skilled workforce, and have the respect and support of all its customers, stakeholders and partners.

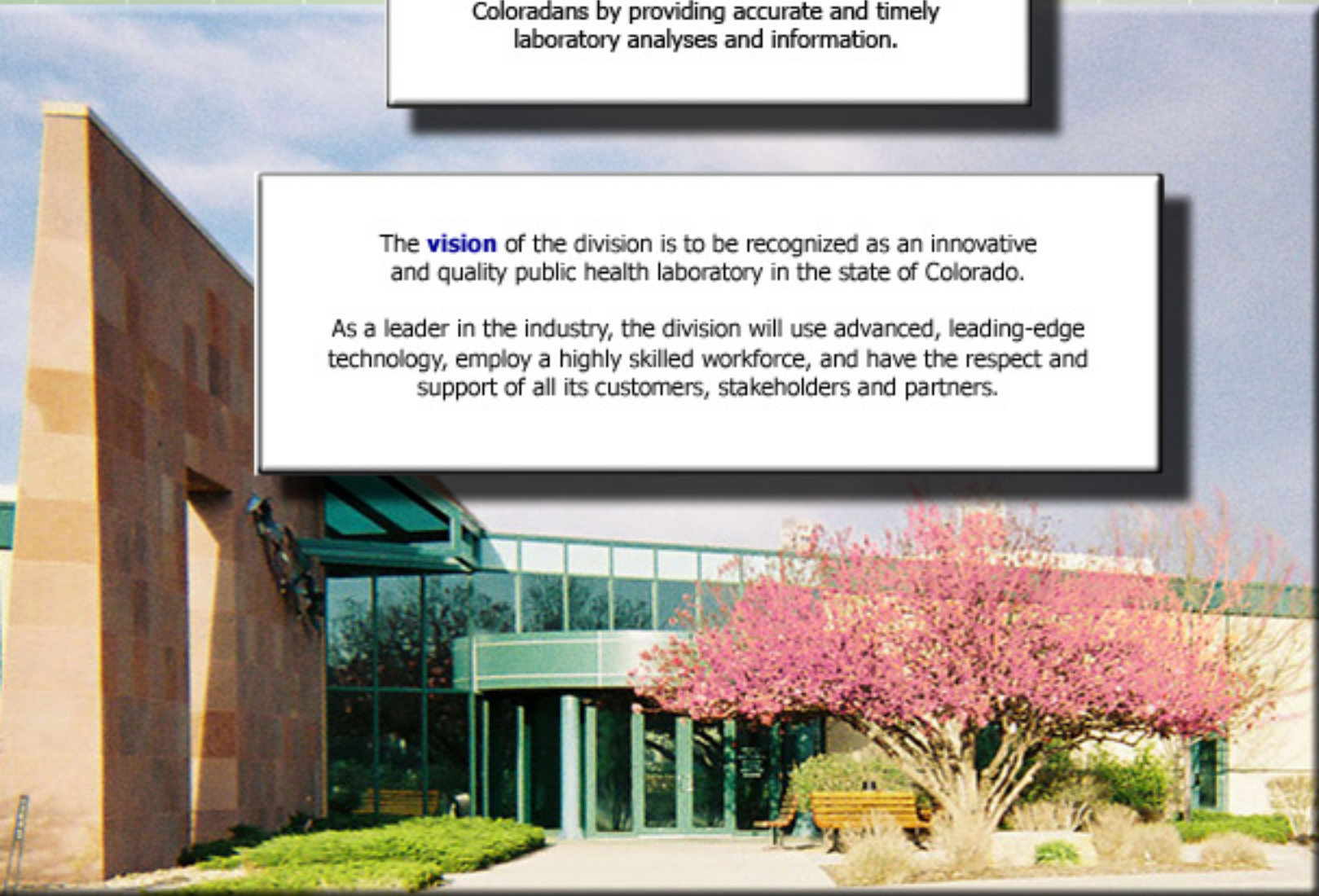


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A Message from the Director



Dear Customers and Stakeholders,

I am pleased to present the division's annual report for the fiscal year ending June 30, 2009.

This past year, we completed the rebuild and implementation of our laboratory information management system. This version incorporates key features to facilitate improved reporting and invoicing of analytical procedures. It is our hope that these features will result in improved customer service.

In spite of the continuing financial challenges, the division was able to mount a first-rate response to the H1N1 influenza outbreak that emerged in late April of this fiscal year. Our pandemic influenza planning and exercises from previous years paid off, and we were able to provide the analytical services necessary to track this outbreak without many of the problems experienced in other states.

The division also was successful in being granted a restoration of state funding for certain epidemiological and surveillance activities during the past legislative session. This will be a great help in addressing the structural deficit we have been dealing with the past three fiscal years.

Thanks to all our customers, professional colleagues and constituents for your continued patronage and support,

David A. Butcher, MBA, MLS (ASCP) SM
Laboratory Services Division Director
Colorado Department of Public Health and Environment

Tracking the 2009 H1N1 Influenza A Virus

The Molecular Science laboratory is characterized by its flexible and rapid response capabilities. The challenges met successfully by this work unit over the past year exercised both of these qualities. New test offerings continue to be developed and implemented by the work unit to enhance existing programs or to support the detection of newly emerging infectious agents that impact the public's health. Molecular-based test methods such as polymerase chain reaction (PCR), pulsed field gel electrophoresis, multilocus variable-number tandem-repeat analysis, DNA sequencing, and high throughput testing protocols are used to provide crucial support to other programs within the Laboratory Services Division and the Department of Public Health and Environment.

The speed and sensitivity provided by molecular testing methods ensure early detection of infectious agents and allow multiple agencies a solid basis from which to mount a public health response sooner than could be done in the past. The most prominent demonstration of the work unit's capabilities came with the emergence of a novel strain of influenza A virus, H1N1.

After completing more than 1,000 tests during the seasonal influenza surveillance program, this new variant (H1N1) of influenza A appeared in Colorado in late April 2009. New test methods were rapidly deployed, and within two days the work unit was certified by the Centers for Disease Control and Prevention to analyze patient samples for the new H1N1 virus. More than 500 samples were tested in May 2009, and all test results were available within 24 hours, supporting public health decisions related to event scheduling and school closures.

Networking Nationwide for Norovirus Identification

Norovirus infection causes a severe gastrointestinal illness, and is acquired by person-to-person and foodborne transmission routes. Outbreaks often are seen in day care centers, nursing homes, cruise ships and university settings. Prevention of foodborne norovirus disease requires safe food and water practices. Attempts to control the spread of noroviruses present a challenge, as the viruses are relatively resistant to environmental conditions. They are known to be able to survive freezing and temperatures as high as 60 °C, and have even been associated with illness after being steamed in shellfish. Moreover, noroviruses can survive in chlorine treatment, well in excess of levels routinely present in public water systems.

Despite these features, it is likely that relatively simple measures, such as correct handling of cold foods, frequent hand washing and paid sick leave, may substantially reduce foodborne transmission of noroviruses. Early detection of gastrointestinal disease due to this highly infectious virus minimizes the spread of illness and lost productivity.

In January 2009, the Molecular Science laboratory joined CaliciNet, a national network for the identification and tracking of norovirus (caliciviruses) outbreaks. Access to the CaliciNet network will allow the state laboratory to track norovirus outbreaks in real time nationwide and influence decisions of public health interest.

Responding to the Re-establishment of Terrestrial Rabies

In Colorado the primary reservoir for rabies is the bat, and for the past decade instances of rabies among other wild animals have been rare. However, over the past two years skunk rabies appears to have become re-established in eastern areas of the state and is moving west toward the Front Range. The re-establishment of rabies in terrestrial animals poses a danger to the public both through human and domestic animal exposures.

The state laboratory has played a vital role in tracking the re-emergence of terrestrial rabies, testing more than 600 specimens for the presence of rabies virus in 2009. Specimens identified as positive for rabies virus included 42 bats of various species, 15 skunks, one raccoon, and one cat (later determined to have a bat strain of rabies). Other interesting animals submitted for rabies testing in 2009 included a bobcat, cows, coyotes, ferrets, horses and foxes.

The state laboratory strives to maintain its excellence in rabies testing, working on the development and implementation of a PCR assay to serve as a confirmatory rabies test for those specimens associated with human bites or exposure. In 2010, the laboratory will implement typing assays that will allow the laboratory to identify the strain of rabies virus present in any positive specimens.

Emergency Preparedness and Response at the State Laboratory

The Laboratory Services Division's role in emergency preparedness and response activities during the fiscal year 2008-09 was uniquely expanded when it was announced in 2008 that the Democratic National Convention would be hosted by the city of Denver in August 2009. These responsibilities were in addition to the ongoing roles of comprehensive laboratory training and proficiency testing programs for clinical and local public health laboratories, as well as an increased number of powder letters which required extensive testing to rule out any biological threats.

Regional Public Health Labs Enhance Statewide Response

After several years of staff training, laboratory remodeling and equipment upgrades, the 2008-09 fiscal year was the first complete year that the five local health departments in Colorado Springs, Denver, Grand Junction, Greeley and Pueblo were all active members of the CDC-sponsored Laboratory Response Network.

Local public health laboratories are expected to be able to identify bacteria or bacterial toxins with the potential to pose a severe threat to public health and safety, also known as "select agents," as defined by the U.S. Department of Health and Human Services and the U.S. Department of Agriculture. In addition to being able to rapidly test for the presence of the select agents responsible for anthrax, brucellosis, glanders, melioidosis, plague and tularemia, these laboratories also are capable of testing for other diseases such as influenza, pertussis (whooping cough) and West Nile virus. The use of newly acquired DNA technology, known as polymerase chain reaction, enabled these facilities to identify these infectious bacteria in only two to three hours instead of two to three days using traditional bacterial growth culture methods. Local public health labs also provide testing surge capacity in the event of any regional or statewide outbreak of disease.

The state lab conducted site visits and inspections of the five local public health laboratories, noting the substantial progress that has been made since the local-state health department partnerships were established in 2001. In addition to these annual site visits, the state lab provided technical assistance to, and performed confirmation testing for, local health departments throughout the year and provided the local health department laboratories with quarterly proficiency testing exercises for identifying unknown bacterial select agents.

Comprehensive Training and Proficiency Testing Programs

Due to employee turnover and improvements in lab testing methods, training of hospital and local public health lab staff is an ongoing process.

Wet workshops offer an excellent training opportunity for hands-on practice with select agent testing and laboratory safety skills to prevent self-infection. The state lab hosted two wet workshops during the fiscal year 2008-09, and approximately 20 clinical lab staff from across Colorado attended the workshops to learn to rapidly identify, rule out or refer to the state lab five bacterial select agents that cause diseases resulting in severe human illness, or even death, if not detected in time for medical treatment. The diseases include anthrax, brucellosis, glanders, melioidosis, plague and tularemia.

Additionally, the state lab hosted an annual meeting of the Colorado Laboratory Forum, which was attended by nearly 30 lab staff members from across Colorado. The meeting provided an opportunity for state and local lab professionals to network; tour the state lab; and attend sessions on current topics such as emerging infectious diseases, new testing technologies and laboratory safety.

Proficiency testing is important in assessing the effectiveness of training, along with statewide laboratory emergency preparedness. During the spring of 2009, 35 clinical and local health department laboratories participated in a statewide proficiency test exercise. In addition to correctly identifying a set of three bacterial unknowns for possible select agents, each laboratory also was required to determine if the specimens could be ruled out for the presence of select agents or presumptively identified and referred to the state lab for confirmation of a select agent. A case study for each of the three unknowns was provided in the test kit, along with report sheets that required the participants to list the tests that were performed and the results of those tests.

Twice yearly, the Association of Public Health Laboratories, Centers for Disease Control and Prevention and College of American Pathologists provide a proficiency testing exercise with unknown organisms to clinical laboratories across the country. The state lab participated in two of these proficiency exercises, serving as the point of contact for clinical laboratories to report their results and a conduit to send the state summary report to the testing service. Eighteen laboratories, including the Public Health Microbiology unit at the state public health lab, participated in this semi-annual exercise.

The state lab also prepares proficiency testing samples in house to send to other regional and national agencies tasked with preparedness roles, to assist them in measuring their testing competency. During the 2008-09 fiscal year, both biological and chemical proficiency-testing materials were provided to the 8th Civil Support Team of the Colorado National Guard for use in its testing program. Monthly proficiency testing samples also were provided to federal analysts in the Denver Biowatch program.

Emergency Response to Biological Threats

As part of the national Laboratory Response Network, the state laboratory helps determine whether perceived or announced biological threats are valid or hoaxes through laboratory testing of samples and specimens. Within the laboratory, Molecular Science, Serology and Public Health Microbiology units coordinate different testing methods to rapidly rule out or confirm the presence of federally designated biological select agents. These agents include bacteria, viruses and biologically produced toxins. Recent technologies enable the laboratory to either rule out or presumptively identify these agents in as few as two to three hours after receipt by the facility. Improved test methods and increased communications with first responders are responsible for these quicker turnaround times.

The state lab is the primary site in Colorado for confirmation testing of bacterial, viral and biological toxin agents. Partners in this response network include the 8th Civilian Support Team of the Colorado National Guard; the Federal Bureau of Investigation; the United States Postal Service Postal Inspection Service; and local fire, HAZMAT and law enforcement teams.

Fiscal year 2008-2009 was a unique and a particularly active year in the state lab emergency response role. Following the announcement that Denver had been awarded the host role for the 2009 Democratic National Convention, a year of planning by federal, state and local agencies began. Organizational meetings established both public health and environmental safety roles for the laboratory. A series of meetings, roundtables and field exercises required participation by the state laboratory. While the convention was a success, with few adverse incidents, there was an alert on the last day of the convention due to a positive reading from an air-sampling device at the venue grounds. State lab analysts responded by traveling to the air sampler, collecting soil and swab samples and returning to the laboratory to conduct confirmation testing. Within two hours of returning the samples to the laboratory, the analysts were able to rule out any threat and determine that natural airborne contamination was the source of the alert. The closing convention ceremonies proceeded without delay or undue concerns for the public.

In addition to the convention, there were many threat letters that the state lab received for testing, including letters mailed to campaign offices, government buildings and an intercepted letter by the United States Postal Service that was addressed to the Governor's Office. The most extensive response was to a series of threat letters sent to branch banks in the Denver metropolitan area as part of a national mailing. Over a period of three days, FBI teams delivered 10 threat letters to the laboratory for testing. All threat letters in this, and the previously mentioned events, were tested and the presence of biological agents was ruled out. Close cooperation with response partners, frequent testing exercises and extensive response plan practicing helped to rapidly identify the threat materials as harmless and relieve the anxiety of Colorado citizens who were victimized by these threats.

Emergency Response to Chemical Threats

During fiscal year 2008-2009, the Chemistry laboratory began validation of the CDC volatile organic compounds in blood procedure. In addition, two state lab analysts were trained in the testing method to detect ricinine and abrine in urine.

Testing the Food Supply for a Quick Response

The Environmental Microbiology laboratory performs both routine food surveillance and outbreak response to foodborne illness. By participating in a number of programs initiated by the CDC, this lab is highly successful in monitoring the quality of retail food products. The laboratory routinely works with the Consumer Protection division of the Colorado Department of Public Health and Environment to obtain food samples for testing related to identified outbreaks.

Bacterial agents such as Salmonella or E. coli O157 have been identified, and contaminated food sources have been linked to the patients suffering from associated illnesses by the Environmental Microbiology lab. In collaboration with the Public Health Microbiology laboratory and the Molecular Science laboratory, the Environmental Microbiology lab was involved in investigating a number of outbreaks of foodborne illness of both local and national importance. Identifying clusters of patients infected by similar bacteria and a possible bacterial contaminant in a food product consumed by all of the affected people enhances the coordinated effort for an effective public health investigation and rapid response to remove the food source from distribution and educate the public.

As the primary site in Colorado for milk testing, a number of analyses are performed on all milk samples by the Environmental Microbiology lab to ensure a safe and quality product is available to consumers. The laboratory was issued a renewed certification by the U.S. Food and Drug Administration as a fully accredited milk-testing laboratory in 2009.

In 2008-09, the Chemistry Program joined the foodborne illness prevention effort by entering into a cooperative agreement with the Food and Drug Administration to enhance food safety. The agreement provides funding to the chemistry laboratory for facility upgrades, supplies and personnel, training in current food testing procedures, testing method development and validation, proficiency testing, and food defense surveillance and assignments.

Water Testing and Environmental Protection

In collaboration, the Organic Chemistry, Inorganic Chemistry, Radiochemistry and Environmental Microbiology laboratories perform water testing from various sources within the state including surface water, rivers and streams, municipal, and private water systems. The large number of water samples tested supports a sustained safe source of drinking water for Colorado.

Highlights of accomplishments in water and environmental testing during the 2008-09 fiscal year include the following:



The Inorganic Chemistry lab added tin to its list of metal testing offered. Tin is a component of many types of soil and may be released in dusts from windstorms, roads and farming activities. Gases, dusts and fumes containing tin also may be released from smelting and refining processes, burning of waste and burning of fossil fuels (coal or oil). ¹ Tin is regulated under the National Pollutant Discharge Elimination System.



The Organic Chemistry laboratory expanded its synthetic organic chemical drinking water test offerings to include testing for the pesticides aldicarb, aldicarb sulfoxide and aldicarb sulfone.



The Chemistry Program continued to support the Environmental Protection Agency and Colorado Department of Agriculture joint pesticide surface water study. The Organic Chemistry laboratory analyzed samples for the insecticides permethrin, bifenthrin and carbaryl, as well as piperonyl butoxide, a synergist added to increase the insecticide's potency.



The Radiochemistry laboratory developed a new method to detect strontium 89 and 90 in a variety of matrices to support monitoring programs at the Hanford site in Washington state.



In a continued effort to monitor exposures to environmental toxins, the Chemistry laboratory conducted analysis of metal content in archived urine collected from the San Luis Valley.

Investing in the Environment - Going Green at the Laboratory

Through cost-effective xeriscaping, the state laboratory saved 2.8 million gallons of water during the 2008 irrigation season alone, generating Denver Water Department rebates of \$14,629. The xeriscape plan began with replacing two acres of Kentucky Bluegrass with Hachita Blue Grama grass, a drought-tolerant grass native to the western Great Plains that thrives in sand or clay soil with full-sun exposure. Grass is mowed only once a year, in the fall, generating additional carbon savings.

Flowerbeds were planted with drought-resistant ornamental grasses and flowers. Some of the plants used include iris, heather, hollyhock and daylily, along with native plants such as yucca and coneflower.

While it took a couple of years to get everything established, and to eliminate most of the weeds, the property now demonstrates the beauty and versatility of xeriscape planting.

In an effort to continue responsible gardening, the front entrance of the state lab was given a natural-looking Rocky Mountain landscape complete with evergreen trees, native and xeriscape flowers, sand and rock outcropping, all funded through a grant received in the summer of 2009.

Other "green" procedures inaugurated in 2008-09, include the following:

- An updated recycling program that encourages a three-tier recycling program
- Improvements in water efficiency, reducing weekly indoor water usage nearly in half
- Motion and timer sensor light switches that turn off lights when a room is not in use

The state laboratory plans to have the building Leadership in Energy and Environmental Design-certified in 2010 by implementing changes to meet a set of standards for environmentally sustainable buildings.

Technology Improvements

Redesigned Information System

In November 2008, the laboratory Information Technology (IT) staff members released a redesigned version of the Laboratory Information Tracking System (LITS+). This new version of LITS+ has the capacity to track every specimen received in the laboratory, track fees in a number of formats and interface with the department's accounting and billing systems to generate invoices.

Benefits to both the Laboratory Services Division and its customers include the following:

- Streamlined Fiscal Unit administrative tasks related to invoicing customers
- More efficient, cost-effective and more accurate billing
- Ability for program managers to monitor workload in their units
- Improved monitoring of grants to determine the status of funds available
- Greater efficiency for data entry of customer specimens/samples, reducing the risk of error

Testing Law Enforcement Officers Online

In 2008-09, the Training Program designed online certification exams for law enforcement instructors and operators of the Intoxilyzer 5000EN equipment. This advancement will improve the Evidential Breath Alcohol Testing Program's ability to administer and grade exams, as well as track certifications through the department's learning management system, CO.TRAIN. A reduction of paper usage and mailing costs also will be realized through these advancements, as officers at their agencies can print their certificates directly from CO.TRAIN upon successful completion of the certification requirements online.

Continued Commitment to Our Citizens

A number of additional programs at the Laboratory Services Division provide ongoing services which are paramount in protecting the health and safety of Colorado citizens and the environment in which they live. These programs include Newborn Screening, Toxicology, Evidential Breath Alcohol Testing and Certification.

Screening Newborns for Disorders

The Newborn Screening laboratory is the designated laboratory in the state to conduct tests for 30 metabolic conditions in newborns. This program is supported through fees for testing and follow-up.

Newborn screening is done shortly after birth by collecting a few drops of blood from the baby's heel on a special piece of filter paper. Colorado infants receive a second newborn screening, usually at the first well-baby checkup (at 8 to 14 days old). A second screen is performed because some conditions may not manifest until later, following discharge from the hospital or birthing center.

The medical conditions that are detectable by this screen may show no obvious symptoms in newborns, but can cause severe illness, mental retardation and, in some cases, death if not found and treated very early in life.

The Newborn Screening uses tandem mass spectrometry technology, or MS/MS, to screen for these metabolic disorders and the lab works in conjunction with metabolic physicians from The Childrens' Hospital of Denver, refining the standards used to define abnormal MS/MS findings, and reducing the number of abnormal calls that did not result in the diagnosis of a true case of illness.



Drug and Alcohol Testing

The Toxicology laboratory routinely analyzes blood and urine specimens for ethyl alcohol, drugs of abuse and volatile substances to assist law enforcement agencies in administering drinking and drugged driver laws. The Toxicology Laboratory provides testing for the forensic community that is sensitive and conclusive for drugs in blood, urine or solid dose materials (pills, powders, etc.). Customers served by the Toxicology Laboratory include professionals from law enforcement, drug treatment centers, youth facilities, community corrections, individuals, hospitals, and public and private attorneys.

Blood Alcohol Testing

Blood alcohol specimens are analyzed by headspace/gas chromatography. All samples are analyzed in duplicate by dual columns.

Blood and Urine Drug Testing

The laboratory uses a range of carefully controlled chromatographic and immunoassay techniques for detecting and confirming the presence of drugs of abuse in blood and urine specimens.


Blood samples are screened by Enzyme-Linked ImmunoSorbent Assay (ELISA) and urine samples are screened by Enzyme Multiplied Immunoassay Technique (EMIT). Confirmations are performed using gas chromatography mass spectrometry (GC/MS).

The standard 10 drug panel identifies the following drugs:

- Alcohol
- Amphetamines
- Barbiturates
- Benzodiazepines
- Cannabinoids (THC)
- Cocaine
- Methadone
- Opiates
- Phencyclidine (PCP)
- Propoxyphene (Darvon)

Additional services provided by the Toxicology laboratory include:

- Expert testimony
- Lysergic acid diethylamide (LSD) identification
- Prescription drug testing
- Specimen adulteration tests,
such as specific gravity and creatinine
- Toxic vapors (inhalants) identification
- Unknown pill and powder identification



Certifying Laboratories

Federal and state authoritative agencies establish regulations pertaining to quality standards of performance to ensure the accuracy, reliability and timeliness of laboratory testing required for labs to gain certification. Administration of these regulations is accomplished through the Laboratory Services Division's Certification Program.

The Certification Program conducts on-site inspections to ensure that testing laboratories meet established certification standards in the following 12 essential areas: personnel qualifications; standard operating manuals; analytical processes; proficiency testing; quality control; security; chain of custody processes; specimen retention; work and storage space; records; results reporting; quality assurance.

Certification by Laboratory Type

Clinical Laboratories

Under the Clinical Laboratory Improvement Amendments (CLIA), a clinical laboratory is defined as any facility that performs testing on specimens derived from humans for the purpose of providing information for the diagnosis, prevention or treatment of disease; or impairment or assessment of health.

The U.S. Congress passed CLIA in 1988, establishing quality standards for all clinical laboratory testing and placing all clinical laboratories under the authority of the amendments. The Centers for Medicare and Medicaid Services administer CLIA at the federal level.

Clinical laboratories that receive Medicare or Medicaid payments must be CLIA-certified. Colorado provides CLIA certification for in-state clinical laboratories. As part of the certification process, CLIA clinical laboratories are required to analyze proficiency-testing samples three times per year in the same manner and by the same individuals as those performing the patient testing.

The Certification Program conducts required on-site inspections every two years to ensure sustained compliance with CLIA requirements.

Drinking Water Laboratories

The Safe Drinking Water Act is the main federal law that ensures the quality and safety of drinking water for Americans. Either the Environmental Protection Agency or the state in which testing is performed must certify laboratories that analyze drinking water samples for compliance with the Safe Drinking Water Act.

The Certification Program conducts on-site inspections every two years for in-state drinking water testing laboratories and select out-of-state laboratories.

Milk Laboratories

The FDA promotes and helps ensure compliance with the model Laboratory Quality Assurance Branch, Grade A Pasteurized Milk Ordinance (PMO), a document that is recommended for legal adoption by states, counties and municipalities to encourage a greater uniformity and a higher level of excellence of milk sanitation practice in the United States.

In the state Certification Program, a milk laboratory evaluation officer (LEO) evaluates and certifies dairy testing laboratories to ensure compliance with the FDA's Laboratory Quality Assurance Branch, Grade A PMO. The LEO reviews the quality systems used by laboratories testing raw and finished milk products as well as dairy plants that perform antibiotic screening of bulk milk tankers.

Alcohol and Drug/Toxicology Laboratories

Under the Colorado Department of Public Health and Environment's Rules and Regulations Concerning Testing for Alcohol and Other Drugs, the Certification Program annually inspects all law enforcement intoxication and drug laboratories that perform tests on subjects arrested under substance abuse laws as they relate to driving and issues certifications when facilities demonstrate compliance with department standards.

Forensic toxicology laboratories are certified for one or more of the following testing categories:

- blood alcohol
- blood drugs
- urine drugs
- post-mortem

As part of the certification process, alcohol and drugs/toxicology laboratories are required to analyze proficiency-test samples from commercial vendors three times per year.

Certifying Intoxilyzers, Operators and Instructors

The Intoxilyzer 5000EN is the evidential breath alcohol testing instrument used by law enforcement agencies in Colorado to determine whether a person is driving under the influence of alcohol. The results from the Intoxilyzer 5000EN have been proven to be scientifically accurate and precise. Results generated by the Intoxilyzer 5000EN are the only breath testing results that are allowed as evidence in Colorado courts.

The rules governing the DUI/DWAI program in Colorado are the Rules Pertaining to Testing for Alcohol and Other Drugs (5 CCR 1005-2). These rules are established by the Colorado Department of Health and Environment and approved by the Colorado Board of Health.

Maintaining and Certifying Equipment

The division's Evidential Breath Alcohol Testing (EBAT) program routinely maintains, repairs, calibrates and annually certifies the Intoxilyzer 5000EN instruments for use by state law enforcement officers. The EBAT program also conducts on-site inspections annually to ensure instruments are being operated in an adequate environment.

Additionally, the EBAT program approves preliminary breath testing devices and ignition interlock devices. Law enforcement officers use preliminary breath testing devices to establish "probable cause" for arrest for driving under the influence of alcohol. However, the results generated by these devices are not considered of evidentiary quality and are not admissible as evidence in Colorado courts.

Training and Certifying Law Enforcement Officers

The EBAT program is responsible for certifying law enforcement officers operating the Intoxilyzer 5000EN to perform DUI testing on suspected drunk drivers. It is responsible for certifying those law enforcement officers who act as instructors, verifying their competency as qualified to teach their staff how to operate the equipment.

Intoxilyzer 5000EN operators undergo an initial certification process with the EBAT program and are subsequently re-certified by a qualified instructor at an approved law enforcement facility using the equipment.

All records of certification for each instructor and operator are maintained at the law enforcement agency.

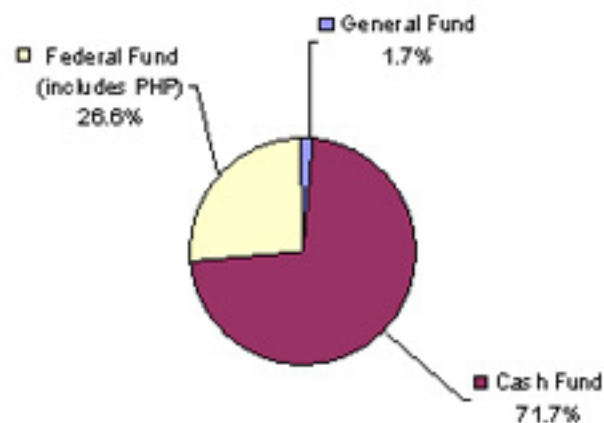
Overview of Fiscal Year 2008-09 Laboratory Funding

Federal grant funding and cash revenues, generated through fees for laboratory services, represent the main sources of funding for the operation of the Laboratory Services Division's programs.

Grants Received

Public Health Emergency Preparedness
Consumer Protection Division (CPD) - Food and Drug Administration Grant
Epidemiology and Laboratory Capacity
Tuberculosis Elimination and Laboratory Program
Emerging Infections Programs
Pandemic Influenza Grant
Public Health Biomonitoring Planning Grant
Refugee Preventive Health Grant
Public Health Laboratory Interoperability Program
Preventive Health and Health Services Block Grant
Clinical Laboratory Improvement Amendments
Environmental Epidemiology Division
DCEED - Syphilis Serology Grant
DCEED - Human Immunodeficiency Grant
Food Safety and Security Monitoring Project (Chemistry)
Prevention Services Division (Fluoride)
Colorado Department of Transportation (CDOT) - Intoxilyzer Maintenance Program
Criminal Justice (DOJ) - Paul Coverdell National Forensic Sciences Improvement

LSD FY2008-09 FUNDING SPLITS - Total Appropriation \$10,090,121



Cash Revenues by Program

Certification	\$ 87,087
Public Health Micro (includes Chlamydia)	\$ 373,734
Toxicology	\$ 672,769
Chemistry	\$ 338,906
EBAT	\$ 12,438
Env Micro	\$ 168,664
Serology (in HIV and Rabies)	\$ 150,054
Molecular/Virology	\$ 179,852
NBS	\$ 4,089,545
Total Fee Revenues	\$ 6,073,049

Other Cash Revenues by Source

LEAF	\$ 775,613
WQCD	\$ 452,052
APCD (Odor School)	\$ 7,430
Misc other Cash	\$ 467
Total Other Cash	\$ 1,235,562

Total Cash Revenues \$ 7,308,611

Expenditures - Fiscal Year 2008-09

Total Indirect Paid	\$ 1,256,889
Total Personal Services	\$ 5,827,867
Total Operating	\$ 2,945,797

Total Expenditures \$10,030,553

INORGANIC CHEMISTRY:

Sample Submitter	FY 08	FY 09
Hazardous Materials	4	84
Water Quality Control Division - River/Streams	21,546	25,968
Water Quality Control Division - Tech Svcs	202	469
Water Quality Control Division - CORADS	NA	492
Cash - Municipal	7,866	15,536
Cash - Private	6,677	10,602
Dental Health	724	744
Consumer Protection	21	63
Air Pollution	0	0
Colorado Geological Survey	0	0
Human Biomonitoring	120	1,371
Other Tests	452	767
Quality Control Audits	161	176
Total Analyses	37,773	56,272
# of Specimens	5,499	7,010

ORGANIC CHEMISTRY:

Sample Submitter	FY 08	FY 09
Hazardous Waste	0	
Water Quality Control Division - River/Streams	154	
Water Quality Control Division - Tech Svcs	121	
Cash - Municipal	1,294	
Cash - Private	239	Included in Inorganic Chemistry Section
Dental Health	0	
Consumer Protection	6	
Air Pollution	0	
Other Tests	32	
Quality Control Audits	62	
Total Analyses	1,908	
# of Specimens	430	

ORGANIC CHEMISTRY:

	FY 08	FY 09
VOC Screen	58	45
SVOC Screen	5	1
TOC	49	147
Oil and Grease	9	5
VOC Regulated	25	72
SOC Regulated	2	22
TTHMs	103	140
HAAs	98	155
EDC/DBCP	0	34
Insecticides	0	25
Totals	349	646

RADIOCHEMISTRY:

Radiochemistry Sample Submitter	FY 08	FY 09
Cash Funded	754	Included in Inorganic Chemistry Section
Rocky Flats Program	0	
Hazardous Materials (non-Rocky Flats)	24	
Water Quality Control Division	578	
Other Agencies	18	
Quality Control Audits	12	
Total Analyses	1,386	
Radiation Counting Facility Analyses		
C-14	12	Included in Inorganic Chemistry Section
Gamma Spectroscopy	31	
Gross Alpha/Beta water	492	
Gross Alpha/Beta contamination survey	236	
Ni-63 Contamination surveys	18	
Radon 222	103	
Radium 226	183	
Radium 228	189	
Americium 241	3	
Plutonium-238/239	3	
Isotopic thorium	11	
Isotopic uranium	180	
Total uranium	131	
Whole Body Counts	18	
Quality Control Audits	7	
Total Analyses	1,617	
Total Number of Analyses	2,984	Included in Inorganic Chemistry Section
QA/QC	19	
Total Analyses	3,003	
Total Samples Submitted	478	

TOTAL FY09 CHEMISTRY TESTS 56,272

PUBLIC HEALTH MICROBIOLOGY		
	FY 08	FY 09
<i>Campylobacter</i> Cultures	221	147
Isolates:	107	73
<i>Campylobacter</i> Confirmations	45	48
Isolates:	31	22
<i>Chlamydia</i> Specimens		
CT & GC Tested by Aptima	34,948	26,253
Positives	1,314	1,479
GC (Gonorrhea) Positive	56	20
CT (<i>Chlamydia</i>) Positive	1,211	1,446
CT & GC Positive	47	13
Enteric Culture Isolates	2,014	2,081
<i>Salmonella</i> Positive	756	638
<i>Shigella</i> Positive	125	157
<i>E. coli</i> 0157 Positive	197	266
Fungus	0	3
Positives	0	1
<i>Neisseria</i> Specimens (Isolates)	16	37
<i>N. gonorrhoeae</i>	0	22
<i>N. meningitidis</i>	15	7
Ova and Parasite Testing		
Specimens Examined	1,506	2,060
Positives	724	676
Reference Bacteriology		
Miscellaneous Cultures	1,258	808
<i>Y. pestis</i> (Plague)	90	14
<i>Yersinia</i> (other)	14	12
<i>V. cholerae</i> (Vibrio)	23	15
<i>Francisella tularensis</i> (Tularemia)	95	8
<i>B. anthracis</i> (Anthrax)	16	33
Total Reference Identifications	1,496	890
Positives	139	229
Specimens Submitted to the CDC*	161	60
Positives	39	37
Streptococcus Culture		
Specimens (Group A, Group B, <i>Strep pneumoniae</i>)	707	1,572
Positives	0	185
Group A		
Group B		
<i>Strep pneumoniae</i>		
Tuberculosis Specimens	1,146	1,238
Isolates:		
<i>M. tuberculosis</i> Complex	13	28
Avium Complex	0	19
Smear Positive	49	37
Culture Positive	87	47

TOTAL FY09 PUBLIC HEALTH MICROBIOLOGY TESTS	34,389
TOTAL FY09 ABNORMALS	3,923

ENVIRONMENTAL MICROBIOLOGY		
<i>Water Analyses</i>	FY 08	FY 09
Drinking Water Specimens		
Private Specimens	1,511	2,279
Municipal Specimens	4,532	3,863
Miscellaneous Tests in Drinking Water (Confirmation, Fecal, Strep, Coliform)	182	0
Waste Water		
Sewage Effluents Analyses	207	28
Stream Pollution Study Specimens	778	739
Miscellaneous Analyses (Confirmation, Fecal, Strep, Coliform, Legionella)	8	177
Total	7,218	7,086
QA/QC	N/A	104
Total Water Analyses	7,218	7,190
<i>Food Analyses</i>		
Food Samples	643	523
Total Food Analyses	2,280	1,307
QA/QC	224	388
Total Food Analyses	2,504	1,695
<i>Milk Analyses</i>		
Finished Milk	1,460	1,138
Raw Milk	312	215
Coliform (Plate count for total coliform bacteria)	1,438	1,411
DMSCC (Direct Microscopic Cell Count)	216	409
Freezing Point (test for added water)	207	232
Inhibitors (test for antibiotics in milk)	1,116	1,151
Phosphatase (test for complete pasteurization)	1,043	1,150
Standard Plate Count (total bacterial content of milk)	1,427	1,362
%Fat	1,045	1,148
Total Milk Tests	6,492	6,863
QC	525	540
Total Milk Analyses	7,017	7,403

TOTAL FY09 ENVIRONMENTAL MICROBIOLOGY TESTS 16,288

SEROLOGY

Syphilis Serology	FY 08	FY 09
Routine RPR	12,536	12,577
Reactive	372	371
VDRL (Spinal Fluid)	255	224
Reactive	9	5
VDRL (non-Spinal Fluid)	8	9
Reactive	8	5
FTA	1,454	290
Reactive	538	96
Syphilis TPPA	N/A	1,129
Reactive	N/A	414
Titer	344	371
Reactive	322	371
Total Syphilis Analyses	14,597	14,600
Total Syphilis Reactive	1,249	1,219
Virus Complement Fixation		
Number of Specimens		
Paired sera	0	0
Single sera	0	0
Total VCF Analyses	0	0

TOTAL FY09 SEROLOGY TESTS	31,478
TOTAL FY09 SEROLOGY ABNORMALS	2,683

SEROLOGY

	FY 08	FY 09
<i>ELISA Serology</i>		
Measles IgM	3	6
Positive	0	0
Mumps IgM	0	2
Positive	0	0
West Nile Virus	125	24
Positive	13	3
Hantavirus		
Human IgG	183	54
Reactive	2	0
Human IgM	184	68
Reactive	9	2
Total ELISA Analyses	495	154
Total ELISA Positives	24	5
<i>Febrile Serology</i>		
Brucella	14	1
Positive	2	0
Tularemia	0	3
Positive	0	0
Total Febrile Analyses	14	4
Total Febrile Positives	2	0
<i>Hepatitis Serology</i>		
Hepatitis A	7	11
Reactive	0	3
Hepatitis B Surface Antigen (HBsAG)		
Refugee sera	704	1,014
Reactive	N/A	43
Non-refugee sera	98	28
Reactive	54	0
Anti-Hepatitis B Surface Antibody (Anti-HBs)		
Refugee sera	704	1,013
Reactive	N/A	288
Non-refugee sera	52	50
Reactive	274	26
HBsAG Neutralization		
Refugee sera	54	41
Reactive	N/A	39
Non-refugee sera	0	0
Reactive	54	0
Hepatitis C	438	419
Reactive	0	70
Total Hepatitis Analyses	2,057	2,576
Total Hepatitis Reactives	382	99

SEROLOGY

<i>Human Immunodeficiency Virus</i>	FY 08	FY 09
EIA		
HIV-1 RNA, TMA (pooled)	7,509	7,516
HIV-1 RNA, TMA (non-pooled)	146	189
Reactive	13	19
HIV-1, 2 plus O EIA	1,994	4,533
Reactive	54	123
HIV-1/2 Multispot	15	32
Reactive	0	0
ELISA		
Serum	1,210	423
Oral Fluid	1,814	353
Total ELISA reactive	142	776
Western Blot	19	441
Total WB positive	18	371
HIV-2	52	0
HIV reactive	11	0
Total HIV Analyses	12,759	13,487
Total HIV Reactive	238	1,289
IFA Serology		
Rocky Mountain Spotted Fever ²	1	0
Positive	0	0
Legionella pneumophila	0	0
Positive	0	0
Coxiella burnetti (Q Fever)		
Phase I	0	1
Phase I Positive	0	1
Phase II	0	1
Phase II Positive	0	0
Total IFA Serology Analyses	1	2
Total IFA Serology Positives	0	1
<i>Plague - Animal</i>		
Total Plague specimens	1	3
Testing Positive	0	0
<i>Plague - Human</i>		
Total Plague specimens	0	1
Testing Positive	0	0
<i>Rabies</i>		
Specimens Examined	692	651
Specimens with bite exposure	326	125
Specimens testing positive	40	70
<i>Rubella Serology</i>		
Premarital Specimens Total	0	0
Specimens with titer <1:10	0	0
Miscellaneous	0	0
Positive	0	0
<i>Specimens Sent to the CDC**</i>	96	47

MOLECULAR

	FY 08	FY 09
<i>Molecular Typing</i>		
Pulsed Field Gel Electrophoresis		
Burkholderia cepacia	0	0
E. coli O157	108	176
other E. coli STEC	57	66
Klebsiella	0	0
Legionella pneumophila	0	0
Listeria monocytogenes	5	12
Methicillin-resistant Staphylococcus aureus	70	70
Pseudomonas aeruginosa	0	0
Salmonella	747	649
Shigella sonnie	62	120
Shigella flexneri	49	34
Shigella boydii	1	3
Streptococcus	0	2
Other	29	50
Total Molecular Typing	1,128	1,182
<i>Influenza**</i>		
Total Influenza A and B Cultures	0	0
Influenza A Positive	0	0
Influenza B Positive	0	0
Parainfluenza virus 1 culture	0	0
Positive	0	0
Parainfluenza virus 2 culture	0	0
Positive	0	0
Parainfluenza virus 3 culture	0	0
Positive	0	0
Total Virology	0	589
Total Virology Positives	0	261

**Influenza testing methodology changed to polymerase chain reaction (PCR) beginning in FY2005 with full implementation 7/1/2007.

TOTAL FY09 MOLECULAR TESTS	10,514
TOTAL FY 09 MOLECULAR ABNORMALS	1,325

MOLECULAR

<i>Polymerase Chain Reaction</i>	FY 08	FY 09
Anthrax	2	4
Positive	0	0
Brucella spp.	17	14
Positive	1	0
Burholderia spp.	0	3
Positive	0	0
Coxiella Burnetti	N/A	4
Positive	N/A	0
H ₂ N ₂ Influenza A	N/A	589
Positive	N/A	261
Influenza A	202	1,009
Positive	100	490
Influenza B	180	656
Positive	20	32
Mumps	8	3
Positive	1	0
Norovirus	1339	1,761
Positive	442	483
Orthopox	N/A	3
Positive	N/A	0
Pertussis	633	438
Positive	17	13
Plague	227	19
Positive	5	2
Ricin	1	3
Positive	0	0
RSV	7	13
Positive	5	7
Shigella	10	0
Positive	0	0
St Louis Encephalitis	331	590
Positive	0	0
Tularemia	212	10
Positive	9	1
Varicella-Zoster Virus	0	1
Positive	0	0
Variola	0	0
Positive	0	0
West Nile, RT-PCR		
Bird/Mosquito Specimens	1,854	3,713
Positive	35	36
Human	1	0
Positive	0	0
Western Equine Encephalitis	330	490
Positive	0	0
Total Polymerase Chain Reaction	5,354	8,734
Total Polymerase Chain Reaction Positives	635	1,064
DNA Sequencing	30	9

*DNA Sequencing added in FY08

TOXICOLOGY

	FY 08	FY 09
Blood Alcohol	5,598	6,059
Methamphetamine Wipes	19	0
Blood Drug Analyses*	4,142	7,063
Confirmations	651	1,240
Urine Analyses	19,310	15,040
Confirmations	3,091	3,155
Total Specimens Received	8,214	8,498
Total Analyses (includes confirmations)	32,811	32,557
QA/QC	12	15
Total Analyses	32,823	32,572
<i>Other</i>		
Court Appearances	152	140
Litigation Packages	367	323

TOTAL FY09 TOXICOLOGY TESTS 32,572

EVIDENTIAL BREATH ALCOHOL TESTING

	FY 08	FY 09
Technical & Court Assistance/Expert Testimony	575	645
Alcohol standard solutions	2,400	2,240
Breath test operator/instructor certification	4,104	1,575
Instrument Certification	378	320
Facility on-site inspections	112	133
Number of facilities cited for deficiencies	47	53
Proficiency Testing/QA	80	N/A
Certified record and subpoenas processed	838	1,190
Alcohol Class Kits Prepared	215	212

Number of law enforcement officers trained annually in the proper usage and maintenance of breathalyzer equipment. 1,575

CERTIFICATION

	FY 08	FY 09
Laboratory Certifications		
CLIA Laboratory Certifications	229	213
Number of laboratories cited for deficiencies	180	192
NCIMS Certifications	8	7
Drug Residue Certifications (LEAF)	11	10
MQSA Inspections	12	12
Safe Drinking Water (SDW) Act		
Radiochemistry Certifications	1	2
Microbiology Certifications	28	28
Chemistry Certifications	19	17
Number of SDW laboratories cited for deficiencies	38	39
Desk Survey Reviews (in-state)	97	46
Desk Survey Reviews (out-of-state)	44	41

TOTAL FY09 CERTIFICATION SURVEYS | 376

NEWBORN SCREENING

Submitter State	FY 08			FY 09		
	Specimen Totals	2nd Screens	Total Analyses	Specimen Totals	2nd Screens	Total Analyses
Colorado						
Initial	70,707	64,939	2,505,076	69,322	63,486	2,454,740
Wyoming	7,157	6,071	250,050	7,154	6,261	251,293
Other States/Territories	3,845	1,842	124,399	3,394	1,490	108,856
Total	81,709	72,852	2,879,525	79,870	71,237	2,814,889
QA/QC	4,400	4,000	8,400	4,400	4,000	8,400
Total Analyses	86,109	76,852	2,887,925	84,270	75,237	2,823,289

NEWBORN SCREENING

	FY 08	FY 09
Total Abnormals		
Congenital Adrenal	779	721
Hemoglobin Abnormals	3,298	2,828
Phenylketonuria	62	76
Biotinidase Deficiency	304	352
Hypothyroidism Abnormals	1,572	1,255
Cystic Fibrosis Abnormals ¹	276	1,975
Galactosemia Abnormals	3	1
MS/MS	423	504
Total Abnormals	6,717	7,712

¹ Detection level lowered from 105 to 60 towards end of FY2008.

TOTAL FY09 NEWBORN SCREENING TESTS	2,823,289
TOTAL FY09 NEWBORN SCREENING ABNORMALS	7,712

		TRAINING EVENTS FY 09
	↙	<i>(Attended by CDPHE Lab staff)</i>
	↘	<i>(Attended by Sentinel Laboratories*)</i>
X	X	BSL-3 Practices in a BSL-2 Lab
X	X	Clinical Role in Food Outbreak Investigations
X	X	FDA Laboratory Perspectives on Food Safety & Public Health
X	X	Transporting Patient Specimens for Chemical Terrorism Testing
X		2009 Training Course for Radioanalytical Laboratory Personnel
	X	Additional Important Lab Safety Topics - Clinical Laboratory Safety - 101 Series
X		After Action Report on Recent Multistate Salmonella Outbreak & Peanut Butter Products
X		Agilent LC Tips and Tricks Seminar
X		Alkalinity Titrator Techniques
X		American Academy of Forensic Sciences 61st Annual Meeting
X		Annual Ethics Training for Environmental Labs
X		APHL Annual Meeting & Third State Environmental Lab Conference: Charting the Next Frontier
X	X	Biosafety: Assessing the Risk
X	X	Carrier Gases in Capillary GC
X		Centennial Chapter CLMA Winter Meeting
X	X	Colorado Emerging Infections Program - 2008 Fall Meeting
X	X	Detecting, Reporting, and Monitoring Carbapenemases
X		Determining Surge Capacity in Public Health Laboratories
X	X	Emerging and Resurging Infectious Diseases: 2009 Update
X		Environmental Laboratory Detection Limits
X	X	Guidelines for the Diagnosis of STEC Infections: Best Practices Promote Good Outcomes
X		HIV Testing: Methodology and Practice
X		How to Combine Methods, Programs, and Standards
X		HPLC Separation Fundamentals
X	X	Influenza Virus H1N1 (Swine-like) and the Clinical Laboratory
X		Interoperable Electronic Newborn Screening Laboratory Reports
X		Introduction to Capillary GC
X		ISO 15189 Series
X		Molecular Testing in Newborn Screening
X		National Laboratory Trainer's Conference V
X		New Technology for Challenging Food Safety and Environmental Applications
X		Role of Clinical Diagnostic and Public Health Labs in Enteric Disease Surveillance & Response
X		Plasmodium knowlesi: Simian Malaria in Humans
X		Replacing NELAC Standards with the New TNI Standards
X	X	Requirements for Laboratories Exempted from Select Agent Registration
X		Ricinine/Abrine by LC/MS/MS
	X	Sentinel Lab Wet Workshop: Anthrax, Plague, Tularemia, Brucella and Burkholderia
X	X	Training Series: Clinical Laboratory Safety
X		Updates in Diagnostic Detection of Free-Living Amoeba
X		Using CLSI Guidelines for Training and Competency Assessment
X		xMAP Technology in the Clinical Lab

BRANCH LAB - GRAND JUNCTION		
	FY 08	FY 09
Environmental Microbiology		
Water Bacteriology		
Samples Tested	4,147	4,716
QA/QC	160	142
Milk Bacteriology		
Samples Tested	875	886
QA/QC	364	380
Total Environmental Microbiology	5,546	6,124
Public Health Microbiology		
Streptococcus Cultures		
Specimens	2,343	2,157
Positives	478	567
Plague DFA		
Specimens	1	0
Positives	0	0
Plague PCR		
Specimens	1	0
Positives	0	0
Syphilis Serology (RPR)		
Specimens	142	149
Positives	0	0
Tularemia Culture		
Specimens	1	0
Positives	0	0
Tularemia PCR		
Specimens	1	0
Positives	0	0
West Nile		
Bird/Mosquito Specimens	262	77
Positive	14	0
Yersinia Culture		
Specimens	1	0
Positives	0	0
QA/QC	316	186
Total PH Microbiology/ Serology	3,068	2,569
Total PH Microbiology/ Serology Positives	492	567

TOTAL FY09 BRANCH LAB TESTS	8,693
TOTAL FY09 BRANCH LAB ABNORMALS	567

Total number of laboratory tests performed during fiscal year 2008-09	3,013,495
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Total number of results detected in excess of established standards (abnormal results)	16,210
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Information sources:

Pg. 13 - 'Toxicology Profile for Tin and Tin Compounds, US Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, August 2005.

Image sources:

Centers for Disease Control and Prevention - Public Health Image Library (PHIL) and Photospin. All images have been used with permission, or are believed to be in the public domain.

Pg. 5 (H1N1): CDC-PHIL

Dr. Terrence Tumpey

Pg. 6 (Norovirus): CDC-PHIL

Charles D. Humphrey

Pg. 7 (Rabies): CDC-PHIL

Dr. Tierkel

Pg. 9 (Anthrax): CDC-PHIL

Courtesy of Larry Stauffer

Oregon State Public Health Lab

Pg. 12 (E.coli O157): CDC-PHIL

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Annual Report

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