HAZARD ANALYSIS OF BROOMFIELD ENVIRONMENTAL SERVICES FIELD OPERATIONS

This Hazard Analysis evaluates risks presented by field operations job tasks performed by City and County of Broomfield Environmental Services personnel.

Broomfield Environmental Services personnel are often called upon to perform a wide range of tasks concurrently under varied conditions. It is therefore difficult, and of little use to personnel in the field, to attempt to provide a detailed, sequential listing of steps required to perform these tasks. Of greater value to the worker is the identification of hazards known to be present or which might be reasonably expected to exist, and measures to be used to prevent or control the hazards. This Hazard Analysis specifically addresses field operations, and utilizes information gathered from sources including the *Broomfield Administrative Policies and Procedures*, the *Broomfield Employee Handbook*, the *Broomfield Safety Program and Safe Work Practices* documents, and the federal safety websites including *Occupational Safety and Health Administration* (OSHA). Detailed information concerning chemical and biological laboratory operations, as well as laboratory chemical hazards and control measures, is presented in the *Broomfield Environmental Laboratory Chemical Hygiene Plan* and the *Broomfield Wastewater Reclamation Facility Chemical Hygiene Plan*.

Environmental Services field operations job tasks include:

- Collect, process, and preserve samples from various indoor and outdoor locations, which may
 include water treatment plant and distribution system, reservoirs, streams, ponds, wells, and
 ditches.
- Transport and operate boat, oars, and battery-powered electric trolling motor to collect pond and reservoir samples.
- Operate electronic and manual instrumentation.
- Clean sampling equipment, instrumentation, and vehicles.
- Put equipment away in designated storage areas.
- Clean, maintain, and operate an environmental sampler at a remote location on the former Rocky Flats Site.
- Operate City and County vehicles for the purpose of collecting samples, investigating consumer concerns, delivering samples to contract laboratories, and other City and County business.
- Carry a portable operational cellular phone for routine and emergency communications.
- Immediately notifying the Laboratory Supervisor of any unsafe conditions, near-misses, vehicle
 accidents, work-related injury, or illness. If an employee is injured on the job employees must
 complete the <u>First Report of Injury</u> and be given the <u>Choice of Provider Letter</u>. Please refer to the
 <u>Safety Policy</u> for specific information on reporting injuries under section IV. Accident Reporting or
 the <u>Safety webpage</u>.

Specific hazards and measures to control or eliminate the hazards are described below in Table 1.

TABLE 1:	HAZARD ANALYSIS OF ENVIRONMENTAL SERVICES FIELD OPERATIONS
HAZARD	PREVENTION or CONTROL MEASURES
Heat and Sun Exposure	Heat stress (Hyperthermia) is a potentially life-threatening situation, and exposure to direct sunlight is a related component.
	Wear light, loose-fitting clothing to allow perspiration to evaporate.
	Consider wearing a vented wide-brimmed hat to keep sun from warming the head and neck, while allowing perspiration to evaporate.
	Avoid strenuous exercise during mid-day – consider scheduling outdoor tasks early to take advantage of cooler conditions.
	Carry and drink plenty of cool water to replace lost fluids.
	Utilize the field vehicle A/C to provide a cool break.
	Wear high SPF sunscreen to minimize UV light exposure.
Cold	Cold stress (Hypothermia) is a potentially life-threatening situation.
	Since most heat is lost through the head and neck, wear a hat or hood and neck scarf.
	Dress in layers and wear fabrics that wick moisture away such as wool and poly fleece. Avoid cotton fabric.
	Stay dry, as heat loss is accelerated by moisture.
	Wear insulated boots and gloves to keep extremities warm.
	Utilize the field vehicle heater to provide a warm break.
	If outdoor temperature is less than 20° F, consult with the Laboratory Supervisor about possible rescheduling of work.
Snow and/or Ice	Access to sampling sites and collection of samples can be adversely affected by snow and/or ice.
	• Suspend boating operations when snow and/or ice prevent safe access. Perform shore sampling instead (reach out and submerge sample bottle into water source).
	Do not step onto ice-covered water, as the ice may not support your weight.
	Minimize the quantity of equipment being carried to aid in balance when walking on slopes or slick surfaces.
	Use less sloping paths when transporting equipment to job sites.
	Minimize walking on the loose, rocky, sloped surfaces surrounding the ponds.
	Test the ground surface prior to attempting to carry loads on slopes.
	Take special care when entering or exiting vehicles onto snow or ice covered surfaces.
	Wear boots with aggressive tread to maximize traction. The laboratory has ice- gripping cleats available that can be strapped on to boot soles to increase traction.
	Where possible, park the vehicle in a level place to minimize slipping. Turn wheels into curb if parking on a roadway.
Wind	All outdoor activities should cease if sustained winds in excess of 40 miles per hour (mph) or gusts greater than 50 mph are encountered (use lab anemometer for direct measurement). Regardless of measured wind speed, employees should always evaluate risk to personal safety or vehicles/equipment prior to sampling during high winds. When winds are in excess of 55 miles per hour, employees should seek shelter in permanent structures. Sampling schedules may need to be

HAZARD	PREVENTION or CONTROL MEASURES
	adjusted to compensate for high wind forecasts or occurrences.
	Eye protection and side shields can be useful during windy conditions.
Lightning	Personnel should cease field operations and seek shelter if lightning is evident.
	Maintain greater than six feet between personnel.
	Minimize the amount of surface in contact with the ground.
	Minimize the profile workers present above the ground, STAY LOW.
	Keep six feet away from any structural support component or tree if shelter is sought.
	Stay away from windows.
	May use the field vehicle for shelter.
Snakes	 Personnel should be careful where they step or place their hands during field operations.
	Never provoke, touch, or handle any snake.
	 Use particular caution when traversing grassy surfaces where visual inspection of walking surfaces is difficult.
	 Personnel should wear durable boots, which extend above the ankle and durable work pants during field operations.
Spiders	Personnel should wear durable gloves, long-sleeved shirt, and long pants when handling debris or other material in which spiders may be residing.
	Grass at worksites may be cut as necessary to minimize worker exposure to infested environments.
	 Any suspected spider bites should be reported to the Laboratory Supervisor and reported as an accident/injury. Subsequent evaluation by a medical professiona may be recommended.
Ticks and Chiggers	 Application of an insect repellant such as DEET may be effective in controlling ticks and chiggers. A repellant named Permethrin[®] may also be effective. As indicated on the product label, it should only be applied directly to clothing due to skin irritation issues.
	 Personnel should inspect themselves for ticks and chiggers following field operations.
	• If ticks are found, they should be removed by gently pulling the head of the tick with tweezers or protected fingers. Take care not to squeeze or crush the tick. Take actions to prevent infection from the body fluids of the tick. If any ticks are attached, they should be reported to the Laboratory Supervisor and reported as accident/injury. Subsequent evaluation by a medical professional may be recommended.
	 Personnel should employ long sleeves and pants to prevent tick or chigger infestation. Pants should be tucked into boots or socks, or taped to eliminate an opening for ticks or chiggers to enter the pant leg.
ees, Wasps, Hornets, Mosquitoes	 Flying insects are prevalent during the spring, summer and fall. Stings from insects can induce a variety of allergic reactions, which if left untreated, can pose serious risks to the individual's health. Allergic reactions can include: hives on th skin, difficulty breathing, itching, and lightheadedness.
	Personnel should avoid the use of perfumes, hair sprays, and other scented products when assigned to field operations.

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HAZARD	PREVENTION or CONTROL MEASURES	
Bees, Wasps, Hornets, Mosquitoes (cont.)	Application of an insect repellant such as DEET may be effective against flying insects. A repellant named Permethrin® may also be effective. As indicated on the product label, it should only be applied directly to clothing due to skin irritation issues.	
	Following a sting, if the venom sac is left in the skin, flick it out - do not squeeze the sac.	
	All stings should be reported to the Laboratory Supervisor and reported as an accident/injury. Subsequent evaluation by a medical professional may be recommended.	
	Never reach into an area which you cannot first visually inspect for hazards.	
	Never disturb debris which may be a nesting location without first determining it to be safe.	
	If a nest is located in an area that cannot be avoided, obtain hornet spray and follow manufacturers' directions for application.	
	Mosquitoes can host West Nile Virus. Minimize exposure by wearing long-sleeved shirts, long pants, and repellant. Minimize outdoor activities during early-morning and dusk when mosquito activity is most prevalent.	
Hantavirus Pulmonary Syndrome (HPS) at the Walnut Creek Autosampler and Great Western Facility	The Walnut Creek autosampler enclosure and Great Western Facility may be inhabited by populations of field mice. Hantavirus Pulmonary Syndrome (HPS) is a virus illness associated with field mouse activity. Symptoms of HPS include fatigue, fever, and muscle aches. Later symptoms include headaches, dizziness, chills, nausea, vomiting, diarrhea, and abdominal pains. Being a new identified disease, the incubation period is not currently known. Current data indicates that symptoms may appear between one and five weeks after exposure. Later symptoms include coughing and shortness of breath as lungs fill with fluid. The best approach to minimize personnel risk due to Hantavirus is to minimize the characteristics of work sites that allow rodents to infest and thrive. The following steps should be an integral part of housekeeping:	
	Maintain spaces clean and orderly.	
	Maintain storage areas and sampling structures free of holes and penetrations which would allow rodent entry and infestation.	
	Eliminate wood/debris piles in which rodents thrive.	
	Disinfection of spaces thought or known to have been infested with rodents should be accomplished by the following steps:	
	Open the space as much as possible to promote natural ventilation.	
	Do not sweep, vacuum, dust, or otherwise perform any act that would disturb dust on surfaces.	
	Don disposable coveralls, boot covers, and full-face HEPA-filtered respirator.	
	Wet down shelves, floors, and other potentially contaminated areas with a liquid disinfectant or a solution of at least 10% bleach.	
	Once wet, remove all waste material with a wet towel.	
	When finished, mop and sponge the area again with disinfectant.	
	If any rodent carcass or droppings are encountered, spray liberally with disinfectant prior to disposal.	
	Seal the bag of waste and remove PPE. Dispose of waste and PPE in accordance with waste disposal requirements.	

HAZARD	PREVENTION or CONTROL MEASURES	
Injury		

TABLE 1	: HAZARD ANALYSIS OF ENVIRONMENTAL SERVICES FIELD OPERATIONS
HAZARD	PREVENTION or CONTROL MEASURES
Personnel Injury (cont.)	
Personnel Injury	 At least one operational cellular phone should always be maintained by each field team. Field operations should be suspended and field personnel should return from the field any time the team's cellular phone fails. Employees must immediately notify the Laboratory Supervisor of any unsafe conditions, near-misses, vehicle accidents, work-related injury, or illness. If an employee is injured on the job employees must complete the First Report of Injury and be given the Choice of Provider Letter. Please refer to the Safety Policy for specific information on reporting injuries under section IV. Accident Reporting or the Safety webpage. Additionally, accidents and/or injuries require the employee, supervisor, and any witnesses to complete the Accident Investigation Report. The City and County requires the wearing of appropriate personal protective equipment for all activities where there is an exposure to hazardous conditions. A first-aid kit containing disinfectant pads, burn ointment, tweezers, and bandages should be carried in each field vehicle. Clothing Employees will wear authorized City and County uniforms on the job as required. This includes clothing that fits properly and shoes designed to protect the feet fron hazardous material or injuries, which may be encountered on the job. Uniforms, tee shirts, coveralls, coats, vests, rain suits, and other issued clothing should not be altered or revised by the employee at any time. Head Gear In warm conditions, consider wearing a vented wide-brimmed hat to keep sun fron warming the head and neck, while allowing perspiration to evaporate. In cold conditions, since most heat is lost through the head and neck, wear a hat of hood and neck scarf. Eye Protection Employees regularly working in areas where occupational hazards necessitate the wearing of safety glasses should wear them. The City and County provides an allowance towards the purchase of prescription saf

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	be used indoors or during overcast conditions.
	Hand Protection
	Chemical resistant gloves should be worn at all times when handling chemicals or substances which may irritate the hands.
Personnel	Leather gloves should be used while performing tasks which present hazards from rough or sharp surfaces.
Injury (cont.)	Waterproof insulated neoprene gloves should be worn for cold water protection during creek, pond, and reservoir sampling.
	General purpose insulated winter gloves should be worn during routine outdoor cold weather activities.
	Gloves should be sized appropriately to allow sufficient manual dexterity for the task.
	Vests and Personal Flotation Devices
	Orange vests should be worn by all employees who work on or near public rights- of-way. Employees should wear reflectorized warning vests when the work shift extends into the dusk or dark hours.
	All personnel operating or riding in the sampling boat should wear U.S. Coast Guard approved personal flotation devices (PFD's).
	Safety Shoes
	Employees regularly working in areas or jobs where there is a danger of toe, foot, or leg injury, are required to wear approved steel-toed safety shoes/boots. The City and County provides an allowance towards the purchase or replacement of approved safety shoes/boots. Ensure that shoes/boots have sufficient tread for the job.
	Material Handling and Lifting
	Based upon an analysis of field sampling and laboratory tasks performed by a professional job site evaluator (Scott P. Sullivan, 5/27/08), the classification category of "medium-heavy work" applies.
	The handling of material is one of the most frequent sources of accidents resulting in back injuries, sprains, strains, lacerations, bruises, and crushed hands and toes.
	Employees are limited to continuous lifting of weights of 60 pounds or less.
	Where possible, mechanical equipment should be used to lift heavier materials. If mechanical assistance is not available, adequate manpower to maintain the 60-pound limit per employee will be required.
	Before an object is lifted, it should be inspected for grease or slippery substances to insure that the object will not slip from grip.
	Long objects should not be carried without assuring that the way is clear and vision is unobstructed to insure that other persons or objects will not be struck by the load.
	All loads protruding three (3) feet or more from the rear of a vehicle should be identified by a red cloth not less than sixteen (16) inches square.
	Lifting Technique

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	Get a good footing, and place feet about shoulder width apart.
	Bend the knees to grasp the weight. Keep the back straight.
	Get a firm hold. Keep the back as upright as possible.
	Lift gradually by straightening the legs. If the weight is too heavy (more than 50-pounds), get help.
	Use your leg muscles, NOT your back muscles.
Propane Torch	 When City and County water storage tank sampling taps become frozen in winter, a small portable propane torch is used to warm the taps. Ensure that the flame is only applied to the tap surface long enough to allow water to flow from the tap. Continued application of flame could cause damage and leakage of the tap sealing materials.
	Ensure the vehicle fire extinguisher is operable prior to using the torch. Keep clothing and other combustible materials away from the flame.
	 Transport the torch in a location that prevents it from rolling around. Keep it out of direct sunlight and away from heater ducts.
	When the torch is not being used, store it in the laboratory cabinet - not in the vehicle.
Exposure to Hazardous	Chemicals used in field operations include acids (for preserving samples), bleach (for disinfecting faucets), and residual chlorine testing reagents.
Chemical	A Safety Data Sheet (SDS) or Material Safety Data Sheet (MSDS) for every chemical used in field operations should be maintained in the laboratory SDS/MSDS file, and/or a laminated copy should be carried in the field vehicle.
	Eye protection should be used to prevent splashing chemicals into the eyes.
	Carry a portable eyewash bottle (refilled with fresh tap water) in the field vehicle for emergency use.
	 Personnel should use chemical-resistant gloves while performing tasks which present hazards from exposure to chemicals.
	Sanitary hand wipes and/or anti-bacterial soap should be carried in the field vehicle to cleanse hands after exposure to wastewater, pond water, or dirty surfaces.
	All chemical containers should be properly marked and labeled.
Operating Vehicles	Prior to operating any vehicle, the operator should inspect it to ensure proper operation and condition. Among the items to be checked are: fluid levels, tires, horn, steering, head and tail lights, wipers, brakes (service and emergency), fire extinguisher, and windows. Any malfunction of the vehicle should be reported to the immediate supervisor no later than the end of a normal working shift.
	 Employees should operate all equipment in accordance with manufacturer's specifications and designed use, taking into consideration traffic and conditions surrounding the use of the equipment, and the safety of other employees and the public. Loose surface conditions and blind spots encountered at some locations mandate that an extremely conservative approach be taken for all vehicle operations.
	 Only fully qualified and properly licensed operators should be permitted to drive or operate City and County vehicles.
	Seats belts should be worn and secured at all times when the vehicle is moving.
	All drivers of City and County vehicles should comply with all state, county, and

HAZARD	PREVENTION or CONTROL MEASURES
	local rules and regulations governing the safe and legal operation of vehicles.
	 The driver should be responsible for assuring that all passengers are seated and properly secured before moving the vehicle. Under no circumstances should passengers ride on fenders, running boards, the tops of vehicles, or any place not designed for passengers.
Operating Vehicles (cont.)	 Trucks transporting materials should secure said materials tightly to prevent movement in transport. All loads protruding three (3) feet or more from the rear of a vehicle should be identified by a red cloth not less than sixteen (16) inches square.
	Speed limits on public roads and highways should be strictly observed by all drivers of City and County vehicles.
	 Accelerate in a slow and controlled manner both to preserve the road surface and minimize the potential for loss of vehicle traction and control. Do not enter a sampling site, roadway, or parking area that could cause the vehicle to become stuck and/or damage the terrain.
	 Brake while descending slopes, as it is easy to rapidly lose control of an accelerating vehicle on the loose surfaces and curving roads encountered at some locations.
	Vehicles and equipment should not be left running unattended.
	 Carry orange traffic cones and place them to the front and rear of vehicles that must be parked near public rights-of-way.
	The vehicle may be equipped with flashing lights. Turning these lights on can provide additional warning to oncoming traffic when entering or exiting sampling locations.
	 The City and County offers a defensive driving class to employees who must operate City and County vehicles. These employees should consider enrolling in this class.
Slips/Trips/Falls	Wear sturdy safety boots that provide a measure of support on sloped surfaces.
	The boots should possess an aggressive tread pattern.
	 Minimize the quantity of equipment being carried to aid in balance when walking on slopes or slick surfaces.
	Use less sloping paths when transporting equipment to job sites.
	Use additional personnel to handle loads on slopes.
	Minimize walking on the loose, rocky, sloped surfaces surrounding the ponds.
	Test the ground surface prior to attempting to carry loads on slopes.
	 Take special care when entering or exiting vehicles onto snow or ice covered surfaces.
Boat and Accessory	General Boat Operations
Equipment	An operational cellular phone should always be maintained by the boating field team.
	At least two people must be involved in any boating operation.
	All personnel operating or riding in the boat should wear U.S. Coast Guard approved personal flotation devices (PFD's).
	Prior to operating boat and accessory equipment, the operator should inspect it to

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	ensure proper operation and condition. Oars and oarlock hardware should be complete and should be checked for	
	tightness.	
Boat and Accessory Equipment	 Balance loads and place battery properly so boat is trim to the water. Trimmed means the bow and stern are drawing the same amount of water. The boat is much more stable with this level load. 	
(cont.)	Secure the boat into the cargo area of the truck to prevent movement during transport.	
	The boat and motor should be operated at speeds that do not present a hazard to occupants or other personnel. A conservative approach must be taken for all boating operations.	
	Accelerate in a slow and controlled manner to minimize the potential for tipping and/or movement of equipment and personnel.	
	Boating operations should not be conducted if lightning, high wind, or turbulent water (whitecaps) exists at the sampling site. Consult with the Laboratory Supervisor about possible rescheduling of work.	
	The water quality at certain sampling sites may be poor. Avoid prolonged contact, and wash hands well with anti-bacterial soap and water (or use sanitary hand wipes) when operations are complete. Avoid contact with food or drink until cleansing procedure is complete.	
	Battery	
	Battery is heavy, so use proper lifting technique.	
	Always use extreme caution when handling batteries and wear gloves to protect hands.	
	Battery fluid level should be full with no leakage. If not full or leakage is observed, maintenance or replacement is necessary.	
	The deep-cycle trolling motor battery should be fully charged at all times. Failing to keep the battery charged will limit its ability to hold a full charge and reduce its overall lifespan.	
	Inspect battery terminals and, if necessary, clean them with a battery wire brush.	
	Disconnect battery from all accessory equipment prior to and during charging.	
	Electric Trolling Motor	
	Prior to inspecting or performing any maintenance on the electric trolling motor, ensure it is disconnected from the battery and it is properly secured to the boat or an appropriate workbench to prevent it from falling. At this time, tighten any loose screws and bolts on the bow-mount.	
	Remove any mud or debris trapped around the unit's moving parts. Inspect the shaft for signs of wear or damage. The motor shaft is adjustable, sliding up and down to control propeller depth. Over time, the shaft can stick. To remedy this, apply a light amount of Armorall® to the composite shaft with a rag to restore smooth operation.	
	Inspect the electrical wiring for the trolling motor. Replace worn or frayed wiring. Inspect all connections, ensuring they are clean from corrosion and properly secured before each use. Vibrations caused by the motor and/or water conditions can cause connections to loosen; verify all necessary straps, screws and nuts are	

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HAZARD	PREVENTION or CONTROL MEASURES
	snug.Disconnect the motor from the battery prior to storage.
Boat and Accessory Equipment (cont.)	 Prop Inspection Prior to inspecting or performing any maintenance on the propeller, ensure the electric trolling motor is disconnected from the battery and it is properly secured to the boat or an appropriate workbench to prevent it from falling. Keep prop and shaft free of dirt, weeds, and fishing line.
	Examine the edges of the prop for damage. Propellers are durable, but not indestructible. Hard surfaces can damage props. For minor nicks and scratches, use fine grit sandpaper to smooth rough edges to minimize interference on prop operation.
	 Prop wear, chips and dings can greatly affect the performance of the trolling motor. For significant prop damage, you will likely need to replace the propeller.
	 To prevent prop damage, the motor depth should be adjusted for the conditions to avoid impact with the bottom, and care should be taken to avoid underwater obstructions.
	 The prop nut should be checked prior to each use to make sure it is secure. The correct tightness for the prop nut is one quarter-turn past snug.