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Animal and Plant Health Inspection Service

Pale Cyst Nematode in Bingham and Bonneville Counties, Idaho

Supplemental Environmental Assessment
April 2016

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I. Purpose and Need

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), is conducting a treatment program to eradicate the pale cyst nematode (PCN) (formerly referred to as potato cyst nematode), *Globodera pallida*, in areas of Bingham and Bonneville Counties, Idaho. PCN is a devastating soil-borne pest to potato crops with the potential to impact related agricultural and nonagricultural plant species (Appendix A). Damage varies from small patches of affected plants to complete crop failure. Infestations generally start out as isolated patches which become larger in subsequent years. If untreated, PCN can cause up to 80-percent yield loss in potato fields. The nematode is primarily spread through the transport of soil via seed potatoes, nursery stock, flower bulbs, farm equipment, or soil-bearing surfaces. Natural dispersion in soil is limited.

PCN was first detected in Idaho during a Cooperative Agricultural Pest Survey in mid-April 2006. In June and July of 2006, two fields were confirmed positive for PCN. On August 29, 2006, APHIS and the Idaho State Department of Agriculture announced the establishment of a regulatory area covering approximately 10,000 acres near Shelley, Idaho. Five new fields tested positive after additional testing within the regulatory area. Surveys of seed potatoes yielded no positive detections of PCN in the state. No additional PCN detections were found in surveys conducted throughout other potato growing states in a 2006-2007 National Survey.

Today, a total of 9,929 acres are currently regulated for PCN in Bonneville and Bingham Counties, Idaho, of which 2,897 acres are infested with PCN (figure 1). APHIS regulates infested fields in addition to other fields that may have been exposed to PCN-infested soil in the past, typically through sharing of farming equipment that may have resulted in soil transfer between fields. APHIS continues to find fields infested with PCN in the area. See the APHIS Pale Cyst Nematode webpage for more information about regulation of PCN.

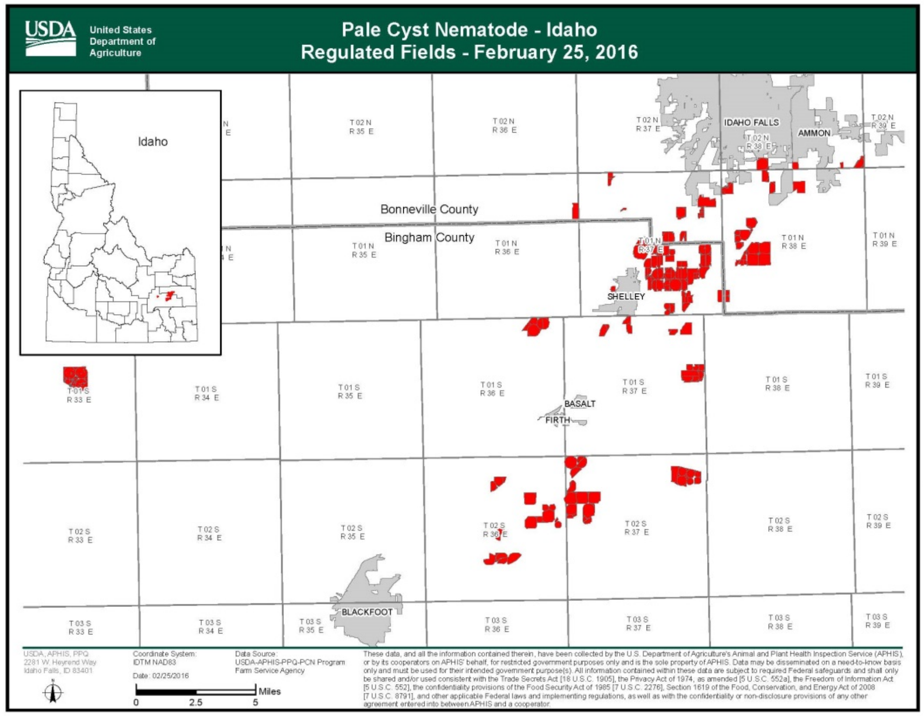

Figure 1. Pale cyst nematode regulated fields in Bingham and Bonneville Counties, Idaho as of February 25, 2016.

APHIS has the responsibility for taking actions to exclude, eradicate, and/or control plant pests under the Plant Protection Act (7 U.S.C. §7701 et seq.). It is important that APHIS take the steps necessary to eradicate PCN from areas in Idaho to prevent spread to potato crops in the United States. APHIS, in cooperation with the Idaho State Department of Agriculture, is currently conducting a program to eradicate PCN from the infested fields in Idaho.

An environmental assessment (EA) was prepared in May 2007 to address the potential action of eradicating PCN where it had been detected near Shelley, ID (USDA APHIS, 2007). The EA was prepared consistent with the National Environmental Policy Act of 1969 (NEPA) and APHIS' NEPA implementing procedures (7 CFR, part 372) for the purpose of evaluating how the proposed action, if implemented, may affect the quality of the human environment.

In the May 2007 EA, the treatment alternative consisted of using one or a combination of fumigants. The fumigants proposed for use were methyl bromide and 1,3-dichloropropene (DCP). In the initial EA, DCP use was limited to one application per growing season applied at 177 pounds (lbs) of active ingredient (ai)/acre (ac). After further evaluation following the first treatment with methyl bromide in May 2007, there was a need to have the option to be able to apply DCP twice per year. In addition, higher application rates were needed to ensure adequate efficacy during treatment. The pesticide label for DCP, sold as Telone II®, did not allow for two applications at a rate above 177 lbs. ai/ac so a special local use need label, or Section 24(c) under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA), was prepared with the new use pattern that allowed for one or two DCP applications per season at a rate of 177 to 354 lbs ai/ac per application. A special local use need, or 24c, is where a state registers additional uses to a federal registered use to meet site specific requirements. APHIS prepared an amended EA in July 2007 to discuss how the proposed changes in use may have affected the quality of the human environment.

The purpose of this supplemental EA is to consider expansion of the PCN eradication program to all potato growing areas in Bingham and Bonneville Counties should PCN be found in new areas, and to include updated information regarding current eradication program practices and activities. Methyl bromide is not being considered for use in this supplemental EA under the preferred alternative. Methyl bromide has not been used in the PCN program since May 2014 due to concerns raised by the public regarding its use to treat PCN infested fields. APHIS has taken this concern very seriously and the Agency immediately started to ascertain the facts related to this concern. Additionally, out of abundance of caution and in regard for those who raised the concern, APHIS decided in 2015 not to use methyl bromide soil fumigation to treat PCN-infested fields. APHIS is working with the U.S. Environmental Protection Agency and others to investigate this concern before resuming the use of methyl bromide soil fumigation in the PCN Eradication Program. Methyl bromide is registered for use to control PCN, however, going forward the program will rely on DCP as the primary fumigant, along with trap cropping, which are discussed in this supplemental EA. Methyl bromide use would be analyzed in a separate EA if it is proposed to be incorporated into any future PCN eradication activities.

A. Background

1. Biology of Pale Cyst Nematode

Nematodes are defined as members of the phylum Nematoda, and are elongated cylindrical worms parasitic in animals or plants, or are free-living in soil or water. PCN (*Globodera pallida*) is a plant parasitic nematode that affects agricultural crops.

Typical of most nematode life cycles, *G. pallida* has four distinct juvenile stages and an adult stage. The second-stage juvenile hatches from the egg which is contained within a cyst formed from the cuticle of an adult female. Three more molts will occur before reaching the adult stage. Upon hatching, the second-stage juvenile is considered the active phase because it is the life stage that actively seeks host plants. Hatching occurs based on appropriate environmental factors such as the presence of substances that diffuse from the roots of host plants. Extensive hatching will occur however, some juveniles will always remain dormant, regardless of the conditions, to ensure population viability (Turner and Evans, 1998). In cases where a host plant is not present, infestations can persist up to 30 years because of delayed hatching of the 200-500 eggs per cyst and the ability of the eggs to remain dormant within the cuticle cyst of the female until hatching cues from hosts plants are detected (Turner, 1996; DEFRA, 1996). Once the second-stage juvenile female encounters a host it will enter the root near the growing point, or a lateral root, and use the hypodermic needle-like stylet in their mouths, to pierce a cell wall. The female then secretes proteins that cause changes to the host cells to include dissolving of cell walls, fusion of host cells and a proliferation of host cellular machinery (such as nuclei and endoplasmic reticula). The syncytium facilitates and coordinates the passage of nutrients from the host plant to the juvenile female. Male juveniles do not set up feeding sites, but feed as endoparasites until the 4th larval stage. The males then emerge from the roots and molt again to adults. Once females breach the root zone, they release sex pheromones that attract males for fertilization. After fertilization, embryos will develop in the egg until the second-stage juvenile emerges. PCN usually has a single generation during a host growing season (Turner and Evans, 1998).

Host plants are those in the family Solanaceae, which includes the potato, tomato, and eggplant, as well as other nonagricultural hosts (appendix A). In cases where PCN populations exceed 5 to 10 eggs per gram soil, the plants can exhibit reduced root systems and altered total mineral uptake. Plants may also have yield reductions due to water stress, altered mineral ratios, and early senescence (DEFRA, 1996; Phillips et al., 1998).

2. Spread of PCN in Idaho

It is not known from where or how PCN came to southeast Idaho. Analysis of the fields' infestation levels and inconclusive investigations of potential pest origins suggest that it was likely unintentionally established in the area decades ago. APHIS continues to find additional lightly-infested fields, but there is no evidence that additional PCN detections are the result of new movement from known infested fields because the PCN regulations designed to prevent PCN spread were implemented in 2006. Detection of these incipient infestations have been made through ongoing cooperative monitoring of associated fields by APHIS and the Idaho State Department of Agriculture (ISDA). Associated fields are those that have grown a PCN host crop in the last ten years with a relationship with an infested field or the field shares a border with an infested field; or the field has come into contact with a regulated article from an infested field in the last ten years, or within the last ten years the field shared ownership, tenancy, seed, drainage or runoff, farm machinery with an infested field that could allow spread of PCN. Infested fields are still being found because incipient infestations take numerous (2-3) crop cycles to build up to detectable levels and PCN eggs can remain dormant in soil for up to 30 years. PCN reproduces primarily on crops and weeds in the Solanaceae plant family. Depending upon a field’s crop rotation, a low level infestation may take several years to detect. Some low population level detections of PCN were made in 2011 which was followed by analysis by the Center for Plant Health Science and Technology (CPHST) and discussions with growers. After further consideration at the 2012 PCN Program Review, and as is allowed by the PCN regulations, the APHIS deregulation protocol was amended. This protocol was then adapted into the May 2014 PCN Guidelines.

3. Previous NEPA Documentation

Since 2006, APHIS has prepared numerous NEPA documents for the PCN program. Initially, APHIS prepared a categorical exclusion decision for an interim rule to establish a PCN quarantine in September, 2006. An EA for the eradication program in Bonneville and Bingham Counties was prepared in May 2007, and was amended in July 2007 because of a change in application rate of DCP used by the program. From 2007 to 2010, APHIS prepared several categorical exclusion decisions as acres were removed from regulation. In 2011, APHIS prepared an addendum to the finding of no significant impact (FONSI) because of a proposed program fumigant change. APHIS continued to prepare additional FONSI addenda in 2012, 2013, and 2014 for additions and removals of acres to the regulated area.

This supplemental EA will eliminate the need for a NEPA document each time there is an expansion or reduction of the regulated area within the two counties.

II. Alternatives

This EA analyzes the potential environmental consequences of the proposed action to eradicate PCN from fields in Idaho where the nematode has been detected. Three alternatives are being considered: (1) maintain current eradication program (no action) (2) no eradication program to eliminate PCN, and (3) the treatment alternative (preferred alternative), which includes the application of chemical treatments and trap cropping to eradicate PCN from infested fields in Bingham and Bonneville Counties, Idaho.

A. No Action Alternative

Under the no action alternative APHIS would maintain the current PCN eradication program that has been previously described (USDA APHIS, 2007). This alternative consists of maintaining a Federal quarantine, as well as treatment of currently infested fields, with a chemical treatment in the spring and fall. Chemical treatments would consist of either methyl bromide (MeBr) or 1,3-dichloropropene (DCP).

1. Federal Quarantine

APHIS maintains a federal quarantine regarding PCN that is designed to restrict the interstate movement of regulated articles. The designation of a quarantine area is based on a field being identified as infested with PCN, fields that have been found to be associated with an infested field, and any area that the Administrator considers necessary to quarantine because of its inseparability for quarantine enforcement purposes from infested or associated fields. APHIS will publish the description of the quarantined area on the Plant Protection and Quarantine Web site, http://www.aphis.usda.gov/planthealth/pcn. The description of the quarantined area will include the date the description was last updated and a description of the changes that have been made to the quarantined area. The description of the quarantined area may also be obtained by request from any local office of PPQ; local offices are listed in telephone directories. After a change is made to the quarantined area, APHIS will publish a notice in the Federal Register informing the public that the change has occurred and describing the change to the quarantined area (CFR §301.86).

2. Methyl Bromide/ Chloro-picrin

A standard application of methyl bromide is injected approximately 12 inches below the soil surface at a rate of 400 pounds (lbs) of 80 percent methyl bromide plus 20 percent chloropicrin per acre. Methyl bromide is odorless and the chloropicrin serves as a warning agent. An impermeable tarp covers the treated field for approximately 5 days for safety and to enhance efficacy, reduce offsite transport and promote degradation of the fumigant. There is a 14-day plant-back restriction after fumigation. Methyl bromide use has not occurred in the PCN program since May 2014 due to concerns about its use in PCN treated fields. No methyl bromide use occurred in 2015.

3. 1,3-Dichloro-propene

Telone II®, which contains the active ingredient 1,3 dichloropropene (DCP), will be applied at a rate of 18-36 gallons per acre, or approximately 177–354 lbs active ingredient per acre depending on site conditions. Applications occur as an injection at least 12 inches below the soil surface. The point of injection is sealed by compacting the soil or the addition of totally impenetrable film (TIF) to minimize volatilization. Telone II® can be applied once or twice a year.

B. No Eradication Alternative

Under the no eradication alternative, APHIS would not eradicate PCN from Bingham and Bonneville Counties, Idaho. A Federal domestic quarantine would remain in effect. In addition, regulated articles including potatoes, nursery stock, and soil may not be moved interstate from regulated fields except under specified conditions that these articles are sufficiently free of soil or accompanying soil is appropriately contained during movement to prevent its entry into agricultural areas, and ultimately disposed of at an APHIS-approved site. Farm equipment moving interstate may not be moved from an infested field unless it has been pressure washed to ensure that all soil has been removed and it has been steam treated in accordance with schedule T406–d of the PPQ Treatment Manual (USDA APHIS, 2015).

Some control or management measures might be taken by other entities; within the State of Idaho however, these actions would not be under APHIS' control nor funded by APHIS. In addition, local business owners and area residents could attempt to control PCN. Due to the difficulty in controlling PCN and the several methods of dispersal from infested areas, the nematode would likely expand its range into other potato-growing areas, as well as infest areas in other states containing other Solanaceae species. Other agricultural crops, such as tomato and eggplant, could be expected to be impacted, as well as nonagricultural Solanaceae species, which could also serve as a source for re-infestation into previously treated fields.

C. Treatment Alternative (Preferred Alternative)

The preferred alternative consists of maintaining a Federal quarantine, as well as treatment of currently PCN-infested fields, with a chemical treatment in the spring and/or fall, a trap crop, and monitoring in Bingham and Bonneville counties. Trap crops are those plants that are planted to attract a particular pest. Previous chemical treatments used in the program included the fumigants 1,3-Dichloropropene (DCP) and methyl bromide/chloropicrin. The proposed DCP treatments would continue until PCN is eradicated. PCN population levels will be monitored on a regular basis to assess the progress of the eradication effort. The preferred timing for DCP treatments is later summer/early fall however a spring treatment could occur within the first part of May, depending on soil temperature. In addition, phytosanitary requirements are in place for application equipment to ensure that PCN is not artificially spread from treated fields. Specific details on protocols and requirements growers must follow to prevent spread are provided regularly in face-to-face meetings with growers and detailed in Compliance Agreements provided by the program headquarters in Idaho Falls. Additional information regarding surveillance and phytosanitary actions are available in recently revised guidelines between the United States and Canada (USDA APHIS, 2014). The guidelines were developed by the United States and Canada, with input from stakeholders, to outline the phytosanitary measures to be taken on the detection of PCN, provide guidance on long-term management and release of infested fields from quarantine and to provide guidance on how seed potatoes and regulated articles could move between the two countries. Different chemical treatment options are available are discussed below, as well as trap cropping and environmental monitoring.

1. 1,3-Dichloro-propene

Telone II®, which contains the active ingredient 1,3 dichloropropene (DCP), will be applied at a rate of 18-36 gallons per acre, or approximately 177–354 lbs active ingredient per acre depending on site conditions. Applications occur as an injection at least 12 inches below the soil surface. The point of injection is sealed by compacting the soil or the addition of totally impenetrable film (TIF) to minimize volatilization. Telone II® can be applied once or twice a year.

2. Trap Cropping

Trap crops are those plants that are planted to attract a particular pest. In the case of PCN the trap crop proposed for use is the Litchi tomato (*Solanum sisymbriifolium* Lam.), which is an annual herb that is native to South America. It is used in Europe as a management tool for PCN and is also grown around the world for ornamental and culinary uses. Litchi tomato can reach up to 3 feet in height. The stems and branches have thorn-like prickles that can be up to ½ inch in length, and the flowers are white to pale blue.

APHIS is proposing to use litchi tomato as a trap crop for PCN in fields where PCN has been detected. The roots of litchi tomato stimulate nematode eggs in the soil to hatch, but do not support nematode feeding or reproduction (Timmermans et al., 2007). Because hatched nematodes have limited food reserves, they die because they cannot successfully parasitize litchi tomato roots. An additional benefit is that the roots of the litchi tomato can reach to greater depths in the soil than the fumigants used in the program can. Initially, litchi tomato has been planted on a limited basis in three PCN-infested fields to determine its efficacy against PCN. If effective, its use may be expanded to other PCN-infested fields.

Litchi tomato is not native to Idaho, and may become invasive in the environment if not carefully managed. The Idaho State Department of Agriculture has restricted the use of litchi tomato and requires that growers and the University of Idaho researchers complete a detailed permitting process prior to planting. A weed management plan has been developed at the University of Idaho to prevent litchi tomato from becoming a weed in years subsequent to planting. Additionally, herbicides that are labeled for use in potatoes and other common southeast Idaho crops will be used to control litchi tomato in subsequent years, if necessary.

3. Monitoring

APHIS has conducted environmental monitoring during fumigations of infested fields and this would continue under the preferred alternative. Factors monitored during the fumigation include date, time, wind speed and direction, air temperature, acres fumigated on day of reading, and the atmospheric concentrations of the fumigants used.

III. Affected Environment

The current area being considered for treatment consists of potato growing areas in Bingham and Bonneville Counties (see figure 2).

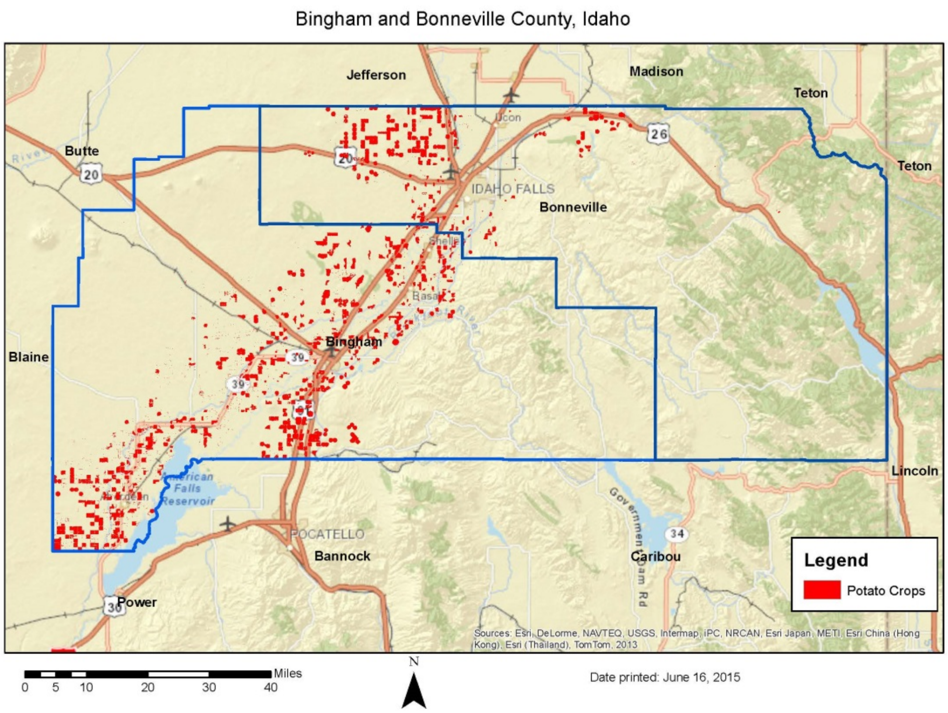

Figure 2. Location of potato fields in Bingham and Bonneville Counties, Idaho, 2012.

A. Land Characteristics and Agricultural Production

Bingham County

Bingham County is 2,184 square miles including the 359 square miles in the Fort Hall Indian Reservation. The county is fairly level, with the Blackfoot mountain range on the east, and lies entirely within the Snake River plain. The economy of Bingham County is heavily dependent on agriculture (Cravens, 2015). The county has 1,265 farms averaging 687 acres in size (U.S. Department of Agriculture, 2012a). Farmland use in the county is 43 percent cropland, 54 percent pastureland, and 3 percent other uses (U.S. Department of Agriculture, 2012a). The top crop item (acres) for Bingham County is wheat for grain (145,820 acres), while potatoes are fourth in acreage, grown on 77,204 acres in the county (U.S. Department of Agriculture, 2012a). The value of vegetables and potatoes for the county is $179,169,000, and this commodity group value is ranked highest in the State. Bingham County has the highest acreage in all Idaho Counties for wheat for grain, all harvested vegetables, and potatoes (U.S. Department of Agriculture, 2012a). The market value of all agricultural products sold in Bingham County, including crops, nursery and greenhouse, livestock, poultry, and their products is reported as $453,267,000 (U.S. Department of Agriculture, 2012a). It is known as the potato capital of the world (Safety, 2005) Bingham County soil mostly falls into three classifications: Sagemoor, Declo, and Bannock (Safety, 2005).

Land ownership in Bingham County is as follows: 392,484 acres of Federal land, mainly owned by the Department of Interior, Bureau of Land Management; 156,198 acres of State land; 786,156 acres of privately owned land; 5,480 acres of County land; and 354 acres of Municipal land (Safety, 2005). Land use is divided as: 3,200 acres of urban land; 428,200 acres of agricultural land; 632,000 acres of rangeland; 51,900 acres of forest; 18,400 acres of water; 16,000 acres of wetland; and 201,800 acres of barren land (1997 Census of Agriculture-County Profile, as cited in (Safety, 2005).

Bonneville County

Bonneville County is approximately 1,900 square miles in size and is part of the Upper Snake River Valley. By population, Bonneville County is the fourth largest in Idaho, with a population of 108,623 as of 2014 (St.Jeor, 2015). The county's economy is less dependent on agriculture than Bingham County, with 893 farms with an average size of 458 acres (U.S. Department of Agriculture, 2012b). Farmland use in the county is 68 percent cropland, 26 percent pastureland, and 6 percent other uses (U.S. Department of Agriculture, 2012b). The top crop item (acres) for Bonneville County is barley for grain (72,280 acres), and is ranked highest in the State (U.S. Department of Agriculture, 2012b). Potatoes are not reported as a top crop item in the County (U.S. Department of Agriculture, 2012b). The market value of all agricultural products sold from Bonneville County, including crops, nursery and greenhouse, livestock, poultry, and their products is less than half of that for Bingham County, reported as $204,176,000 (U.S. Department of Agriculture, 2012b).

Other land in the counties includes a portion of the Caribou-Targhee National Forest. This National Forest occupies over 3 million acres and stretches across southeastern Idaho, from the Montana, Utah, and Wyoming borders. There are 307,419 acres of Caribou National Forest, and 175,618 acres of Targhee National Forest in Bonneville County (Service, 2007a). Grays Lake National Wildlife Refuge (NWR) is located in Bonneville County, and lies within Grays Lake, a high elevation 22,000 acre bulrush marsh.

B. Air Quality

The Clean Air Act (CAA) (42 U.S.C. §§ 7401 et seq.) is the primary Federal legislation that addresses air quality. In any given region or area of the United States, air quality is measured by the concentration of pollutants in the atmosphere, and is influenced by surface topography and prevailing meteorological conditions. The Environmental Protection Agency (USEPA) established National Ambient Air Quality Standards (numerical concentration-based standards) for six criteria pollutants that impact human health and the environment (40 CFR § 50). These pollutants are common and accumulate in the atmosphere as a result of natural processes and normal levels of human activity. They include carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), sulfur dioxide (SO2), small particulate matter, and lead (Pb).

There are no air quality non-attainment or maintenance areas in Bingham or Bonneville Counties. However, a non-attainment area for particulate matter with an aerodynamic diameter of less than or equal to 10 micrometers (PM-10) occurs in the Fort Hall Indian Reservation in Bannock County, near Bingham County. To improve air quality in the area, the Environmental Protection Agency (EPA) published a final rule for a Federal Implementation Plan on August 23, 2000 (Agency, 2000) to impose emission limits and work practice requirements for an elemental phosphorus facility located on the reservation. Next to this non-attainment area is the Portneuf Valley Maintenance Area for PM-10, also in Bannock County. It includes federal land managed by the Bureau of Land Management and the Caribou National Forest, as well as privately owned land in the cities of Pocatello and Chubbuck. The USEPA issued a final rule in 2002 indicating that a finding of attainment for PM-10 was achieved for this area (formerly known as the Portneuf Valley Non-Attainment Area) as of December 31, 1996 (Agency, 2002).

C. Water Quality

Idaho has more than 95,000 miles of rivers and streams and 437 lakes and reservoirs, making water one of the state's most important resources. These rivers, lakes, streams, reservoirs, and wetlands provide natural beauty as well as water necessary for drinking, recreation, industry, agriculture, and aquatic life.

The Snake River flows northwest through Bonneville County, beginning at the Wyoming border as the Palisades Reservoir. The river exits the county about midway on its northern border, turns and re-enters approximately 20 miles west to flow southwest through Idaho Falls. The river flows southwest through the middle of Bingham County; at the county's southwest corner the river is the American Falls Reservoir.

Other waterbodies in Bingham and Bonneville Counties include: the Ririe Reservoir, located on Willow Creek, a popular fishery close to Idaho Falls; Palisades Reservoir which is part of the Greater Yellowstone ecosystem, is surrounded by forested mountains and is used for boating, fishing, camping, and wildlife viewing; the Blackfoot River that joins the Snake River in Bingham County, formed at the convergence of Lanes Creek and Diamond Creek, and dumps into the Blackfoot Reservoir in Caribou County.

Mercury can be found in Idaho's environment from historic gold mining practices and much of it is still present in Idaho water bodies today (Quality, 2015). In a 2007 lake and reservoir survey in Idaho, 20 out of the 50 lakes sampled had at least one fish species in which the mercury criterion (0.3 milligrams/kilogram) was exceeded. As of February 2009, there were thirteen lakes or reservoirs and two streams across the state of Idaho with fish consumption advisories for mercury (Essig, 2010), including the American Falls Reservoir for Utah suckers and South Fork Snake River for brown trout (Quality, 2013). In addition, a statewide consumption advisory for smallmouth and largemouth bass was issued in 2008 (Essig, 2010).

Nitrate is one of the contaminants responsible for groundwater degradation and is one of the most widespread ground water contaminants in Idaho. High levels of nitrate in drinking water are associated with adverse health effects in humans and livestock. High levels of nitrate also adversely affect fish and surface waters such as lakes and rivers. Nitrate priority area ranking is used to prioritize the development and implementation of strategies to help reduce nitrate loading from land-use activities. Two nitrate priority areas (NPAs) have been identified in Bingham County, the Fort Hall and Blackfoot NPAs. These NPAs are areas where elevated levels of nitrate have been found in ground water. The minimum criterion for a Priority 1 NPA is 25 percent of sampled wells that have nitrate levels at or above 5 milligrams per liter (mg/L) (Quality, 2008). The state and federal drinking water standard, as well as the Idaho Ground Water Quality Standard for nitrate is 10 mg/L. In water samples from the Fort Hall NPA, 88 percent of wells were found to have greater than 10 mg/L of nitrates (Quality, 2008). In the Blackfoot NPA, 20 percent of wells had greater than 10 mg/L of nitrates (Quality, 2008).

D. Vegetation and Wildlife

Vegetation

The Bingham County Comprehensive Plan (Safety, 2005) describes the vegetation in Bingham County as follows: In the desert and mountains, Wyoming big sagebrush, basin big sagebrush, rocky mountain juniper, Utah juniper, mountain big sagebrush and three-tipped sagebrush are found. In the mountains, mountain penstemon, mountain eriogenum, aspen, douglas fir, rocky mountain juniper, and Utah juniper can be found. Green rabbit brush, four wing salt bush, tall rabbit brush, balsam root, hawksbeard, and herbaceous sage can be found throughout Bingham County. Along the river bottoms, black cottonwood and several types of willows can be found that are also found in the mountains. Native grasses found in Bingham County consist of blue bunch wheat grass, stream band wheat grass, basin wild rye grass, Nevada bluegrass, and sandburg grass. Sedges, rushes and tufted hair grass are found along the river bottoms. In the mountains, blue bunch wheat grass, basin wild rye, stream bench wheat grass, western wheat grass, slender wheat grass, Idaho fescue and pine grass occur. Mountain shrubs consist of serviceberry, snowberry, chokecherry, and snowbush.

Wildlife

The Sterling Wildlife Management Area (WMA) in Bingham County is located in along the northwest shore of American Falls Reservoir, and these areas likely support the greatest variety of shorebirds in Idaho. Bufflehead, Canada goose, gadwall, mallard, pintail, redhead, ring-necked duck, ruddy duck, scaup, shoveler, teal, and widgeon are common on the area at various times. Avocet, black-necked stilt, sandhill crane, and a variety of sandpipers use the area. Antelope, badger, beaver, cottontail rabbit, coyote, marmot, mink, mule deer, muskrat, pocket gopher, raccoon, red fox, striped skunk, and jackrabbits are some of the mammals which commonly occur in the area. The marshes provide good duck hunting. Food and cover plots provide opportunity for goose and pheasant hunting. (From: (Game, 2015)).

The Tex Creek WMA is located east of Idaho Falls in eastern Idaho’s Bonneville County. Rocky Mountain elk and mule deer begin moving north toward Tex Creek in the late fall. More than 3,000 elk, 3,000 mule deer and 50 moose may winter on WMA lands each year. Sage and sharp-tailed grouse and gray partridge are found in the dry shrublands of Tex Creek WMA. Black-capped chickadees, brown creepers, wrens, goldfinches, shrikes, and chipping sparrows inhabit Tex Creek WMA's forest, riparian and upland communities. Bald and golden eagles, goshawks, and American kestrels also occur in the area. When water flows are sufficient, the lower reaches of Tex Creek WMA's streams support native cutthroat trout and introduced brook and German brown trout. Hunting is popular at Tex Creek WMA. Big game, upland bird and small game hunting are all allowed in season. (From: (Game, 2015)).

The Grays Lake NWR in Bonneville County is a montane marsh with expansive wetland habitats that attract numerous bird species such as waterfowl, shorebirds, and wading birds. It also has the largest breeding concentration of sandhill cranes in North America. This NWR provides significant habitat for breeding waterfowl in the late spring and early summer, and nesting habitat for colonial birds, including a large mixed colony of white-faced ibis and Franklin's gulls. The habitat consists of wet meadows, shallow water, uplands, mudflats, and bulrush marshes. Large mammals including moose, elk, and mule deer are seen at Grays Lake, as well as smaller non-game species including muskrats and badgers (Service, 2014).

A potential 300 species of nesting birds, 85 species of mammals and 17 amphibians and reptiles occur on the Caribou-Targhee National Forest that occurs in part in Bonneville County but stretches across southeastern Idaho, from the Montana, Utah, and Wyoming borders. The National Forest provides summer range for elk, and both elk and deer winter ranges occur, particularly in the southern portions along the Tetons into the South Fork of the Snake River drainage. Both bighorn sheep and mountain goats occur on areas of the Forest. Pronghorn antelope are relatively common within the western extreme of the Forest and moose occur in suitable habitat in many areas of the Forest. (From: (U.S. Department of Agriculture, Undated).

IV. Environmental Impacts

A. No Action Alternative

This alternative consists of maintaining a Federal quarantine, as well as treatment of currently infested fields, with a chemical treatment in the spring and fall. Chemical treatments would consist of either methyl bromide (MeBr) with chloropicrin, or 1,3-dichloropropene (DCP). The analysis of the potential environmental impact from the use of each fumigant is incorporated by reference from the previous amended EA, with an updated analysis for methyl bromide and chloropicrin in appendix B of this supplemental EA. An updated analysis for DCP is presented in the preferred alternative section of this supplemental EA.

B. No Eradication Alternative

The no eradication alternative in the PCN program would be the continuation of the domestic quarantine that is currently in place in Idaho. In addition to the ISDA regulation which restricts intrastate movement of regulated articles and prevents farmers on fields classified as infested from growing potatoes and other host crops, the Federal regulations restrict interstate movement of regulated articles including—

- Pale cyst nematodes.
- The following pale cyst nematode host crops:
    - Eggplant (*Solanum melongena* L.)
    - Pepper (*Capsicum* spp.)
    - Potato (*Solanum tuberosum* L.)
    - Tomatillo (*Physalis philadelphica* Lam.)
    - Tomato (*Lycopersicon esculentum* L.)
- Root crops.
- Garden and dry beans (*Phaseolus* spp.) and peas (*Pisum* spp.).
- All nursery stock.
- Soil, compost, humus, muck, peat, and manure, and products on or in which soil is commonly found, including grass sod and plant litter.
- Hay, straw, and fodder.
- Any equipment or conveyance used in an infested or associated field that can carry soil if moved out of the field.
- Any other product, article, or means of conveyance not listed in paragraphs (a) through (h) of this section that an inspector determines presents a risk of spreading the pale cyst nematode, after the inspector provides written notification to the person in possession of the product, article, or means of conveyance that it is subject to the restrictions of this subpart.

The no action alternative would provide a means of slowing the spread of PCN outside of the State but, due to the difficulty in inspecting all the regulated articles listed above, it would be difficult to contain the infested acreage to the small area where it currently occurs. PCN would be expected to expand its range beyond the currently infested fields and possibly infect other potato growing areas within the State of Idaho, as well as other potato-growing regions in the United States (figure 3.)

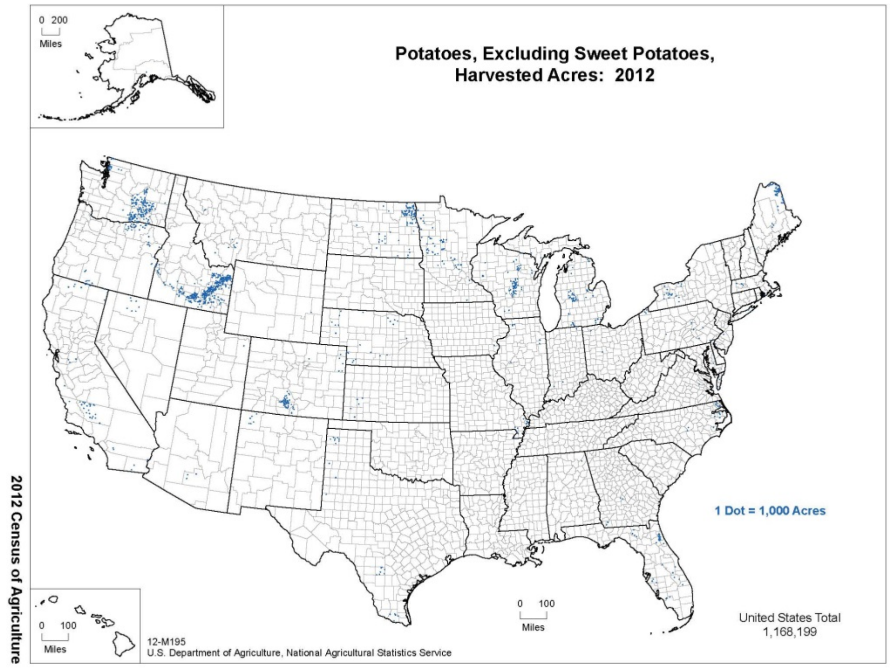

Figure 3. Harvested potato acreage in the United States – 2012.

While the current infestation is localized and affects only potatoes, PCN is known to have additional host plants within the plant family Solanaceae (appendix A). These include other agricultural crops, such as tomatoes and eggplant, but also a wide variety of nonagricultural species. While the impacts of PCN to nonagricultural Solanaceae are unknown, it could be expected to impact those species in cases where nematode levels increase to damaging levels. In addition, these areas could serve as sources for PCN to be spread to other areas and be reintroduced into previously treated fields.

Movement of PCN to other potato-growing areas of the United States would eventually result in nematode levels reaching economic threshold levels that would justify additional pesticide applications. Controlling PCN in agricultural and nonagricultural areas would require increased pesticide use that would result in an increase in pesticide loading to the environment with fumigants, such as methyl bromide and DCP, and other nematicides. High-use rates are common with fumigants so any additional pesticide applications to control PCN could dramatically increase environmental loading while also increasing potential risk. Environmental concerns could result from the increased use of pesticides while also increasing production costs for any crops that would require additional pesticide applications.

B. Treatment Alternative (Preferred Alternative)

The preferred alternative consists of maintaining the quarantine to slow any futher movement of PCN, and to eradicate PCN from currently infested fields using fumigant applications. In addition trap cropping using the litchi tomato may be used if proven effective. Litchi tomato is a non-native plant to Idaho that may become invasive if not properly managed. The potential for the litchi tomato to become established in the immediate area of its proposed use, and other parts of the United States, is high if not managed properly (USDA APHIS, 2013). However, the potential for environmental impacts from litchi tomato plantings in the proposed program is expected to be low based on its restricted use by the Idaho Department of Agriculture and the implementation of a weed management plan designed to prevent its unintended introduction into other areas. The quarantine and associated monitoring for PCN are not expected to have any environmental impacts; therefore, the discussion on potential environmental impacts from the preferred alternative will focus on pesticide use.

The fumigant being considered for use in the PCN eradication program is DCP which is considered a methyl bromide replacement fumigant (UNEP, 2002). A summary of the risk profile for DCP is presented below.

a. Toxicity

DCP (1,3-Dichloropropene) has moderate acute oral and dermal toxicity while having comparably lower inhalation toxicity. Acute toxicity values for DCP in the rat range from an oral LD_{50} value of 224 (females) and 300 mg/kg (males). The dermal LD_{50} in rabbits is reported as 333 mg/kg while the inhalation LC_{50} values in rats were 3.88 (males) to 4.69 mg/L (females) (USEPA, 1998). In 13-week subchronic feeding studies, the rat and mouse NOAEL values were 5 and 15 mg/kg/day and LOAEL values of 15 and 50 mg/kg/day based on hyperkeratosis and/or basal cell hyperplasia in the stomachs of the rat, and decreased weight gain in the mouse. Subchronic inhalation studies in mice and rats resulted in NOAEL values of 10 and 30 and LOAEL values of 30 ppm, based on histopathological lesions in the nasal turbinates, or they were the highest concentration tested (USEPA, 2007). The oral or inhalation animal studies showed no evidence of developmental or reproductive effects (USEPA, 2008b). Human incident reports show that health effects from accidental exposure of DCP spills are skin injuries (blistering, burning sensation, or dermal irritation) and respiratory effects.

USEPA classifies DCP as likely to be carcinogenic to humans based on a 2-year chronic feeding study using rats. The chronic study reported the NOAEL of 2.5 mg/kg/day and the LOAEL of 12.5 based on a decrease in body weight gain and an increase in the number of cells in an epithelium resembling the basal cells of the nonglandular mucosa in the stomach. The study also revealed liver cell adenoma formation at the highest dose tested in the study, 25 mg/kg/day. DCP has also been shown to be genotoxic based on mutagenicity studies (USEPA, 2007). 1,3-Dichloropropene is absorbed, conjugated with glutathione to form mercapturic acid, and excreted in the urine quickly (Schneider et al.. 1998; USEPA, 2008b). DCP does not bioaccumulate in target tissues based on its chemical properties and rapid metabolism (USEPA, 2008b).

Acute effects to birds demonstrate that DCP is moderately toxic with a reported LD_{50} value of 152 mg/kg for the bobwhite quail. Dietary LC_{50} values for the bobwhite quail and mallard duck are greater than 10,000 ppm; however, these values should be interpreted with caution because the product is highly volatile and was most likely lost during the duration of the study. No chronic avian studies are available due to the short dissipation half-life and the typical one application per year scenario for DCP (USEPA, 1998).

The formulated material, Telone® II Soil Fumigant, (Dow AgroSciences, 2015) has moderate acute toxic to birds with an oral LD_{50} of 139.8 mg/kg for the bobwhite quail. It is practically non-toxic to birds via a dietary route with a dietary LC_{50} greater than 6243mg/kg diet for the mallard. The toxicity to soil-dwelling organisms reported the 14 day LC_{50} of 55.6 mg/kg for earthworms. DCP is moderately toxic to honey bees with a 48-hr LD_{50} of 6.6 micrograms/bee (µg/bee) based on a dusting technique (USEPA, 1998). Another study showed that the applications of 1,3-D do not adversely affect soil arthropods, but have a transient effect on earthworms and soil microflora with full recovery within six months and 4.5 months of DCP application, respectively (CalEPA, 2012; Small et al., 2008).

DCP is considered to be moderately toxic to fish and very highly toxic to aquatic invertebrates based on standard toxicity tests. Several fish LC_{50} values exist for DCP with the most sensitive species being the walleye (LC_{50} = 1.08 ppm) and most tolerant being the bluegill sunfish (LC_{50} = 7.1 ppm). Toxicity to freshwater invertebrates appears to be limited to *Daphnia magna* with a reported 48-hour EC_{50} value of 0.09 mg/L. No chronic aquatic vertebrate or invertebrate data is available due to the short half-life of DCP in aquatic systems and the typical one application per season use pattern (USEPA, 1998).

The DCP formulation proposed for use in the PCN program is highly toxic to fish with the 96 hour LC_{50} for sheepshead minnow of 0.87 mg/l. The 96 hours LC_{50}s for rainbow trout and Bluegill sunfish are 2.78mg/l, and 3.7 mg/l, respectively. The acute toxicity to aquatic invertebrates data show that the 48 hour EC_{50} for the water flea (*D. magna*) and eastern oyster are 3.58 mg/l and 0.64 mg/l, respectively. The acute toxicity to algae/aquatic plants data show the 72-hr EC_{50} for green algae is 14.9 mg/l (biomass), while 120-hr EC_{50} for the diatom, *Navicula* sp. is 2.35 mg/l (biomass), with a 14-day EC_{50} of 14.56 mg/L for that aquatic plant, *Lemna gibba*. Chronic exposures using the fathead minnow estimated a NOEC of 0.0318 mg/l for the fathead minnow based on survival impacts. The chronic toxicity to aquatic invertebrates using *D. magna* reported a 21-day NOEC of 0.0701 mg/l.

b. Exposure and Risk

The dissipation of DCP from soil after application occurs primarily through volatilization, leaching, abiotic hydrolysis, and aerobic soil metabolism (USEPA, 2008). Field volatility studies with DCP have shown that 45 to 53% percent of the material volatilizes from the field within 14 days (Kim et al., 2003), while field dissipation half-lives range from 1 to 7 days (USEPA, 1998). Laboratory metabolism half-life values in soil range from 12 to 54 days under aerobic conditions, but is much shorter under anaerobic soil conditions with a half-life of 2.4 to 9.1 days. Increased microbial degradation of DCP occurs with increasing temperature in most cases (Dungan and Yates, 2003). In aquatic systems, DCP volatilizes from water or can be degraded through hydrolysis. Hydrolysis half-lives are temperature dependent with reported half-lives of approximately 100 days at 2 ^{o}C, 13 days at 15 ^{o}C , and 2 days at 29 ^{o}C. Hydrolysis half-lives do not appear to be pH dependent with a reported half-life of 13.5 days for pH values of 5, 7, and 9 at a constant temperature of 20 ^{o}C (USEPA, 1998). Increased light intensity and NO_2 concentration can greatly increase photodegradation of DCP (CalEPA, 2012). The atmospheric half-life via photodegradation is 7 to 12 hours (Dow AgroSciences, 2015). Plants such as bush beans, carrots and tomatoes can absorb DCP from the soil. DCP absorbed by the plants is metabolized and converted into 3-chloroallyl alcohol and then to normal plant products. The isomers of DCP and 3-chloroallyl alcohol were generally non-detectable 120 hours after administration (Berry, 1980; CalEPA, 2012). DCP plant residues are not a concern after fumigation because of the rapid degradation of DCP in plants, and that crops are typically planted after most of the fumigant has dissipated (WHO, 1993; EFSA, 2009; CalEPA, 2012).

DCP is mobile in soil and has high water solubility (2800 mg/L at 20°C); however, due to the low rainfall in the area, the distance of the treated fields from surface water (approximately 0.25 miles), and the method of application, no residues are expected to occur via drift or runoff to aquatic water bodies. Site-soil characteristics and the location of the water table (35 to 50 ft) reduce the potential for DCP, or its metabolites, to contaminate groundwater through leaching. Data collected by the U. S. Geological Survey (USGS) in soil types similar to those in the area where the eradication program is being proposed demonstrated that DCP residues were at, or below, detection limits at 3 ft below the surface in a majority of the soils tested. One sampling site did have concentrations above detection at 3 ft below the soil surface but levels were low (<3.0 ppb) (USGS, 2000). The label for DCP requires 100-ft buffers adjacent to water wells and occupied structures, further reducing human health risks.

The potential exposure routes for DCP as a pre-plant soil fumigant include inhalation, incidental ingestion, and dermal contact for workers, and inhalation exposure as a result of DCP fumigant off-gassing for the general public who live or work in the vicinity of a fumigation site. The actual exposure to DCP for workers is reduced because of: protection by using PPEs; engineering controls requirements such as a mechanical transfer system, end-row spillage control, and transferring Telone II® through connecting hoses, pipes, and/or couplings sufficiently tight with all bulk and non-bulk containers; and other label required mitigation measures. Other mitigation measures include best management techniques in the field, such as use of impermeable tarps and soil injection reaching at least 12 inches below the soil surface designed to protect workers and the public. Telone II® is a restricted use pesticide due to its acute inhalation toxicity and carcinogenicity and used only by certified applicators or persons under their direct supervisions. The Telone II® label (DowAgroScience, 2012) includes specific requirements such as PPEs for handlers, entry restriction, posting fumigant warning signs at entrances to treated areas, and a buffer zone to mitigate potential exposures to workers and the general public. Examples of specific label required restrictions to prevent exposure to the general public include:

- Telone II® should not be applied within 100 feet of an occupied structure (i.e. a school, hospital, business or residence),
- No person shall be present at this structure at any time during the seven consecutive day period following application,
- Telone® II shall not be applied to soils more frequently than twice each year, and
- Individuals without proper training and PPEs are prohibited to enter the area from the start of application until 5 days after application.

Consequently, human health risks from direct contact are low due to reduced exposure. APHIS personnel measured the atmospheric concentrations of DCP during fumigation treatments from August 14 to 28, 2008. Field measurements detected trace concentrations (0.1 ppm) of DCP below the established regulatory threshold limits (USDA APHIS, 2008b). Additional monitoring in 2010 and 2011 demonstrated similar results with most residues at or below detection. The highest concentration measured in 2010-2011 was 3.5 ppm in one sample collected in the treatment field in 2010.

DCP exposure to terrestrial nontarget organisms can occur through direct or indirect exposure. The likelihood of direct exposure (other than to soil invertebrates in the treated fields) is low because DCP will not drift due to the method of application which involves injecting the material into the soil at a minimum depth of 12 inches. In compliance with the label, the soil will then be sealed by compaction after injection of DCP which serves to reduce volatilization (Wang et al., 2001). Plant residues from a cover planting that could serve as forage for nontarget organisms are not expected due to the lack of residues that have been determined in multiple crop residue studies (USEPA, 1998). A lack of measurable DCP residues in plants is related to the rapid degradation of DCP, and its dissipation after fumigation (WHO, 1993; CalEPA, 2012).

Field dissipation and degradation of DCP could result in soil residues that could be ingested by mammals and birds that serve as prey for predators and scavengers. The residues would be low due to the short dissipation half-life and method of application of DCP. Additionally, residues should not be significant based on metabolism studies with DCP. Dosing studies with rats and mice show rapid excretion of DCP through the urine, indicating predators and scavengers would not accumulate significant DCP residues (USEPA, 1998); therefore, indirect exposure via contaminated prey is not expected to occur based on the metabolism and environmental fate of DCP.

c. Summary

DCP poses minimal risk to human health based on the method of application, label requirements for engineering controls and exposure prevention, and the lack of expected residues from any crop or in drinking water. The application site will also be posted to insure no incidental human exposure occurs by accessing treated fields. USEPA has also updated protection measures for all fumigants that are designed to further reduce the risk to human health (USEPA, 2012a-f). The current labels incorporate USEPA mitigation measures to reduce potential risks to fumigation workers and the general public. The mitigation measures for soil fumigants (as a restricted use pesticide) include a clear description of handler activities, training and on-site supervision, respirator protection, air monitoring, tarp perforation and removal, entry-restricted period, establishing and posting of a buffer zone (unless a physical barrier exists to prevent access to a buffer zone), good agricultural practices, emergency preparedness and response plans, notice to state and tribal lead agencies, and site-specific fumigant management plans.

The use of DCP also poses minimal risk to most nontarget organisms. Aquatic organisms will not be impacted because rainfall in the area is low and the application sites are far enough from any water source to minimize residues from drift, runoff, or leaching. Risk to nontarget terrestrial organisms (other than soil invertebrates which are expected to succumb) is also minimal due to the method of application and environmental fate of DCP. Risk to human health and the environment is further reduced by other management practices such as soil injection during application, sealing the injection site to reduce offsite transport, and a 100-ft buffer around water wells and occupied structures.

C. Cumulative Effects

Cumulative effects from the preferred alternative relate to the management actions in the proposed treatment area. The proposed areas of treatment are agricultural fields and will continue to be planted in crops based on any label restrictions, or may be planted in some type of cover planting; therefore, no cumulative impacts related to soil erosion are expected. A cover planting may be used in the winter; however, it will be dependent on whether environmental conditions allow the planting to establish prior to the end of the growing season. Historically, winter cover plantings are not used in this area; therefore, any soil erosion related to the preferred alternative is not expected to be any greater than would occur under typical agricultural practices in the area. Cumulative impacts from the use of the litchi tomato are expected to be negligible since these plantings will be restricted and managed by the Idaho State Department of Agriculture, and require a weed management plan to prevent spread to other areas where control measures would be required.

The potential cumulative impacts of DCP to aquatic resources are expected to be incrementally negligible. The label for DCP does contain a groundwater advisory; however, the soil conditions and depth to the water table reduce the likelihood of DCP moving into groundwater even with the additional proposed application and higher rate. DCP would also not be expected to have cumulative impacts related to elevated nitrate levels that have been reported in groundwater in the area. DCP is regularly used in the area proposed for eradication; however, groundwater monitoring for DCP and its metabolites have shown no historical detections (USGS, 2000).

Based on the chemical properties of DCP, it will volatilize into the atmosphere. Additional DCP use does occur in Idaho primarily on potatoes, sugar beets and onions (Figure 6).

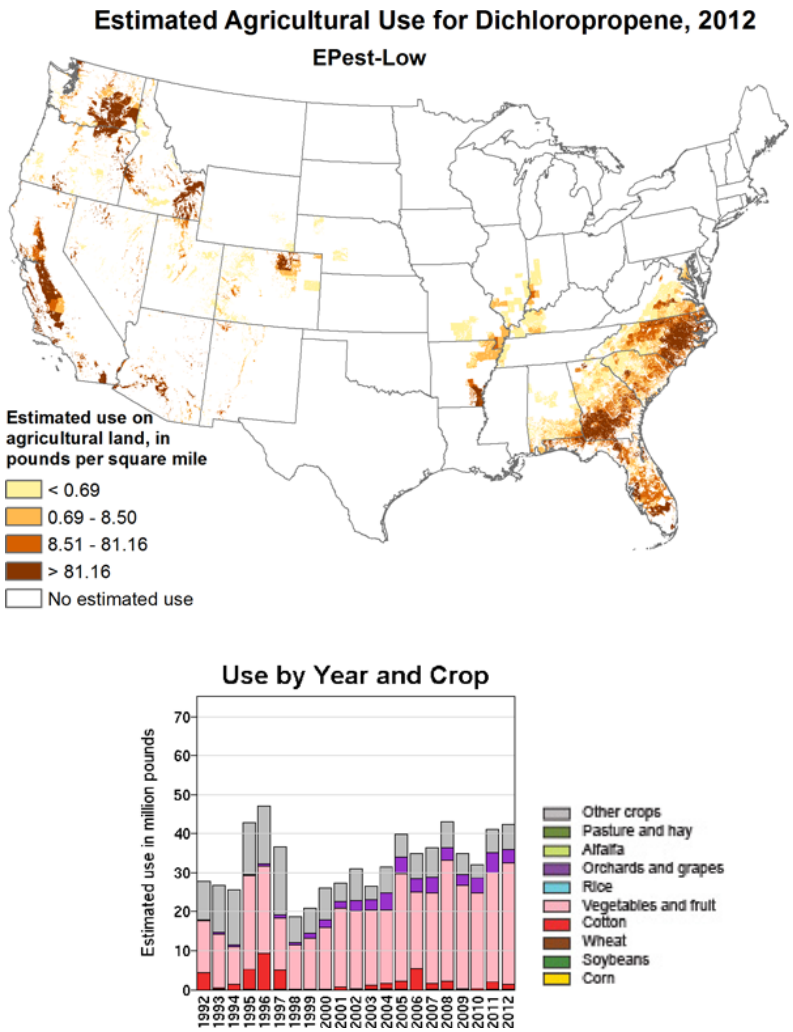

Figure 6. Estimated dichloropropene use in the United States. (Source: USGS, 2015. Method for Estimating Pesticide Use for County Areas in the Conterminous United States.)

Currently, neither sugar beets nor onions are grown near the PCN-infested fields. The potential cumulative impacts to air quality would be minimal due to temporal differences in the PCN-related DCP applications. For a majority of uses, DCP is used as a pre-plant fumigant which would mean applications would occur just prior to the growing season in early spring or the previous fall. The projected applications for DCP in the PCN eradication program will typically occur late summer or early fall, at a time when any volatilized DCP from earlier applications would have dissipated and been dispersed by wind. Cumulative effects to air quality would be expected to be minimal due to efforts to minimize volatilization by soil injection and sealing the soil where injections occur.

D. Threatened and Endangered Species

Section 7 of the Endangered Species Act (ESA) and its implementing regulations require Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of critical habitat.

Two federally threatened species occur in Bingham County, Idaho; the yellow-billed cuckoo (*Coccyzus americanus*) and its proposed critical habitat and the (*Spiranthes diluvialis*). In Bonneville County, there are four threatened species, the yellow-billed cuckoo and Ute’s ladies’ tresses, as well as the Canada lynx (*Lynx canadensis*) and grizzly bear (*Arctos ursos horribilis*).

Western yellow-billed cuckoo

Western yellow-billed cuckoo habitat is comprised of riparian trees including willow (*Salix* sp.), Fremont cottonwoods (*Populus fremontii*), alder (*Alnus* sp.), walnut (*Juglans* sp.), sycamore (*Platanus* sp.), boxelder (*Acer* sp.), ash (*Fraxinus* sp.), mesquite (*Prosopis* sp.), and tamarisk (*Tamarix* sp.) that provide cover, shelter, foraging, and dispersing habitat (U.S. Department of the Interior, 2014b). Critical habitat has been proposed in Bingham County, along the Snake River. This proposed critical habitat unit is 9,294 acres in extent and is a 22-mile long continuous segment of the Snake River from the upstream end of the American Falls Reservoir in Bannock County upstream to a point on the Snake River approximately two miles west of the Town of Blackfoot in Bingham County, Idaho (U.S. Department of the Interior, 2014a). This proposed critical habitat within Bingham County is approximately 25 miles from the current treatment area near Shelley, ID.

Ute’s ladies’ tresses

Ute’s ladies’ tresses is known from moist meadows associated with perennial stream terraces, floodplains, and oxbows at elevations between 4,300-6,850 feet, as well as seasonally flooded river terraces, sub-irrigated or spring-fed abandoned stream channels and valleys, and lakeshores. In addition, 26 populations have been discovered along irrigation canals, berms, levees, irrigated meadows, excavated gravel pits, roadside barrow pits, reservoirs, and other human-modified wetlands. (From: (U.S. Fish and Wildlife Service, Undated)). These plants would not be present within potato fields.

Canada lynx

The Canada lynx range extends south from the classic boreal forest zone into the subalpine forest of the western United States, and the boreal/hardwood forest ecotone in the eastern United States. In Bonneville County, the lynx would not likely be present in potato growing areas. The Targhee National Forest has known Canada lynx habitat, but program actions would not occur there.

Grizzly bear

Agricultural fields are not considered suitable habitat for grizzly bears because this land type does not contain adequate food resources to support grizzly bears (U.S. Department of the Interior, 2007).

Assessment

Program activities will have no effect on threatened species or proposed critical habitat in Bingham and Bonneville Counties. Fumigation activities occur in potato fields; these do not provide habitat for listed species. If additional species are federally listed, critical habitat is designated, or program activities change so that they could affect federally listed species, APHIS will initiate consultation with the U.S. Fish and Wildlife Service (FWS) as necessary. In particular, if treatments of fields will occur within one mile of yellow-billed cuckoo critical habitat, APHIS will initiate consultation with FWS.

E. Migratory Birds

The Migratory Bird Treaty Act of 1918 (16 United States Code (U.S.C.) 703–712) established a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird.

Executive Order 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds,” directs Federal agencies taking actions with a measurable negative effect on migratory bird populations to develop and implement a memorandum of understanding (MOU) with the U.S. Fish and Wildlife Service (FWS) which promotes the conservation of migratory bird populations. On August 2, 2012, an MOU between APHIS and U.S.

Fish and Wildlife Service was signed to facilitate the implementation of this Executive order.

Bingham and Bonneville Counties occur within the Pacific flyway. This flyway extends from the Arctic tundra to South American wetlands. This flyway includes Alaska, Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington; portions of Colorado, Montana, New Mexico, and Wyoming west of the Continental Divide; and the Canadian provinces of British Columbia and Alberta; and the Yukon and Northwest Territories. Migratory birds of conservation concern in the two counties are listed in Table 1.

Table 1. Migratory birds of conservation concern in Bingham and Bonneville Counties, Idaho (Service, 2015a; 2015b).

Common name	**Scientific Name**	**County**
Black rosy-finch	*Leucosticte atrata*	Bingham, Bonneville
Brewer's sparrow	*Spizella breweri*	Bingham, Bonneville
Calliope hummingbird	*Stellula calliope*	Bingham, Bonneville
Cassin's finch	*Carpodacus cassinii*	Bingham, Bonneville
Eared grebe	*Podiceps nigricollis*	Bingham, Bonneville
Ferruginous hawk	*Buteo regalis*	Bingham, Bonneville
Fox sparrow	*Passerella iliaca*	Bingham, Bonneville
Greater sage-grouse	*Centrocercus urophasianus*	Bingham, Bonneville
Green-tailed towhee	*Pipilo chlorurus*	Bingham, Bonneville
Lewis' woodpecker	*Melanerpes lewis*	Bingham, Bonneville
Loggerhead shrike	*Lanius ludovicianus*	Bingham, Bonneville
Long-billed curlew	*Numenius americanus*	Bingham, Bonneville
Olive-sided flycatcher	*Contopus cooperi*	Bingham, Bonneville
Peregrine falcon	*Falco peregrinus*	Bingham, Bonneville
Pinyon jay	*Gymnorhinus cyanocephalus*	Bingham
Sage thrasher	*Oreoscoptes montanus*	Bingham, Bonneville
Short-eared owl	*Asio flammeus*	Bingham, Bonneville
Swainson's hawk	*Buteo swainsoni*	Bingham, Bonneville
Williamson's sapsucker	*Sphyrapicus thyroideus*	Bonneville
Willow flycatcher	*Empidonax traillii*	Bonneville

Program activities will occur only within potato fields. Migratory birds would not be expected to be present within these fields during application. DCP toxicity to birds is considered moderate. The method of application, environmental fate of each fumigant, and areas of treatment suggest that migratory birds would be at low risk from exposure to pale cyst nematode treatments.

F. Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668–668c) prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle…[or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

In Idaho, large concentrations of wintering bald eagles are found along Lake Coeur d'Alene, Lake Pend Oreille, and sections of the Snake, Salmon and Boise Rivers. Although some nesting pairs remain in Idaho year-round, the winter population is supplemented by migrants from Canada. The bald eagle count in Idaho has ranged from 480 to 832 birds. In Bingham and Bonneville Counties, eagle nests are concentrated along the Snake River (Game, 2008).

Eagles are not likely to be disturbed by routine activities that pre-date the eagles' successful nesting activity in a given area, and ongoing existing uses can with the same intensity with little risk of disturbing bald eagles (Service, 2007b). Farming activities routinely occur in treated fields, and fumigations would be very similar to those activities in those fields. Therefore, eagles would not likely be disturbed by program activities. The risk of exposure to fumigants would also be low based on the method of application and the expected lack of prey that would be present in treated fields.

V. Other Considerations

Executive Order (EO) 13175, "Consultation and Coordination with Indian Tribal Governments," was issued to ensure that there would be "meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications…."

The Fort Hall Reservation occurs within Bingham County, a reservation for the Shoshone-Bannock Tribes. Currently, the eradication program does not occur on the Fort Hall Reservation; however, potato fields occur on the Reservation and could be affected should PCN spread.

APHIS prepared a letter and sent it to the Shoshone-Bannock Tribes, describing the program, and requesting input regarding potential effects on the Tribes, and an invitation for consultation. Federal and State agriculture officials will continue to collaborate with Indian tribal officials to ensure that they are well-informed and represented in policy and program decisions that may impact their agricultural interests.

Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations," focuses Federal attention on the environmental and human health conditions of minority and low-income communities and promotes community access to public information and public participation in matters relating to human health or the environment. This EO requires Federal agencies to conduct their programs, policies, and activities that substantially affect human health or the environment in a manner so as not to exclude persons and populations from participation in or benefiting from such programs. It also enforces existing statutes to prevent minority and low-income communities from being subjected to disproportionately high or adverse human health or environmental effects.

Using U.S. Census Bureau estimates, in Bingham County 16 percent of the population identifies speaks a language other than English at home, but only 6.8 percent of the population report speaking English less than "very well" (Bureau, 2013). Approximately 14 percent of Bingham County residents are considered persons in poverty (Bureau, 2014). The population reporting their race as Black is 0.5 percent, Asian as 0.7 percent, Hispanic or Latino as 17.6 percent, and American Indian and Alaska Native as 7.4 percent (Bureau, 2014).

In Bonneville County, approximately 11 percent of its residents are considered persons in poverty (Bureau, 2015). The population reporting their race as Black is 0.7 percent, Asian as 1 percent, Hispanic or Latino as 12.4 percent, and American Indian and Alaska Native as 1.1 percent (Bureau, 2015). Only 3.8 percent of the population report speaking English less than "very well" (U.S. Census Bureau, 2013).

The demographic information does not suggest low-income and minority residents would require additional outreach to ensure adequate understanding of the program. Consequently, APHIS finds additional outreach to these segments of the population is not needed. Because the preferred alternative is to apply fumigants in privately-owned potato fields, these segments of the population are not likely to be disproportionately adversely affected by the treatment. APHIS has determined that the environmental and human health effects from the proposed changes in applications for eradication of PCN in Idaho are minimal and are not expected to have disproportionate adverse effects to any minority or low-income populations.

EO 13045, “Protection of Children from Environmental Health Risks and Safety Risks,” acknowledges that children, as compared to adults, may suffer disproportionately from environmental health and safety risks because of developmental stage, greater metabolic activity levels, and behavior patterns. This EO (to the extent permitted by law and consistent with the agency’s mission) requires each Federal agency to identify, assess, and address environmental health risks and safety risks that may disproportionately affect children. Applications will follow label requirements designed to reduce risk if infested fields are in proximity to schools, parks, or day care facilities where children may be present. In addition, the method of application and management of the fields will minimize residues from drift, volatilization, and dietary exposure. Based on the distance of the application area from surface and groundwater resources, no residues from any of the proposed fumigants would be expected in drinking water. The preferred alternative is not expected to have disproportionately high or adverse human health or environmental effects to children.

Consistent with the National Historic Preservation Act of 1966, APHIS has examined the proposed action in light of its impacts to national historic properties. Several historic sites exist within the current quarantine as well as the counties (table 2), but treatments will occur in potato fields and these will not impact historic properties. Treatments for PCN on historic properties are not anticipated at this time. In the event that future treatments could occur on historic properties they would be coordinated with the State Historic Preservation Officer and other appropriate contacts.

Table 2. Historic sites within Bingham and Bonneville Counties, Idaho (National Register of Historic Places, 2015 http://www.nps.gov/nr/research/index.htm)

Historic Site	**County**	**Address**	**City**
Art Troutner Houses Historic District	Bonneville	3950, 4012 and 4032 S. 5th W.	Idaho Falls
Beckman, Andrew and Johanna M., Farm	Bonneville	US 20 0.5 mi. W of jct. with New Sweden Rd.	Idaho
Beckman, Oscar and Christina, Farmstead	Bonneville	SW corner of jct. of New Sweden--Shelley Rd. and US 20	Idaho Falls
Bonneville County Courthouse	Bonneville	Capital Ave. and C St.	Idaho Falls
Bonneville Hotel	Bonneville	400 Blk W. C St.	Idaho Falls
Douglas-Farr Building	Bonneville	493 N. Capital Ave.	Idaho Falls
Eagle Rock Ferry	Bonneville	N of Idaho Falls on Snake River	Idaho Falls
Eleventh Street Historic District	Bonneville	Roughly bounded by S. Boulevard, 13th, 10th, and 9th Sts., S. Emerson and S. Lee Aves.	Idaho Falls

Farmers and Merchants Bank Building	Bonneville	383 W. A St.	Idaho Falls
First Presbyterian Church	Bonneville	325 Elm St.	Idaho Falls
Hasbrouck Building	Bonneville	362 Park Ave.	Idaho Falls
Holy Rosary Church	Bonneville	288 E. Ninth St.	Idaho Falls
Hotel Idaho	Bonneville	482 W. C St.	Idaho Falls
I.O.O.F. Building	Bonneville	393 N. Park Ave.	Idaho Falls
Idaho Falls Airport Historic District	Bonneville	2381 Foote Dr.	Idaho Falls
Idaho Falls City Building	Bonneville	303 W. C St.	Idaho Falls
Idaho Falls Public Library	Bonneville	Elm and Eastern Sts.	Idaho Falls
Iona Meetinghouse	Bonneville	In Iona	Iona
Kress Building	Bonneville	451 N. Park Ave.	Idaho Falls
Montgomery Ward Building	Bonneville	504 Shoup Ave.	Idaho Falls
New Sweden School	Bonneville	SW corner of jct. of New Sweden School Rd. and Mill Rd.	Idaho Falls
Ridge Avenue Historic District	Bonneville	Roughly bounded by N. Eastern Ave., Birch St., S. Blvd., Ash St., W. Placer Ave. and Pine St.	Idaho Falls
Rocky Mountain Bell Telephone Company Building	Bonneville	246 W. Broadway Ave.	Idaho Falls
Sealander, Carl S. and Lizzie, Farmstead	Bonneville	W end St. John Rd.	Idaho Falls
Shane Building	Bonneville	381 N. Shoup Ave.	Idaho Falls
Shelton L.D.S. Ward Chapel	Bonneville	SW of Ririe on Shelton Rd	Ririe
Trinity Methodist Church	Bonneville	237 N. Water Ave.	Idaho Falls
U.S. Post Office	Bonneville	581 Park Ave.	Idaho Falls
Underwood Hotel	Bonneville	343-349 W. C Street	Idaho Falls
Wasden Site (Owl Cave)	Bonneville	Address Restricted	Idaho Falls
Blackfoot I.O.O.F. Hall	Bingham	57 Bridge St.	Blackfoot
Blackfoot LDS Tabernacle	Bingham	120 S. Shilling St.	Blackfoot
Blackfoot Railway Depot	Bingham	Main St., NW	Blackfoot
Eastern Idaho District Fair Historic District	Bingham	97 Park Dr.	Blackfoot
Fort Hall Site	Bingham	16 mi. N of Fort Hall	Fort Hall
Idaho Republican Building	Bingham	167 W. Bridge St.	Blackfoot
Jones, J. W., Building	Bingham	104 Main St., NE	Blackfoot
Lincoln Creek Day School	Bingham	Rich Ln., eight mi. SE of St. Hwy. 91	Fort Hall
North Shilling Historic District	Bingham	N. Shilling Ave.	Blackfoot
Nuart Theater	Bingham	195 N. Broadway	Blackfoot
Ross Fork Episcopal Church	Bingham	Mission Rd.	Fort Hall
Ross Fork Oregon Short Lines Railroad Depot	Bingham	Agency Rd.	Fort Hall

Shilling Avenue Historic District	Bingham	Shilling Ave. between E. Idaho and Bingham Sts. and Bridge and Judicial Sts. to Stout Ave.	Blackfoot
St. Paul's Episcopal Church	Bingham	72 N. Shilling Ave.	Blackfoot
Standrod Bank	Bingham	59 and 75 Main St., NW	Blackfoot
US Post Office--Blackfoot Main	Bingham	165 W. Pacific	Blackfoot

VI. Listing of Agencies and Persons Consulted

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Plant Health Programs
4700 River Road, Unit 134
Riverdale, MD 20737

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
Environmental and Risk Analysis Services
4700 River Road, Unit 149
Riverdale, MD 20737

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
State Plant Health Director
9118 W. Blackeagle Drive
Boise, ID 83709

Idaho PCN Program Director
U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Idaho Falls, ID 83042

Bureau Chief
Plant Industries Division
Idaho State Department of Agriculture
P.O. Box 790
Boise, ID 83701

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Appendix A: Potential Host Plants for *G. pallida*

Bold= confirmed in the literature
Non Bold = listed in either CABI Compendium or GPDD

Note: Most papers were prepared before *Globodera pallida* was distinguished from *G. rostochiensis*. Many older papers refer to the potato cysts nematodes as a strain of *Heterodera schachtii*.

<u>Primary Hosts:</u>
Lycopersicon esculentum (tomato)
Solanum melongena (eggplant, aubergine)
Solanum tuberosum (potato)
Capsicum spp.

<u>Minor Hosts:</u>
Datura stramonium (Devil's trumpet, Jamestown-weed)
Lycopersicon pimpinellifolium (currant tomato) (syn. **Lycopersicon racemigerum)**
Oxalis tuberosa (oca)
Solanum aviculare (kangaroo apple)
Solanum gilo (syn. Solanum integrifolium) (scarlet or tomato eggplant)
Solanum indicum (Indian nightshade)
Solanum marginatum (white-edged (margined) nightshade)
Solanum mauritianum (tree tobacco, earleaf nightshade)
Solanum nigrum (black nightshade) (Winslow (1954) found as a non-host, appears there are multiple varieties that vary in susceptibility/resistance (Scholte (2000)).
Solanum quitoense (Naranjillo)
Solanum sarrachoides (hairy nightshade)

<u>Other hosts:</u>
Atropa belladonna? (deadly nightshade) - Reported as a host by Franklin (1940), Found to be negative by Winslow (1954)
Datura tatula (jimsonweed)
Hyoscyamus niger (black henbane)
Lycopersicon esculentum aureum
Lycopersicon glandulosum (Peruvian nightshade)
Lycopersicon hirsutum (hairy tomato)
Lycopersicon mexicanum
Lycopersicon peruvianum (wild tomato)
Lycopersicon pyriforme (garden tomato)
Physalis philadephica (Mexican groundcherry)
Physochlainia orientalis (purple trumpet flowers)
Salpiglossis spp. (painted tongue)
Saracha jaltomata

Other *Solanum spp.*

Solanum acaule (Wild Andean potato)
Solanum aethiopicum (Ethiopian nightshade, African eggplant)
Solanum ajanhuiri (Ajanhuiri)
Solanum alandiae
Solanum alatum (red fruited nightshade)
Solanum americanum (American black nightshade)
Solanum anomalocalyx
Solanum antipoviczii *(now* ***S. stoloniferum*****)**
Solanum armatum (forest nightshade)
Solanum ascasabii
Solanum asperum
Solanum berthaultii (wild potato)
Solanum blodgettii (mullein nightshade)
Solanum boergeri
Solanum brevimucronatum
Solanum brevidens (wild potato-diploid)
Solanum bulbocastanum **–** (ornamental nightshade) - also listed as *S. bulbocastana*
Solanum calcense
Solanum calcense x Solanum cardenasii
Solanum caldasii
Solanum canasense
Solanum capsibaccatum
Solanum capsicoides (cockroach berry)
Solanum cardiophyllum (heartleaf horsenettle)
Solanum carolinense (Carolina horsenettle)
Solanum chacoense **–** (Chaco potato) also reported as *S. chacoense* v. *subtilis*
Solanum chaucha
Solanum chenopodioides
Solanum chloropetalum
Solanum citrullifolium (watermelon nightshade) – also listed as *S. citrillifolium*
Solanum coeruleifolium (chaucha)
Solanum commersonii (Commerson's nightshade)
Solanum curtilobum (rucki)
Solanum curtipes
Solanum demissum (nightshade)
Solanum demissum x Solanum tuberosum
Solanum dulcamara (bittersweet)
Solanum durum
Solanum elaeagnifolium (silverleaf nightshade)
Solanum famatinae
Solanum fraxinifolium
Solanum fructo-tecto
Solanum garciae
Solanum gibberulosum

Solanum giganteum (African holly)
Solanum gigantophyllum
Solanum glaucophyllum (waxyleaf nightshade)
Solanum goniocalyx (yellow potato)
Solanum gracile (whitetip nightshade)
Solanum heterodoxum (melonleaf nightshade)
Solanum heterophyllum (unarmed nightshade)
Solanum hirtum (huevo de gato)
Solanum hispidum (devil's fig)
Solanum intrusum (garden huckleberry)
Solanum jamesii (wild potato)
Solanum jujuyense
Solanum juzepczukii (ckaisalla)
Solanum kesselbrenneri (phureja)
Solanum kurtzianum
Solanum lanciforme (heartleaf nightshade)
Solanum lapazense
Solanum lechnoviczii
Solanum leptostygma (potato)
Solanum longipedicellatum *(now S. stoloniferum)*
Solanum luteum (red-fruited nightshade)
Solanum macolae
Solanum macrocarpon (African eggplant)
Solanum maglia
Solanum mamilliferum (chauca)
Solanum miniatum (red-fruited nightshade)
Solanum multidissectum
Solanum muricatum (pepino melon)
Solanum nitidibaccatum (Argentinian nightshade)
*Solanum ochroleucum (*syn. *S. nigrum)*
Solanum ottonis (divine nightshade)
Solanum pampasense
Solanum parodii
Solanum penelli
Solanum phureja (chauca)
Solanum photeinocarpum (terimini inuhoozuki)
Solanum pinnatisectum (tansyleaf nightshade)
Solanum platypterum
Solanum platense
Solanum polyacanthos
Solanum polyadenium (potato)
Solanum prinophyllum (forest nightshade)
Solanum radicans (cusmayllo)
Solanum raphanifolium (wild potato)
Solanum rostratum (buffalobur nightshade)
Solanum rybinii (phureja)

Solanum salamanii
Solanum saltense
Solanum sambucinum
Solanum sanctae-rosae
Solanum scabrum
Solanum schenkii
Solanum schickii
Solanum semidemissum
Solanum simplicifolium
Solanum sinaicum (nightshade)
Solanum sodomaeum (apple of Sodom)
Solanum soukupii
Solanum sparsipilum
Solanum stenotomum (pitiquina)
Solanum stoloniferum
Solanum suaveolens
Solanum subandigenum (Andigena)
Solanum sucrense
Solanum tarijense
Solanum tenuifilamentum (chauca)
Solanum tomentosum
Solanum toralopanum (apharuma)
Solanum triflorum (cutleaf nightshade)
Solanum tuberosum ssp. andigena (potato)
Solanum tuberosum ssp. tuberosum (Irish potato)
Solanum tuberosum 'Aquila',
Solanum tuberosum ' Xenia N'
Solanum utile- South American genus-strongly attacked
Solanum vallis-mexicae
Solanum vernei (purple potato)
Solanum verrucosum
Solanum villosum (red-fruited nightshade)
Solanum violaceimarmoratum
Solanum wittmackii
Solanum wittonense
Solanum xanti (chaparral nightshade)
Solanum yabari (pitiquina)
Solanum zuccagnianum (gilo)

Web Resources:

CABI Crop Compendium. www.cabicompendium.org
Extensive list of hosts. List *Salpiglossis spp.* that are actually *Solanum spp.*

Global pest and disease database. https://www.gpdd.info.
Extensive list of hosts.

HYPP Zoology. *Globodera rostochiensis* (Wollenweber, (U.S. Department of Agriculture)
http://www.inra.fr/Internet/Produits/HYPPZ/RAVAGEUR/6gloros.htm

This species exclusively parasitizes the Solanaceae, especially potato, tomato, egg plant and a few volunteer plants such as bittersweet (*Solanum dulcamara*) and henbane (*Hyoscyamus niger*).

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Potato (*Solanum tuberosum*) is the major host. Other hosts include many *Solanum* species, oca (*Oxalis tuberosa*), Jamestown-weed (*Datura stramonium*), tomato (*Lycopersicon* spp.), and *Salpiglossis* spp.

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Appendix B. Methyl Bromide and Chloropicrin Summary Risk Analysis

The Environmental Protection Agency (EPA) approved pesticide label (Tri-Con 80/20, EPA Reg. No. 58266-1) for the proposed application of methyl bromide for the PCN eradication program contains two active ingredients. Methyl bromide is the primary active ingredient comprising 80 percent of the formulated product while chloropicrin makes up 19.9 percent of the product with 0.1 percent other ingredients. The purpose of adding chloropicrin to the formulation is to act as a warning agent because methyl bromide is odorless, while chloropicrin has a strong odor. Chloropicrin is also an active ingredient in the Tri-Con 80/20 formulation. Summary risk profiles for both chemicals are discussed in the following sections.

Methyl Bromide

a. Toxicity

Methyl bromide is an odorless gas. Human toxic effects from incidents of agricultural applications of methyl bromide exposure include symptoms such as headache, malaise, weakness, difficulty breathing (dyspnea), convulsions, severe skin burns, vomiting, and diarrhea. Animal studies show that methyl bromide has low to moderate toxicity via oral or inhalation exposure. Methyl bromide does have high toxicity through dermal and ocular routes of exposure (EPA, 2006, 2007a). The median lethal oral dose (LD_{50}) in the rat is 86 mg/kg, while the median lethal inhalation concentration (LC_{50}) in rats is 3.03 mg/L (EPA, 2007a). Neurotoxicity is the major hazard concern in acute and chronic toxicity exposure studies. Decreased activity, ataxia, and tremors, and paralysis are common signs of exposure in inhalation studies using methyl bromide. In developmental inhalation studies using the rabbit, the maternal no observed adverse effects level (NOAEL) was 40 ppm, while the developmental toxicity NOAEL was also 40 ppm. In subchronic studies (5 to 7 weeks) using the dog (the most sensitive species to the neurotoxic effects of methyl bromide), a systemic NOAEL of 26 ppm was established based on daily doses of methyl bromide. Chronic studies using the rat, over a 127- week period, resulted in a lowest observed adverse effects level (LOAEL) of 3 ppm, based on respiratory irritation and a systemic toxicity NOAEL of 30 ppm.

USEPA currently classifies methyl bromide as not likely to be a human carcinogen because there is not enough evidence to support a different classification at this time (EPA, 2007a). Despite epidemiologic studies suggesting methyl bromide exposure may be associated with prostate, stomach, and testicular cancers (Alvanja et al. 2003, Mills and Yang, 2003, Cockburn et al. 2011, Mills and Yang, 2007, and Wong et al., 1984), a more recent study evaluated the associations of methyl bromide with the cancer cases of pesticide applicators in the Agricultural Health Study (AHS) (http://aghealth.nih.gov/) with follow-up from 1993 through 2007 (Barry et al., 2012). This study also evaluated interactions with a family history for four common cancers (prostate, lung, colon, and lympho-hematopoietic). The results indicated little evidence of methyl bromide association with cancer risks (including prostate cancer) except for stomach cancer risk. An association with prostate cancer with shorter follow-up (through 1999) previously was observed. The association, however, did not persist with longer follow-up. Therefore, the researchers suggested in the report to re-evaluate the exposure-dependent increase in stomach cancer risk with longer follow-up in the AHS along with other epidemiologic studies.

Methyl bromide is genotoxic based on available human and animal studies. A study of methyl bromide fumigation workers reported lymphocyte-related genotoxic effects associated with methyl bromide exposure (Calvert et al., 1998). In animal studies methyl bromide exposure induced micronuclei formation in the bone-marrow and peripheral blood cells of rats and mice (USEPA, 2001, IARC, 1999). A rat testicular DNA alkaline elution assay showed genotoxic potential in testicular DNA from repeated short-term inhalation exposure of methyl bromide (USEPA, 2001). A DNA-binding study of methyl bromide exposure in rats detected DNA adducts in the liver, lung, stomach, and fore stomach (Gansewendt et al., 1991).

Metabolism studies using ^{14}C-MeBr in rats indicated that inhaled methyl bromide is absorbed and distributed in all tissues with the lungs, liver, and kidneys being the major organs, and is then metabolized, and excreted mainly as Br^- and carbon dioxide (NRC, 2012, Honma et al., 1985, Bond et al. 1985, Medinsky et al., 1985). Approximately 27 - 50% of methyl bromide vapor inhaled was absorbed after a six hour exposure (USEPA, 2006, Medinsky et al., 1985). For metabolism, methyl bromide may react with water and break down to methanol and bromide ion. Methyl bromide may also react with organic thiols to form S-methyl derivatives. Methanol and S-methyl derivatives further break down to form carbon dioxide (approximately 40-50% of the administered dose) and other nonvolatile metabolites (approximately 20-25%) (ATSDR, 1992). The excreted ^{14}C methyl bromide metabolites orally administrated were primarily found in urine (43%), and expired carbon dioxide (32%) with less amounts in carcass (14%), and feces (less than 3%) over a 3-day period (Medinsky et al., 1984). Bromine concentrations in tissues peaked 4-8 h after inhalation exposure, and the half-life of elimination was about 5 days in rats (Honma et al., 1985). Bromide and chloride present in body fluids in animals in steady state are excreted readily. Increased chloride intake has been shown to increase bromide excretion (WHO, 2009).

In mammals, bromine converts to the bromide ion (USEPA, 2005). Acute oral and dermal studies using sodium bromide show low toxicity (oral LD_{50} of 4,200 mg/kg and dermal LD_{50} >2,000 mg/kg) with mild eye and skin irritation (USEPA, 1993a). Chronic diet studies in mice show no observed adverse effect levels (NOAELs) ranging between 400 and 1,200 mg/kg (NRC, 2005, Hansen and Hubner, 1983). Dietary studies in rats observed disturbances in thyroid and renal function at dietary levels between 1,200 and 19,200 mg/kg (NRC, 2005, Loeber et al., 1983). A decrease in fertility also occurred at 1,200 mg/kg (NRC, 2005, van Leeuwen et al., 1983). A 1-year sodium bromide exposure study in dogs with doses of 100 mg/kg/day of bromide as sodium bromide or doses up to 150 mg/kg/day of bromide as food fumigated with methyl bromide reported a NOEL of 100 mg/kg/day (USEPA, 1993b, Rosenblum, et al., 1960). Effects on weight gain and lethargy were observed at 150 mg/kg/day. A 2-year study in rats using feed fumigated with methyl bromide reported effects on body weight at a residual bromide level of 500 mg/kg, but no effect on body weight at a residual bromide level of 200 mg/kg (NRC, 2005, Mitsumori et al., 1990).

An evaluation of human studies on bromide indicated a daily NOAEL of 4 mg/kg of body weight (van Leeuwen and Sangster, 1987). Neurotoxicity appeared to be the most sensitive effect at higher levels in humans. The Food and Agriculture Organization/World Health Organization (1967) set the acceptable daily intake of bromide at 1 mg/kg estimated from all food sources (NRC, 2005).

In nontarget organisms, such as birds, the clinical signs of toxicity are comparable to mammals. Decreased activity, ataxia, and tremors were observed in the bobwhite quail with a reported LD_{50} value of 73 mg/kg and a no observable effect concentration (NOEC) of 33 mg/kg. Methyl bromide is moderately toxic with the acute (4 h) inhalation LC_{50} of 561 ppm in bobwhite quail, and 780 ppm in mouse. The chronic (11 week) reproductive study in Norway rat reported a NOAEL of 30 ppm (24 mg/kg/day) for parental/systemic toxicity and a LOAEL of 90 ppm (73 mg/kg/day) based on reduced body weight during gestation. The study also reported a juvenile survival no observed adverse effects concentration (NOAEC) of 3 ppm and LOAEC of 30 ppm based on pup weight (USEPA, 2011).

Methyl bromide is moderately to highly toxic to aquatic organisms. The range of acute LC_{50} values in five different fish species ranges from 0.7 to 17 ppm. Chronic fish toxicity is lower with a reported no observable effect concentration (NOEC) of 0.1 ppm. Toxicity to the freshwater aquatic invertebrate, *Daphnia magna*, appears to be similar to fish with a reported 48-hour LC_{50} value of 2.6 ppm and a NOEC of 1.2 ppm. The breakdown product of methyl bromide, the bromide ion, has also been evaluated for aquatic toxicity and found to be much less toxic to aquatic fauna. For acute exposures to fish and invertebrates, the bromide ion was approximately four to five orders of magnitude less toxic for invertebrates and fish, respectively. Chronic fish toxicity values for the bromide ion were also less toxic than methyl bromide with a NOEC value that is an order of magnitude less than the parent.

b. Exposure and Risk

The primary mechanism of methyl bromide dissipation is through volatilization into the atmosphere. Twenty four percent to seventy four percent of methyl bromide applied as a soil fumigant dissipates into the atmosphere (Yagi et al., 1993, 1995; Majewski et al., 1995; Yates et al., 1996bc; Williams et al., 1999). Volatilized methyl bromide degrades in the upper troposphere through its reaction with the hydroxyl radical (half-life 210 days), and stratosphere via photoionization by UV light (lifetime 35 years). The estimated total global lifetime of methyl bromide in atmosphere is 0.7 years (USEPA, 2011). Field dissipation studies show half-lives ranging between 4 and 11 days. Methyl bromide that does not volatilize is susceptible to hydrolysis (half-life 11 to 15 days), as well as microbial activity, with reported aerobic and anaerobic soil half-lives ranging from 6 to 59 days, depending on soil type (USEPA, 2011). Methyl bromide breaks down to bromine (inorganic bromide). The PCN program environmental monitoring reported residual bromide soil concentrations ranging between 0.724 mg/kg and 10.6 mg/kg mostly detected in subsurface soil of the fumigated fields at depths between two and three feet (APHIS, 2015). Degradation of methyl bromide is dependent on soil organic matter with increased rates of degradation in soils with increasing levels of organic matter. Methyl bromide degradation in water is somewhat pH-dependent with hydrolysis half-life values ranging from 29 days at a pH of 3, to 9 days at a pH of 8 (USEPA, 2011). The high pH of the soil in the areas to be treated will contribute to the rapid breakdown of methyl bromide.

Bromine in soil is a negatively charged ion, and can be taken up by plants. Crops (fruits, grains, and vegetables) grown in soils after methyl bromide fumigation may have higher levels of bromide (NRC, 2005, Brown et al., 1979, Roughan and Roughan, 1984) with potential for increased bromide accumulation (Ellis et al., 1995, Kempton and Maw, 1972). High bromine concentrations (up to 8,400 mg/kg) were reported in plants such as barley, bur clover, filaree, wild oat, ryegrass, spinach, lettuce, and oat hay with no phytotoxic symptoms (Brown et al., 1979, Kempton and Maw, 1972, and Knight and Costner, 1977). Bromide residues are especially high in plants planted closely after soil fumigation (Roughan and Roughan, 1984) and during the first year of the fumigation (Brown et al., 1979). APHIS (2015) reported an average level of 9,545 mg/kg in fodder samples of baled and grain stage peas, oats, and barley harvested from a field in the same year of soil fumigation in 2013. Average concentrations of 6,265 mg/kg and 4,827 mg/kg were reported in baled hay samples collected from the first and second cutting of 2014. An average concentration of 1,443 mg/kg was reported in baled hay samples collected from the first cutting in the same fields in 2015 (fumigation was not performed in 2015). Elevated levels of bromine in plants used for animal feeds have shown adverse health effects such as lethargy, weakness, and ataxia in horses, goats, and cattle (Knight and Costner, 1977) and motor incoordination in cattle (Knight and Reinea-Guerra, 1977). Reported bromide intoxication of livestock in California was caused by ingestion of volunteer oat hay cut from a field treated with methyl bromide the previous year (Knight and Costner, 1977). The bromide levels in the hay ranged from 6,800 to 8,400 ppm. Bromide levels in plants grown in methyl bromide treated fields may result in exposure to non-target vertebrates, such as wildlife and domestic animals that consume plant material. Residues of bromine in soil and plants will be dependent upon site conditions that affect methyl bromide degradation.

The maximum tolerable level (MTL) of bromine is the dietary level consumed for a duration of time that will not impair animal health or performance. The National Research Council (NRC) established a MTL of 300 mg/kg in rodents. NRC uses an estimated MTL of 200 ppm in animal feed for swine and cattle (NRC, 2005). The level was estimated based on no observed effects seen in a pig diet study (pigs exposed to bromide salts at level of 200 mg/kg/day) (Barber et al., 1971) and cattle diet studies (cattle exposed to inorganic bromide at levels of 19 mg/kg/day and 43 mg/kg/day) (Lynn et al., 1963). Limited information is found in the open literature on residue levels in meat and milk of animals at various dietary bromide levels. A dietary study in dairy cows (Vreman et al., 1985) reported muscle and milk bromide levels of 3 mg/kg and 6 mg/kg, respectively (dietary bromide level of 22 mg/kg), and 20.8 mg/kg and 31 mg/kg, respectively (dietary bromide level of 115 mg/kg). In the study, dairy cows were fed diets contained 22, 69, or 115 mg/kg inorganic bromide residues from the decomposition of methyl bromide fumigate for 5 weeks.

Human exposure to methyl bromide gas can occur during and after application because of its volatility and ability to move off site for an extended period of time after application. Fumigant applications result in exposures up to several thousand feet from a treated field depending on the size of the fumigated field, the amount of fumigant applied, and the rate at which the fumigant escapes from the treated field. The rate of a fumigant off-gassing from a treated field after application is dependent on factors such as the application method, soil moisture, soil temperature, organic matter levels, water treatments, the use of tarps, biological activity in soil,

soil texture, weather conditions, and soil compaction (USEPA, 2008a). The potentially exposed human populations include workers (applicators and handlers) with inhalation, incidental ingestion, and dermal contact as the exposure routes, and the general public who live or work in the vicinity of a fumigation site with inhalation as the primary exposure route.

Concerns regarding potential human exposure to fumigants resulted in EPA implementing additional safety requirements in 2012 to increase protection for agricultural workers and bystanders who live, work, or spend time near fumigated fields (USEPA, 2012a).

The safety measures to be incorporated into a soil fumigant product label include: (1) agriculture worker protection, (2) handler training information, (3) good agricultural practices, (4) application method, practice and rate restrictions, (5) restricted use pesticide classification, (6) buffer zone and posting requirements, (7) site-specific fumigant management plans, (8) emergency preparedness and response requirements, (9) applicator training programs, (10) information for handlers, communities, and first responders, and (11) compliance assistance and assurance measures. As specified in the site-specific Fumigant Management Plan (FMP) and post-application summary factsheet (USEPA, 2012b), a site-specific FMP must contain information such as: (1) certified applicator information, (2) buffer zone determination, (3) provisions for state and/or tribal lead agency advance notification, and (4) applicable mandatory good agricultural practices. A FMP also contains plans for air monitoring, emergency response, and communication among key parties. The post-application summary also is delineated in the factsheet (USEPA, 2012b). The summary must describe any deviations from the FMP requirements for measurements taken to comply with good agricultural practices, and any complaints and whether any reportable incidents occurred.

For worker protection, mitigation measures include a clear description of handler activities on labels, on-site supervision and training, respiratory protection requirements, tarp perforation and removal requirements, and entry-restricted period requirements (USEPA, 2012c). For the general public such as bystanders, a buffer zone will reduce the potential exposure to air concentrations that may cause acute adverse health effects. The buffer zone distance is based on application rate, field size, application equipment and methods; and credits (USEPA, 2012d). Posting requirements for buffer zones (USEPA, 2012e) will inform bystanders the location of the buffer to ensure they do not enter areas designated as part of the buffer zone. The applicators must perform on-site monitoring of the buffer zone perimeter in areas where residences and other occupied structures are within a specific distance. As an alternative, the applicators can provide emergency response information directly to neighbors when the buffer zones are greater than 25 feet, and there are residences and businesses within 50, 100, 200, or 300 feet from the outer edge of the buffer zones of >25 feet and <100 feet, >100 feet and <200 feet, >200 feet and <300 feet, and >300 feet, respectively (USEPA, 2012f).

Fumigation site monitoring will reduce exposures during or after the fumigation to people who may be near a buffer zone. Emergency response information for neighbors is provided through mail, telephone, door hangers, or other methods. The information includes the location of the application block, information on the fumigant product, time period (must not range more than 4 weeks), early signs and symptoms of exposure to the fumigant(s), what to do, and emergency responder phone number, and additional information about fumigants.

The Tri-Con 80/20 formulation is a restricted use pesticide with use only by certified applicators, or persons under their direct supervision. The label (2014) incorporated EPA required safety measures and includes specific requirements to mitigate exposure to workers and the general public. For example, fumigation workers must have certified applicator training. The label requires personal protective equipment and specifies a National Institute for Occupational Safety and Health (NIOSH)-certified full-face piece air-purifying respirator with cartridges certified by the manufacturer for protection from exposure to methyl bromide at concentrations up to 5 ppm when an air-purified respirator is required. Air monitoring is required at least every 2 hours in the breathing zones of a handler performing a representative handling task when full-face piece air-purifying respirators are worn. Stop work is triggered when a methyl bromide air sample is greater than 5 ppm. A direct read detection device with sensitivity of at least 1 ppm (methyl bromide) and 0.15 ppm (chloropicrin) must be used for air monitoring. No respirator is required when air concentrations are less than 1 ppm and no sensory irritation is experienced. Only correctly trained personnel with required personal protective equipment (PPE) can enter the application block. The entry restriction periods are 5 days for untarped applications and 14 days after the completion of tarp applications. The maximum application rate for nematode control is 400 lbs methyl bromide/acre (cannot exceed 500 lbs Tri-Con 80/20 per acre). The maximum application block sizes allowed are 100 acres except for untarped deep applications in orchard replant applications. A buffer zone is required that extends outward from the edge of the application block perimeter equally in all directions. The buffer zone distance (a minimal distance of 25 feet) is calculated using the application rate and size of the application block to reduce the potential exposure for the general public. The planting or transplanting interval is at least 14 days after the completion of application and can vary based on what crops may be planted and soil conditions. Per label requirements, APHIS also develops a site-specific fumigation management plan that reflects current site conditions and contains information about EPA required safety measures for each application block.

Management techniques in the field also have a large influence on methyl bromide volatilization and degradation. The use of a tarp after methyl bromide application has been shown to be an effective means of reducing volatilization and increasing degradation of methyl bromide (USEPA, 2011). The Tri-Con 80/20 label requires that tarps must not be perforated until a minimum of 5 days (120 hours). Soil injection has also been shown as an effective means of limiting methyl bromide volatilization (Yagi et al., 1995). Both management actions are to be implemented in the PCN eradication program as a means to limit off-site movement of methyl bromide. Language on the label regarding placards for the site, as well as the use of the warning agent chloropicrin, will further reduce potential human-related exposure. Consequently, human health risks from direct contact are minimal due to reduced exposure. The lack of exposure is supported by environmental air monitoring data that was collected between 2008 and 2014 in fields after application. Approximately 119 samples have been collected over that time period with approximately 81% of the samples having methyl bromide residues below analytical detection. Of the collected samples most were at trace levels (0.2 ppm and 0.5 ppm) of methyl bromide which is below established regulatory threshold limits.

Exposure is expected to be minimal in both terrestrial and aquatic environments due to the location of the application sites in relation to sensitive areas and the safety language present on the label. While methyl bromide is highly soluble (15.2 g/L) and mobile in soil, the distance of the application area from surface and groundwater precludes any exposure that could impact human health or nontarget aquatic organisms. The closest surface water is approximately 0.25 miles from the application area, while soil type and water table depth mitigate groundwater exposure. Surface to groundwater distance ranges from 35 to 50 feet based on data collected in proximity to the proposed application area (USGS, 2000). The low rainfall in the area, coupled with the ability to manage irrigation water, provide additional confidence that movement of methyl bromide into ground and surface water is unlikely.

Soil invertebrates, as well as any other nontarget animals present during the fumigation and unable to escape, are expected to succumb to the fumigation. The fumigated areas, however, are small and likely to be recolonized within a short time.

There is the potential for small nontarget terrestrial organisms to be exposed through inhalation or ingestion of contaminated soil. The proposed treatment areas are agricultural fields which are highly disturbed areas. The likelihood of small terrestrial organisms being exposed is expected to be minimal. The use of a tarp and the warning agent, chloropicrin, will act as a deterrent for small mammals that may try to forage in or near treated fields. Any exposure to nontarget terrestrial organisms related to the ingestion of treated soil or inhalation should not be at levels sufficient to cause adverse effects. Small terrestrial nontarget organisms that could serve as prey would not be expected to accumulate sufficient residues to impact predators. Methyl bromide has been shown to be rapidly excreted primarily through urine or exhaled as carbon dioxide (EPA, 2006a). The environmental fate and limited exposure pathway, as well as the rapid metabolism of methyl bromide, would suggest that methyl bromide does not accumulate in the tissue of exposed animals.

Methyl bromide has been identified by EPA and the United Nations as a product that can cause ozone layer depletion. The human health effects from thinning of the ozone layer include skin cancer, cataracts, and immunosuppression due to increased ultraviolet (UV) radiation reaching the earth's surface (USEPA, 2008a). However, manmade sources of methyl bromide contribute a minor amount of ozone-depleting compounds to the atmosphere when compared to other chlorine and bromine gas sources (figure 4). Total chlorine gas sources are more than 100-fold above bromine sources.

Atmospheric methyl bromide levels peaked in the mid- to late-1990's and have been decreasing at a rate of 4 to 6 percent per year in the northern hemisphere since 1996 (UNEP, 2007; Yokouchi et al., 2002). Methyl bromide contributions from human sources have decreased by 61.8 percent between 1998 and 2012 as a result of Montreal Protocol (Hegglin et al., 2015). While many of the ozone-depleting substances have long half-lives in the atmosphere, the half-life for methyl bromide is comparatively shorter (0.7 years) and, therefore, any decline in methyl bromide use is reflected more quickly in atmospheric levels.

Methyl bromide uses related to the PCN eradication program represent a small percentage of total use in the United States. Recent data regarding methyl bromide use in the United States for critical use exemptions (CUE) and quarantine pre-shipment (QPS) treatments shows that 3,670 metric tons, or approximately 8.09 million pounds were used in 2011. Methyl bromide use for the PCN program in Idaho has ranged from 144,640 to 438,609 lbs between 2007 and 2014. The range of methyl bromide quantities used in the PCN program represents approximately 1.8 to 5.4% of the total used for CUE and QPS in the Unites States. When compared to global use of methyl bromide the percent contribution would be much less. The contribution of methyl bromide from PCN use would be considered negligible when compared to all ozone-depleting substances since the contribution relative to other bromine and chlorine source gases is minor (Figure 4).

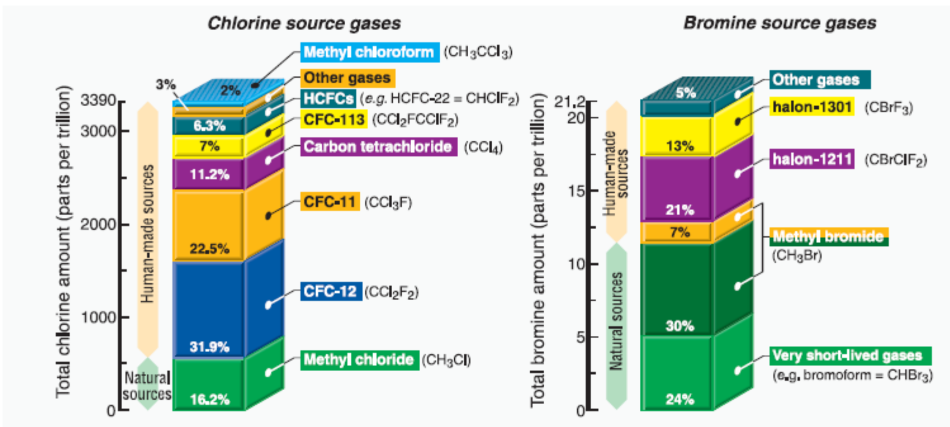

Figure 4. Primary source of chlorine and bromine gases for the stratosphere in 2004. (Source: UNEP, 2006. Twenty Questions and Answers about the Ozone Layer: 2006 Update.)

c. Summary

Based on the method of application, label restrictions and other mitigation measures required for most fumigants the risk to human health is expected to be minimal. The proposed use of methyl bromide also poses minimal risk to nontarget organisms. Aquatic organisms will not be impacted because the application sites are far enough from any of the treated fields to minimize residues from drift or runoff. In addition, high soil pH will speed degradation and low rainfall will greatly limit any potential for runoff or leaching into ground and surface waters. Risk to terrestrial organisms (other than the soil invertebrates in the treated fields that would be impacted) is also minimal due to the method of application and the environmental fate of methyl bromide. Risk to human health and the environment is further reduced by other management practices such as soil injection of methyl bromide in the soil, posting warning signs at the application site, and the use of a tarp to reduce volatilization and enhance degradation. Air quality impacts related to ozone depletion is also low because methyl bromide is not a large source of manmade ozone depleting gases, and its use in this program relative to global methyl bromide use is negligible. Risks to bromine in the environment as a result of methyl bromide applications and degradation are expected to pose low risk to human health and most non-target organisms. The potential for exposure and risk to non-target organisms is greatest for terrestrial vertebrates that feed on plants or crops that grow on fields after they are treated. This risk diminishes as soil bromine levels decrease over time with less available for uptake by plants.

Chloropicrin

a. Toxicity

Chloropicrin is the other active ingredient that is present in the methyl bromide formulation proposed for use in the PCN eradication program. Chloropicrin is a fumigant (19.9 percent of the formulation) as well as a warning agent to prevent accidental exposure. It has chemical properties similar to other fumigants, such as high volatility (vapor pressure of 23.8 mm @ 25 ^{o}C and Henry's Law Constant (2.05 x 10^{-3} atm M^3/mole) and a low affinity for binding to soil (Koc 36.05 ml/g).

Mammalian toxicity data for chloropicrin demonstrates high acute toxicity based on median lethal oral (LD_{50} = 37.5 mg/kg), inhalation (LC_{50} = 17 ppm), and dermal (LD_{50} = 100 mg/kg) studies. Chloropicrin is corrosive to skin and causes irritation to the eye, nose, throat, and upper respiratory with the most sensitive effect being eye irritation in humans (USEPA, 2009a). The human sensory irritation study shows that study participants felt mild eye irritation within 30 minutes at 0.1 ppm and 20 minutes at 0.15 ppm. Effects ceased 1 hour after the exposure ended with no irritation effects the following day. Based on the sensory irritation the studies, USEPA determined a bench mark concentration level ($BMCL_{10}$) of 0.073 parts per million (ppm) (no eye or nose irritation, or upper respiratory changes) (USEPA, 2009b). Sub-chronic inhalation studies report a NOAEL of 0.3 ppm in both the mouse and rat. The inhalation developmental studies report a maternal NOAEL of 0.4 ppm in the rat and rabbit. Chronic feeding studies using the rat and dog resulted in a NOAEL of 0.1 mg/kg/day for both test species and a LOAEL of 1 mg/kg/day based on liver and immune system effects in the rat, and gastrointestinal irritation and blood chemistry alterations in the dog. EPA does not consider chloropicrin to be carcinogenic based on oral or inhalation routes of exposure (USEPA, 2009b).

Limited studies show that chloropicrin is metabolized and excreted rapidly in the body (USEPA, 2009b). A 48-hour study administering ^{14}C-chloropicrin to male mice showed that urine was the major route of excretion (43-47% excreted in the first 24 hours, and another 8-8.5% between 24 and 48 hours) (Sparks *et al.*, 1997). The other routes of excretion were expired air (6.5-15% of the applied dose excreted as CO_2 in 48 hours), and feces (only 2.5-9% in 48 hours). Tissue radiological measurements show that the liver had the highest level of radioactivity, followed by the kidney, lung, blood, fat and skin at 1 hour and 48 hours.

As a pre-plant soil fumigant, EPA considers the use of chloropicrin to be a non-food use and tolerances are not needed (USEPA, 2009b). This is because chloropicrin is degraded in both aerobic and anaerobic soil to carbon dioxide (CO_2), and used by the plants to be incorporated into starch, proteins, pectin, lignin, hemicellulose, and cellulose (USEPA, 2009b).

Chloropicrin is considered highly toxic to wild mammals through oral, inhalation and dermal exposures. No acute or chronic data appear to be available that describe effects to avian species. Chloropicrin is considered very highly toxic to aquatic organisms, with fish LC_{50} values ranging from 16.5 part per billion (ppb) for the rainbow trout to 105 ppb for the bluegill sunfish. Toxicity to aquatic invertebrates is similar to fish with a 48-hour median effective concentration

(EC_{50}) value of 63 ppb for *Daphnia pulex*. No chronic aquatic toxicity values appear to be available for chloropicrin; this may be due to its extremely short half-life in water (EPA, 2006d).

b. Exposure and Risk

Based on the chemical properties of chloropicrin, the primary route of dissipation is through volatilization. Airborne chloropicrin is sensitive to light with half-lives less than 8 hours in direct sunlight. Chloropicrin left in soil degrades quickly with half-lives ranging from 3.7 to 4.5 days (USEPA, 2009). Chloropicrin is highly soluble in water and has low adsorption potential in soil suggesting it may be mobile. Chemical and physical properties for chloropicrin, such as high solubility and lack of partitioning to tissue, suggest that it will not bioconcentrate or bioaccumulate in animals.

Similar to methyl bromide, the potential exposure routes for chloropicrin include inhalation, incidental ingestion, and dermal contact for workers, and acute inhalation exposure for the general public who live or work in the vicinity of a treatment. The actual inhalation exposure to chloropicrin for fumigation workers and the general public are minimal due to the use of PPE, the label required mitigation measures, and best management techniques in the field (e.g. impermeable tarp and soil injection approximately 12 inches below the soil surface). As discussed in the methyl bromide section, the Tri-Con 80/20 formulation label (2014) includes specific requirements such as certified applicator training, PPE, air monitoring, entry restriction, the maximum application rate and maximum application block size, and establishment and posting of a buffer zone to mitigate potential exposures to fumigation workers and the general public. Consequently, human health risks from direct contact are minimal due to reduced exposure. Available air monitoring data for chloropicrin collected in treated fields between 2008 and 2014 supports a lack of exposure potential since all samples were below detection with the exception of two samples that had trace levels of chloropicrin (0.1 ppm).

Chloropicrin is highly soluble and mobile; however, due to the low rainfall in the area, the location of the treatment fields relative to aquatic resources and the application method, chloropicrin migration from runoff into surface water or leaching into groundwater is unlikely. Residues in water and aquatic organisms are not expected.

Direct and indirect exposure to nontarget terrestrial organisms (other than soil invertebrates in the treated fields which are expected to succumb), is highly unlikely due to the method of application and the use of an impermeable tarp during treatment. There is a slight possibility that terrestrial prey could be contaminated if they ingest soil from the treated area after tarp removal. However, prey would have to occupy the treated fields immediately after tarp removal to be exposed. Because its use for this application is as a warning agent, any terrestrial prey would most likely not forage in treated areas due to the eye and nasal irritability of chloropicrin. In the event of chloropicrin exposure, residues would not accumulate in tissue based on its chemical properties that suggest it would not partition to tissue, and its rapid metabolism in mammals.

c. Summary

Based on the method of application, mitigation measures required by the Tri-Con 80/20 label, and the lack of residues from any crop or drinking water, the use of chloropicrin poses minimal risk to human health. The use of chloropicrin also poses minimal risk to nontarget organisms (other than to soil invertebrates in the treated sites which are expected to succumb). Aquatic organisms will not be impacted because of low rainfall in the area and the application sites are far enough from any aquatic habitats to minimize residues from leaching, drift, or runoff. Risk to terrestrial organisms is also minimal due to the method of application and the environmental fate of chloropicrin. Risk to human health and the environment is further reduced by its use as a warning agent and other management practices such as soil injection during application, posting warning signs at the application site, and the use of a tarp to reduce volatilization and enhance degradation. Based on the lack of exposure and available toxicity data, the use of chloropicrin and methyl bromide as a formulated mixture will not significantly increase environmental risk compared to their associated risks when used individually.