505 West Northern Lights, Suite 205
Anchorage, Alaska 99503
Phone (907) 222-7714; Fax (907) 222-7715
www.akaction.org; info@akaction.net

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Stephanie Stewart, Administrative Assistant
Alaska Department of Environmental Conservation
555 Cordova Street Anchorage, AK 99501
Phone 907-269-7644
Fax 907-269-7654
Email: Stephanie.Stewart@alaska.gov

Re: Proposed Permit for Application of Herbicides by the Alaska Railroad Corporation

Comments Prepared by: Pamela Miller, M.En., Executive Director and Biologist with Alaska Community Action on Toxics

Dear Ms. Stewart:

These comments are presented on behalf of Alaska Community Action on Toxics, Arctic Audubon Society Chapter, Cook Inletkeeper, Defenders of Wildlife, Kachemak Bay Conservation Society, Lynn Canal Conservation, Prince William Soundkeeper, and Resurrection Bay Conservation Alliance.

Alaska Community Action on Toxics ("ACAT") is a statewide non-profit public interest environmental health research and advocacy organization dedicated to protecting environmental health and achieving environmental justice. Alaska Community Action on Toxics *mission: to assure justice by advocating for environmental and community health. We believe that everyone has a right to clean air, clean water and toxic-free food*. We work to stop the production, proliferation, and release of toxic chemicals that may harm human health or the environment.

Arctic Audubon Society Chapter, a chapter of the National Audubon Society, was chartered in 1977. Arctic Audubon has worked to protect Alaskan ecosystems by encouraging research, education, and management.

Cook Inletkeeper is a member-supported nonprofit organization with offices in Homer and Anchorage which works to protect clean water and healthy salmon.

Defenders of Wildlife, founded in 1947, is one of the country's leaders in science-based, results-oriented wildlife conservation. Defenders of Wildlife is an organization committed to saving

imperiled wildlife and championing the Endangered Species Act, the landmark law that protects them. Their Alaska office is located in Anchorage.

Kachemak Bay Conservation Society is concerned with protecting Kachemak Bay and the Kenai Peninsula. The organization concentrates on logging, oil and gas leases, herbicides and wildlife issues. The Society monitors environmental issues locally and statewide and keeps its members informed through a periodic newsletter.

Lynn Canal Conservation is a grass roots conservation organization based in Haines, Alaska. Haines is located about 85 miles north of Juneau. For over 30 years, LCC has been dedicated to fostering environmental awareness and protecting the natural environment and quality of life in our region.

Prince William Soundkeeper is a grassroots 501 c(3) organization founded in 2004 to protect water quality in Prince William Sound and the life it sustains. Prince William Soundkeeper is a member of the global Waterkeeper Alliance.

Resurrection Bay Conservation Alliance (RBCA), based in Seward, formed to advance the environmental integrity of our community. We focus on watershed issues like air and water pollution, protection and restoration of habitat, reducing bear and human conflicts, pursuing new energy sources and weighing in on development proposals.

Alaska Community Action on Toxics, Cook Inletkeeper, Kachemak Bay Conservation Society, Lynn Canal Conservation, Prince William Soundkeeper, and Resurrection Bay Conservation Alliance firmly oppose the use of herbicides and associated chemicals for vegetation management purposes by the Alaska Railroad. Please enter these comments into the public record and confirm receipt. We appreciate your careful consideration. While we support the Railroad in its efforts to maintain safe operations, the use of herbicides does not provide an effective or economical solution. We maintain that there are viable, economical alternatives that preclude the need for chemical treatments. Our comments provide justification for our opposition on the basis that herbicide use poses an unacceptable threat to water quality, fish, wildlife, habitat, workers, and public health. We assert that the Alaska Department of Environmental Conservation should deny the permit application of the Alaska Railroad in order to meet the Department's obligation to protect human health and the environment. The Alaska Railroad's permit application for the application of herbicides is grossly and legally deficient because it fails to properly identify potentially affected water bodies or offer measures to protect water quality, sensitive aquatic habitats, fish and wildlife, drinking water sources, neighborhoods adjacent to the tracks, people using the railroad, and workers. The permit application fails to meet the requirements of 18 AAC 90.515. Further, the Railroad does not justify the use of herbicides.

Over the past three decades, citizens of Alaska have consistently voiced strong opposition to the use of herbicides by the Alaska Railroad. Prompted by the concerns of people about the harmful effects of herbicides on human health and the environment, Governor Jay Hammond banned the use of herbicides by state agencies in 1978. Community members along the railway initiated a lawsuit to stop herbicide use by the Alaska Railroad. A federal judge determined in 1983 that herbicides could not be used without preparation of an Environmental Impact Statement as

mandated by the National Environmental Policy Act. In 1985, the state assumed control of the railroad and the state ban on the use of herbicides was applied and continues to apply to the present.[i] Alaskans have particular concern about the use of herbicides because many people in this state "participate in the harvest and consumption of various wild plants, game, and fish." Also, our economy depends on "several of Alaska's major industries such as commercial fishing and tourism…, on the image, as well as the reality, of a pristine, non-toxic environment," and the "unique environmental conditions inherent in the sub-Arctic and Arctic environment." In a study published in 1991, the University of Alaska Fairbanks "found a greater persistence of the parent herbicide compounds and far more extensive downward migration of the herbicides than had been anticipated based on the available scientific literature."[ii]

The Department must respect and heed the substantive on-going public opposition to the Railroad's current permit application for proposed use of herbicides. Resolutions and letters have been formally adopted by local tribes, borough governments, municipalities, and community councils. Resolutions and letters expressing opposition to the use of herbicides by the Alaska Railroad include: Native Village of Eklutna (resolution and letter from the tribal government), Montana Creek Native Association, Inc. (resolution), Municipality of Anchorage (letter), City of Seward (resolution), Kenai Peninsula Borough (resolution), Matanuska-Susitna Borough (resolution), Denali Borough (resolution), Birchwood Community Council, and Talkeetna Community Council. The federally recognized tribal government of the Native Village of Eklutna states particular concerns in their resolution and letter about threat of proposed herbicide use to the safe harvest of berries, medicinal plants, fish and wildlife that are vital to their spiritual, cultural, and physical sustenance. Although we agree for the need to address problems of invasive and noxious weeds, herbicides are not necessary to accomplish solutions to this problem.

Vegetation and Safety for the ARRC

The ARRC justifies its pesticide permit application by claiming overgrown vegetation presents a safety hazard and "at stake are the safe transport of nearly half a million passengers per year and the safe transfer of thousands of tons of freight, 40% of which is hazardous material."[iii] However, ARRC has not applied herbicides for vegetation control since 1983, and has, instead, employed non-chemical alternatives and manual labor.[iv] These mechanical/manual methods appeared to be working as the ARRC asserted: "2005 marked an all-time low in terms of employee accidents and train derailments, and our train accident rate is half the national average."[v] Though the ARRC claims that "the weeds are winning," in the *2nd Quarter*, *2006 Community Ties*, they did not receive any fines due to vegetation in 2005 and as of July, 2006.[vi] The Railroad would have us believe that there is an upward trend in accidents and derailments—after reviewing information provided by the Railroad, there seems to be no upward trend in these statistics from 2005-2009. However, it does seem obvious that the ARRC has neglected vegetation management/maintenance in order to justify herbicide use. Herbicide use is not necessary to ensure the safe operation of the Railroad—in fact the use of herbicides increases the health and safety hazards for workers and clients.

Alternatives to Herbicides/Chemical Mixtures for Vegetation Management

ADEC must deny the permit request by the Alaska Railroad to use herbicides on the basis that non-chemical methods exist that are effective and economical. Although the Railroad claims that non-chemical methods have failed, we note that alternative methods have been poorly tested by the Alaska Railroad and with tests of alternatives seemingly designed to fail in order to justify herbicide use. The Alaska Railroad has not demonstrated or provided an assessment of their mechanical removal program and without that, ADEC cannot find there are no feasible alternatives to herbicides. The Railroad has provided an insufficient assessment of the range of alternatives. Contrary to claims by the Alaska Railroad, alternative methods have not been assessed in a rigorous manner. Furthermore, most tests of alternative methods were conducted more than a decade ago. Since then, new technologies and products have been developed that provide safe, economical alternatives to the use of herbicides. We maintain that an integrated non-chemical approach would be highly effective and preferable to threatening the numerous aquatic environments, water sources, subsistence use areas, and community health.

A 2003 report commissioned by the Federal Transit Administration, "*Non-Chemical Methods of Vegetation Management on Railroad Rights-of-Way*," concluded that "prototype weed control equipment was highly effective at killing treated vegetation, easy to operate, and adaptable to a variety of application platforms." The steering committee for this project determined that wet infrared was the "single most appropriate technology." The report states: "The wet infared technology offers advantages not found with any other thermal weed control systems. It is highly effective, and efficient with respect to propane and water use. The combined use of pre-watering and three forms of intense heat for weed control (turbulent hot air, infared energy, and direct flame), with simultaneous and selective application of water for fire prevention, all in a single treatment pass, is a unique technology. The prototype weed control equipment was highly effective at killing treated vegetation, easy to operate, and adaptable to a variety of application platforms. As environmental, water quality, and human health concerns continue to add constraints on routine use of pesticides, other forms of vegetation management must be developed." Railroad personnel "adapted the ballast regulator as an effective platform for carrying and using Sunburst's weed control equipment. The regulator was stable and rugged; carrying the three thermal units with ease while the telescoping arms provided more than adequate strength, flexibility, and reach for manipulating the four-foot units for treatments along the side of the ballast. Development of the lorry car to carry propane and water supplies and equipment was an excellent innovation that worked well, although additional propane tank capacity would be needed when treating an extensive length of track." The report determined that the annual costs per mile for vegetation "could reasonably be expected to range from $70-500 per mile. Of that cost, 65-80% would be labor. If labor costs are internalized within the railroad maintenance budget, significant savings over external expenditures could be realized."[vii]

The report also concludes that "the European railroad industry appears to be much more committed to the concept of integrated vegetation management than the North American railroad industry. This most likely is a result of a combination of cultural perceptions, regulatory restrictions, and administrative differences related to public (European) vs. private (North America) ownership. The European experience has shown that the technology to implement integrated vegetation management programs is available and achievable given the proper incentives." The Canadian Pacific Railway implemented hot water technology as a "primary management tool on a portion of its track in the Pacific Northwest. In the mid-1990s, Asplundh

Corp in collaboration with Aqua Heat built a hot water vegetation control apparatus." The technology, tested across North America, was successful and effective in vegetation control. Other alternatives to the use of herbicides tested and used in Canada and Europe include: mechanical removal, steam, competing and replacement vegetation, timely mowing, thermal infrared, vacuum cutters, geotextile applications, use of soybean-based fuels to support infrared treatment. In Germany, infrared methods which cover the ballast and shoulders up to 17 feet on either side of the railway center line have proven to be the most successful and cost effective of the non-chemical alternatives. Mechanical measures including cutting, girdling, mowing and grazing animals provide effective means to eradicate unwanted vegetation along rights-of-way. In Sweden, the railroad uses a combination of preventative and non-chemical measures on 750 miles of track where chemical weed control may not be used. In contrast, attempts by the Alaska Railroad to evaluate and implement alternative technologies have been poorly designed and executed. Railroad officials attempt to justify herbicide use citing safety concerns, but the evidence does not support their assertions.

The provincial government of British Columbia recommends the use of ecological vegetation management rather than the use of herbicides. The government's Integrated Pest Management Program notes that "repeated herbicide applications to keep sites bare, such as around electrical substations, along a fence lines or railroad tracks, will encourage the growth of weeds. The herbicides create a disturbance, both in the vegetation, and, depending on the herbicide, in the soil--which then encourages weed invasion. This disturbance is not limited to the area of application, but may be felt in the vegetation for some distance away…Minimizing herbicide use can reduce weed growth and result in cost effective vegetation management systems."[viii] Herbicide applications are likely to result in higher costs over the long-term, as plants develop resistance to herbicide applications. The use of herbicides will perpetuate resistance of the vegetation to treatment and will not be effective in vegetation management in the future.

We assert that there are new and proven methods and technologies that preclude the need for synthetic herbicides, including new acetic acid-based products, improved infrared steam technology, cultural and biological control methods. Moreover, cleaning and changing of ballast at regular intervals (required infrequently—e.g. every 10 years) is proven to be effective (by the Railroad's own admission) in reducing and eliminating weed problems—clean ballast does not support plant growth. Innovative methods using goat herds to graze unwanted vegetation have proven successful in public lands and rights-of-way vegetation management on small to large-scale projects.[ix]

We urge the agency to require that the Alaska Railroad establish a public oversight council to fully evaluate, develop, and adopt an integrated least-toxic vegetation management system for the Alaska Railroad, including mechanical, cultural, and biological methods. The public oversight council will ensure proper implementation of economically feasible alternatives to the use of herbicides for controlling vegetation in railroad rights-of-way and rail yards.

Environmental and Human Health Effects of the Proposed Chemical Mixture

The following sections provide a review of some of the peer-reviewed literature concerning the environmental and health effects associated with the active ingredient and herbicide mixture. Although not intended as an exhaustive review of the literature, the summary presented here

clearly demonstrate that the active ingredient and herbicide mixture proposed for use by the Alaska Railroad is unacceptable for use because it will likely harm the health and well-being of fish, wildlife and communities in close proximity to the railroad, workers and railroad users, and individuals who use adjacent lands and waters for berry-picking, fishing, and hunting. A 1991 study by the University of Alaska Fairbanks states: "Should herbicides contact groundwater in significant concentrations, considerable liability could result from cleanup efforts."[x] The Railroad has failed to consider this potential liability and other externalities and monitoring requirements in their permit application.

On August 1, 2006 the Attorney General of Alaska announced that Alaska "joined with 13 other states and the U.S. Virgin Islands to petition the Environmental Protection Agency (EPA) to require pesticide manufacturers to disclose on the label of their product all hazardous ingredients…The EPA currently requires that pesticide labels disclose only the product's "active" ingredients that contain toxic materials intended to kill insects, weeds, or other target organisms. Pesticide products also contain many other "inert" ingredients, which are intended to preserve or improve the effectiveness of the pesticides' active ingredients. These "inert" ingredients may be toxic themselves…" The news release further states that "people who use or who are impacted by the use of a pesticide should have notice of all that product's potential health risks." Thus, it would be wrong for the State to issue a permit to the Alaska Railroad to apply herbicides for which the manufacturers do not disclose ingredients that may harm human health.

Dr. Warren Porter, Professor of Environmental Toxicology at the University of Wisconsin, Madison, completed a review of the literature concerning the environmental health effects of low-dose chemical mixtures of pesticides.[xi] He concluded:

- Pesticides have interactive effects and ultra low-level effects that are below EPA allowable levels. These effects include adverse neurological, endocrine, immune, reproductive and developmental health outcomes.
- EPA assessments of biological risk can be off by a factor of 10,000 at ultra low doses. Scientists call for a new type of risk assessment in the open literature because of the inadequacies of the current EPA pesticide registration system.
- Pesticides have broad biological effects that are unintended and often unpredictable because of physicochemical properties engineered into their molecules.
- Pesticides of different classes can have similar impacts on endocrine disruption and sexual development. Chemicals affect development at levels in the tenths of a part per billion range.

In a recent issue of the preeminent peer-reviewed environmental health journal published by the National Institute for Environmental Health Sciences, *Environmental Health Perspectives*,[xii] the authors warn: "Inert ingredients may be biologically or chemically active and are labeled inert only because of their function in the formulated product…Inert ingredients can increase the ability of pesticide formulations to affect significant toxicological endpoints, including developmental neurotoxicity, genotoxicity, and disruption of hormone function. They can also increase exposure by increasing dermal absorption, decreasing the efficacy of protective clothing, and increasing environmental mobility and persistence. Inert ingredients can increase

the phytotoxicity of pesticide formulations, as well as toxicity to fish, amphibians, and microorganisms." In this case, the active ingredient, glyphosate, cannot be used without an adjuvant and/or surfactant. The scientific literature supports the fact that the use of surfactants/adjuvants increases the bioavailability, toxicity, persistence, and bioaccumulation of the active ingredient.

Glyphosate—Environmental and Health Effects

The Alaska Railroad relies on outdated information, much of which lacks scientific peer review, concerning the herbicide glyphosate in its permit application and in the "fact sheet" ("*Glyphosate—Frequently Asked Questions*") prepared by Railroad consultant, Glenn Millner of the Center for Toxicology and Environmental Health. The "*Glyphosate—Frequently Asked Questions*" document prepared by the railroad's consultant misrepresents facts and lacks proper references for its assertions of glyphosate safety, contains few peer-reviewed scientific journal citations (of 25 references provided, only 2 are from peer-reviewed scientific journals), and is clearly written from a vested-interest perspective (as a paid consultant to the Railroad) in order to justify the use of glyphosate.

Further, the herbicide research project funded by the Alaska Railroad through a contract with the University of Alaska Fairbanks is incomplete and the study design is deficient. The Railroad had committed to complete the study prior to submitting a new permit application for the use of herbicides. The project has thus far provided very limited data, thus any conclusions based on this incomplete project are spurious. The study also has serious limitations that prevent conclusive determinations about the migration and persistence of the herbicide mixture—it examines glyphosate alone. The UAF project did not conduct the study under realistic application conditions—the herbicide glyphosate was not co-released with the surfactant during the tests (Personal Communication with David Barnes, UAF, 8/12/09), thus any determinations about the movement and persistence are virtually meaningless because the surfactant enhances the mobility, transport, persistence and bioavailability (as discussed in more detail in these comments). The UAF project is too limited in scope to assess the movement of the herbicide beyond the immediate area of the railroad ballast. The project does not assess bioavailability, uptake, effects on "non-target" species, biological or human health effects.

The U.S. Environmental Protection Agency (EPA) is currently conducting a Registration Review for glyphosate and the docket is open for comment until September 21, 2009. The EPA has not conducted a registration review of glyphosate ***since 1993***. Since that time, many articles in the peer-reviewed literature have presented new evidence concerning the harm to health and environment associated with glyphosate and glyphosate-based formulations.

Glyphosate is the active ingredient in chemical product in Aquamaster. Glyphosate is persistent in soils after application, especially in northern regions. In a Finnish study, the measured half-life of glyphosate was 249 days.[xiii] In Ontario, Canada, glyphosate had a half-life in forest soils of 24 days with detectable residues persisting for 335 days.[xiv] On 3 British Columbia forestry sites, glyphosate persisted 360 days.[xv] In a Swedish study, glyphosate persisted from one to three years on eleven forestry sites.[xvi] Another peer-reviewed study reported that glyphosate has a half-life of 3 days to 25 weeks in soil and 1 day to 25 weeks in water with a pH of 7.[xvii]

The herbicide has the potential of eliminating a wide variety of plants including desirable as well as "undesirable" vegetation, grasses and many broad leaf species. The main breakdown products of glyphosate are aminomethylphosphonic acid (AMPA).[xviii] Another reported degradation product of glyphosate is formaldehyde,[xix] a known carcinogen. In a study of glyphosate degradation in Willapa Bay in Washington State, glyphosate concentrations in the estuarine mudflats took 119 days to decline to 72%, while AMPA did not degrade during that period.[xx] Other studies show that the half-life for glyphosate in water ranges from 35-65 days. "In British Columbia, following application of glyphosate using a no-spray buffer and very low concentrations of glyphosate, the breakdown product AMPA was sometimes observed in water and sediment of streams after the first heavy rain following application.[xxi] Another study of agricultural watersheds shows similar results, with the highest concentrations in runoff one to ten days, and detection up to 4 months after application.[xxii] Higher peak concentrations were observed in water following heavy rain events up to three weeks after application and "sediment peaks were observed later and persisted in stream sediments for more than one year."[xxiii] A fact sheet about glyphosate from the Oregon State University Environmental Toxicology and Chemistry Program does not recommend berry or mushroom consumption from newly-treated areas.

Herbicides cause "trophic cascades" including direct and indirect harmful effects on many species, including aquatic invertebrates that are food sources for salmonids and other fish.xxiv In general, herbicides and other pesticides have long residence times in soils and waters at northern latitudes. Product formulations of active ingredients and proprietary, undisclosed additives such as solvents and surfactants can cause enhanced adverse effects to the environment and human health. Interactive and low-level effects at concentrations below EPA allowable levels have been found to cause profound impacts on neurological, endocrine, immune, and developmental processes including the development and function of the brain, as well as reproductive health.

Glyphosate and its primary degradation product aminomethylphosphonic acid (AMPA) were classified among the first contaminants in rivers.[xxv] Glyphosate, the active ingredient in Aquamaster, is toxic to a variety of aquatic insects and tadpoles. Species richness of aquatic biota (copepods, *Daphnia*, snails, arthropods, amphibians) was reduced 22% in this 2005 study. Toad tadpole survival was reduced from 97 % to 0%.[xxvi] In a study published in 2000, Giesey and other researchers found toxicity of glyphosate can be quite high to some invertebrates.[xxvii] Glyphosate also causes serious sub lethal effects in fish at low concentrations, including erratic swimming, gill damage and liver structure changes.[xxviii][xxix] Fry and fingerlings are more vulnerable to the toxic effects of glyphosate than adult fish, with harmful toxicological effects on developing rainbow trout at 2-3 ppm.[xxx]

In comments from the U.S. Fish and Wildlife Service on the proposed aerial application of glyphosate for forestry purposes in SE Alaska (letter to ADEC dated October 28, 2005), agency biologists stated: "We are concerned that these application restrictions for Accord [active ingredient is glyphosate] will not be adequate to protect aquatic resources, based on recent glyphosate toxicity data. Accord [active ingredient glyphosate] does not appear to be an acceptable product due to its potential for aquatic toxicity." The Agridex surfactant has similar chemical properties in enhancing the toxicity of the herbicide glyphosate because the petroleum-

based compound “carries” the herbicide more effectively into biological systems and across cell membranes.

Toxicity of glyphosate is affected by such environmental factors as water hardness, temperature, and pH. Toxicity increases at lower pH levels and higher temperatures.[xxxi] Surfactants may exhibit increased toxicity in alkaline waters.[xxxii] In addition, glyphosate has an antagonistic effect on the toxic action of a surfactant.[xxxiii] High pH (7.5) “increased the toxic effects of the herbicide” [glyphosate] on survival, reproduction, and development time in zooplankton and amphibian species (frog species *Rana pipiens* and zooplankton species *Simocephalus vetulus*).[xxxiv]

Glyphosate sub-lethal effects in fish and wildlife have not been well-studied, although available science indicates cause for concern. Chronic exposure to glyphosate for 14 days resulted in histopathological changes in gill and liver structure, as well as adverse effects to liver, heart, kidney and serum enzyme activity. Threshold gill and liver histopathological responses were observed at concentrations equal to 0.8% (5 ppm) and 1.6% (10 ppm), respectively, of the 96 LC50 for that species (620 ppm). Researchers surmised that the gill histopathological response was reparable if the fish were relocated to clean water, however the liver fibrosis was considered indicative of serious liver damage. Statistically significant changes in enzyme activity were observed at 0.4% of the 96 hr. LC50, the lowest exposure concentration, in liver (alkaline phosphatase, P less than 0.01; and glutamic-pyruvic transaminase, P less than 0.05) and kidneys (glutamic-oxaloacetic transaminase, P less than 0.05 and glutamic-pyruvic transaminase, P less than 0.05. Responses to chemical exposure vary by species, but equivalent exposure concentrations (0.4%, 0.8%, and 1.6% of the 96 hour LC50) for salmonids would be 4.4 ppm, 8.8 ppm, and 17.6 ppm.[xxxv], [xxxvi] Rainbow trout fry were the most sensitive life stage followed by emergent fry.[xxxvii] After treatment with Roundup, aquatic macro invertebrate density declined by 42% for a 1.5 year period.[xxxviii]

Studies show adverse effects on the following categories of beneficial insects: pollinators, soil aerators, predators, and soil producers. Glyphosate reduces the growth and survival of earthworms.[xxxix] It is acutely toxic (at concentrations ranging from 2-55 ppm) and causes sub-lethal effects on fish.[xl] Roundup (with associated proprietary surfactants and other additives) is 20-70 times more toxic than glyphosate alone.[xli] The surfactant proposed for use in the permit application of the Alaska Railroad is a Toxicity increases with water temperature.[xlii]

Glyphosate causes an increase in water temperature for years following application through the destruction of shading vegetation—this increase is particularly dangerous to fish such as juvenile salmon, which depend on cooler water temperatures for survival.[xliii] In Nova Scotia, studies of treated forests revealed that songbird densities (white-throated sparrows and common yellowthroat) were reduced for two years after the glyphosate application.[xliv] A three-year study of treated forests in Maine demonstrated a decline in the abundance of songbirds.[xlv] Declines in small mammal populations and adverse effects on moose, elk, and deer browse have also been documented.[xlvi] Glyphosate can adversely affect the health of soils and nutrient cycling by: 1) inhibiting nitrogen fixation[xlvii], 2) causing a decline of beneficial mycorhizal fungi[xlviii], and 3) increasing the disease susceptibility of plants.[xlix]

Contrary to claims of safety by the applicant, recent research demonstrates serious harmful effects to human health associated with exposures to the herbicides. A 2002 study by Garry, et.al. found that glyphosate showed a significant correlation with excess adverse birth and neuro-developmental effects. The authors also note: "Regarding the herbicide glyphosate, our present study shows a tentative association between ADD/ADHD and use of this herbicide."[l] A 2001 study concluded: "Preconception exposure to the pesticide active ingredients glyphosate, atrazine, carbaryl, and 2,4-D was associated with a 20-40% relative increase in risk…The herbicide glyphosate was associated with increased risks of late abortion, regardless of when exposure occurred."[li] "The genotoxicity of glyphosate has been positive in *in vitro* cultures of bovine and human lymphocytes and weakly mutagenic in a *Salmonella* assay."[lii] One study observed the onset of parkinsonian syndrome following an accidental exposure to glyphosate. "A 54-year old man accidentally sprayed himself with the chemical agent glyphosate, an herbicide derived from the amino acid glycine. He developed disseminated skin lesions 6 hours after the accident. One month later, he developed symmetrical parkinsonian syndrome."[liii]

Exposure to glyphosate is also associated with elevated risk of a rare form of non-Hodgkins's lymphoma (NHL), hairy cell leukemia: "The more recent study described two case-control studies, one on NHL alone and one specifically on hairy-cell leukemia, a rare form of NHL, with respect to pesticide exposure (with many different pesticides and exposure levels tested). A pooled analysis (done in order to increase numbers) revealed elevated ORs with statistical significance for herbicides in general, phenoxyacetic acids, glyphosate, and MCPA. Also, there were dose-response effects in these pesticide groups, most with statistical significance."[liv], [lv] A 2003 study confirmed the association of glyphosate exposure with increased incidence of non-Hodgkin's lymphoma.[lvi]

Many currently used pesticides have the capacity to disrupt reproductive function in animals. Walsh and colleagues conducted a study concerning the underlying cause of reproductive endocrine disorders because "the possibility these compounds can affect the reproductive health of humans and wildlife in their natural habitats is of great concern. Little information is available regarding the effects of pesticides…on endocrine system function, despite their widespread use." The authors conclude: "Roundup [active ingredient glyphosate] disrupted steroidogenesis in Leydig cells through a post-transcriptional reduction in StAR (Steroidogenic Acute Regulatory) protein expression. Not only does StAR play an important role in steroid (hormone) production in gonads, but it is also indispensable for steroidogenesis in the adrenal glands. As a result, a disruption in StAR protein expression may impair more than just fertility. The adrenal glands synthesize glucocorticoids and mineralocorticoids, and a reduction in StAR expression in the adrenal glands may affect carbohydrate metabolism, immune system function, and balance. Because many toxicants that reduce StAR expression and steroidogenesis in the adrenal gland, a disruption in StAR protein expression may underlie many of the toxic effects of environmental pollutants."[lvii]

Finnish researchers showed that Roundup's active ingredient, glyphosate, decreases the defenses of enzymes of the liver and intestines.[lviii] Roundup, as a mixture of all its ingredients, has been shown to shut down a powerful antioxidant in the liver that detoxifies harmful compounds so they can be excreted through bile. Glyphosate also alters gene expression and inhibits necessary

steroid production by disrupting a particular protein expression. In 2002, a paper shows that glyphosate can also affect early cell division processes in embryos."[lix]

In a systematic review of the peer-reviewed scientific literature concerning health effects of pesticides, a team of physicians from the Ontario College of Family Physicians concluded: "The literature does not support the concept that some pesticides are safer than others; it simply points to different health effects with different latency periods for the different classes…Some more surprising positive associations were found for pesticides that are considered less toxic in acute poisoning settings…The herbicides glyphosate and glufosinate had associations with congenital malformations [birth defects]. Parental preconception exposure to glyphosate was associated with late abortion."[lx] A growing body of evidence implicates glyphosate and its formulations with health problems thus far ignored by the applicant and ADEC.

Recent papers published in peer-reviewed scientific journals provide additional evidence concerning the harmful environmental and health effects of glyphosate and its formulations:

- "Glyphosate-based herbicides belong to the first herbicides used worldwide, and are major pollutants of rivers and [other] surface waters….it s now well-documented that mixtures formulated with glyphosate and adjuvants are themselves not environmentally safe, in particular for aquatic life. They can even enhance heavy metal toxicity."[lxi]
- Gasnier et al (2009) state: "In conclusion, according to these data and the literature, glyphosate-based herbicides provoke DNA damage, endocrine disruption *in vitro*, and CMR (carcinogen, mutagen, and reprotoxic) effects *in vivo*. The direct glyphosate action is most probably amplified by vesicles formed by adjuvants or detergents that allow cell penetration, stability, and probably change its bioavailability and thus metabolism." Results from the study also clearly show that the DNA of the human hepatoma cell line is damaged by a glyphosate-based herbicide.[lxii]
- Glyphosate formulations affect human placental cell viability at levels significantly below prescribed application concentrations and sexual steroid biosynthesis at lower non-toxic doses. This effect was amplified with adjuvants, the so-called inert ingredients of herbicide formulations kept confidential by the chemical companies. Glyphosate is toxic to human placental cells at lower concentrations than those prescribed by label instructions. In a 2005 article published in *Environmental Health Perspectives*, the authors conclude that glyphosate acts as a disruptor of mammalian cytochrome P450 aromatase activity from concentrations 100 times lower than the recommended use; "this is noticeable on human placental cells after only 18 hours, and it can also affect aromatase gene expression. It also partially disrupts the ubiquitous reductase activity but at higher concentrations. Its effects are allowed and amplified by at least 0.02% of the adjuvants present in Roundup, known to facilitate cell penetration [Note: the surfactant in Agridex has similar chemical properties], and this should be carefully taken into account in pesticide evaluation. The dilution of glyphosate in Roundup formulation may multiply its endocrine effect. Roundup [and other formulations] may thus be considered as a potential endocrine disruptor. Moreover, at higher doses still below the classical agricultural dilutions, its toxicity on placental cells could induce some reproduction problems." Effects of the herbicide on aromatase are particularly significant because aromatase is the enzyme responsible for the irreversible androgen to estrogen conversion—if this system is disrupted, there are critical effects on sexual and several

cell differentiations, reproduction, pregnancy, liver metabolism, bone development, behavior, and hormone-dependent cancers such as breast or prostate cancer. “here we show that glyphosate is toxic to human placental JEG3 cells within 18 hours with concentrations lower than those found with agricultural use, and this effect increases with concentration and tie or in the presence of Roundup adjuvants.” The authors also conclude “endocrine and toxic effects of Roundup, not just glyphosate, can be observed in mammals.” The study adds to the weight of evidence that glyphosate and Roundup are likely endocrine disruptors and supports several other studies that have shown toxic effects of both glyphosate and its formulations. Product formulations include added “inert” ingredients and adjuvant chemicals that make the product more toxic and help it to perform better (by causing it to stick, spread, reduce evaporation, or other desired function).

- In embryonic cells as well as in normal human placental and equine testis, there was glyphosate induced endocrine disruption through aromatase inhibition at low dose levels. Embryonic cells were even more sensitive. Adjuvants enhanced the cumulative effects with increased bioaccumulation or time-delayed effect. Adjuvants enhance absorption through plasmatic membranes.
- Glyphosate formulations cause total cell death within 24 hours through inhibition of mitochondrial succinate dehydrogenase activity and necrosis by release of cytosolic adenylate kinase measuring membrane damage. They also induce apoptosis via activation of enzymatic caspases 3/7 activity. The authors confirmed this by “characteristic DNA fragmentation, nuclear shrinkage (pyknosis), and nuclear fragmentation (karyorrhexis)”…These effects were observed at dilution levels far below label recommendations.[lxiii]
- Three recent case-control studies suggest “an association between reported glyphosate use and the risk of non-Hodgkin lymphoma (NHL).”[lxiv]
- “Similarly, use of the phosphonamino herbicides (glyphosate, Roundup) was overrepresented in the adverse birth and developmental effect group. Forty-three percent of the children (6 of 14) who had parent-reported ADD/ADHD used phosphonamino herbicides (OR = 3.6; CI, 1.35–9.65). No other commonly used pesticide compared by major organ and/or functional system was uniquely associated with specific adverse birth or developmental effects.”[lxv]
- There is evidence that glyphosate disrupts development by disrupting DNA transcription. A study of the effects of glyphosate herbicides on sea urchins found that specific DNA transcription occurred later and to a lesser extent than transcription in control urchins. Further studies determined it was glyphosate and not other ingredient that causes this effect.[lxvi]

Surfactant—Agridex

Agridex is non-ionic surfactant. In general there is a lack of scientific data on the potential ecotoxicological and health effects of surfactants. There is little toxicity testing done on this and other surfactants, however surfactants increase the toxicity, persistence, and bioavailability of the herbicide formulation. Toxicity tests are primarily acute toxicity tests on select aquatic organisms.[lxvii] Surfactants enhance the toxicity of the herbicides with which they are used in combination.[lxviii,lxix] The actual ingredients of Agridex are proprietary. “Heavy range paraffin based petroleum oil, polyol fatty acid esters” and “polyethoxylated polyol fatty acid esters” are

broad chemical groups containing multiple chemicals of varying toxicity. While some paraffin oils are included on list 2 of the US EPA's list of inert ingredients as "potentially toxic inerts with high priority for testing," others are totally omitted. The reasons for this discrepancy are not apparent.[lxvii] Ethylene oxide and 1,4 dioxane can be incorporated into the final surfactant during production of ethoxylated fatty acid esters. Both of these chemicals are carcinogens.[lxx] Some ethoxylated fatty acids have log K_{ow} (measure of bioaccumulation) greater than 5.0, the accepted value for bioaccumulative substances.[lxxi] This means some portions of ethoxylated surfactant mixtures may concentrate and bioaccumulate in the food web. The material safety and data sheet from Bayer Crop Science is clear about the potential for harm to aquatic ecosystems. It states "DO NOT contaminate streams, rivers or waterways with Agridex or the used containers" [capitalization in original].[lxxii]

Alaska Railroad and DeAngelo Brothers, Inc.

In order to properly apply the proposed pesticides, thus reducing drift and possible contamination of drinking water sources and other water bodies, a certified and dependable contractor is required. The Alaska Railroad proposes to engage the services of the pesticide application company, DeAngelo Brothers, Inc.—this contractor is not reputable and has, in fact, a questionable history. The selection of this company by the Alaska Railroad serves to undermine the public trust. The State of Oregon issued civil penalties against the company for "conducting a pesticide application in a faulty, careless, or negligent manner." The State also issued civil penalties because the company was not properly licensed. DeAngelo Brothers, Inc. was fined for its role in three separate incidents in violation during its work for the Union Pacific Railroad. In 2005, DeAngelo Brothers, Inc. was investigated and implicated as the responsible party by the Oregon Department of Environmental Quality for the dumping of pesticide wastes containing glyphosate, diuron, and sulfometuron-methyl. DeAngelo Brothers dumped the pesticides when under contract to perform vegetation management on the Union Pacific Railroad rights-of-way from Portland to Ontario.[lxxiii]

Furthermore, in a 2005 court case, DeAngelo Brothers, Inc. was sued along with the U.S. Bureau of Land Management and Thomas Helicopters by approximately 440 farmers and landowners for the improper application of herbicide, causing it to drift onto the plaintiff's land resulting in damages of more than $700 million.[lxxiv] The proposed contractor was also part of a ten year litigation process concerning its liability as "owners" and "operators" of Armour Road Superfund Site in North Kansas City, Missouri, in order to be held accountable for clean up costs under section 107(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9607.[lxxv] In

With the history of a negligent contractor, it cannot be assumed that the pesticides will be applied correctly or adhere to the ten-foot buffer zone as proposed in the pesticide permit application, DeAngelo Brothers, Inc. not only has an irresponsible track record for applying herbicides, but they were also part of an ongoing litigation process in which they denied their accountability. If contracted within Alaska, who is to guarantee their negligence will not be conducted here? The health of Alaska citizens and Alaska's ecosystems should not be put into the hands of such a capricious company.

Sensitive Water Sources, Water Bodies, and Aquatic Habitats

ADEC should deny the Railroad's permit application to apply the herbicide/surfactant mixture because the chemicals pose a threat to drinking water sources (for example, the City of Seward drinking water source is within close proximity to the proposed herbicide application area), anadromous fish habitats, and other vulnerable aquatic habitats. Buffers would not protect sensitive water bodies because of the close proximity of wetlands, streams, rivers, coastal marshes, and bogs along the area proposed for herbicide applications. Further, the ADEC cannot provide assurance of compliance and monitoring. We assert that the applicant should not be granted the permit to apply herbicides; however, at a minimum the Railroad would be required to obtain a Clean Water Act discharge permit because of the potential damage to water quality and health. The applicant does not fulfill the condition set forth in 18 AAC 90.515(8)(D) which states that the permit must adequately provide a description of the affected area including, "each potentially affected surface water or marine water body within 200 feet of the treatment area."[lxxvi] Although we are in opposition to the proposed permit, it is the responsibility of ADEC to closely examine the list provided by the ARRC to confirm that every water body is, in fact, cataloged in compliance with 18 AAC 90.515(8)(D). With this letter, we are also providing ADEC with GIS maps demonstrating the proximity of vulnerable water bodies, including anadromous fish streams and sensitive aquatic habitats.

Premise of the Maps:

Knowing that the Alaska Railroad (AKRR) planned to *NOT* spray within 100 feet of an existing water body (small and large streams; standing water in lakes and ponds; ocean waters, etc.), we decided to use GIS to find out how much of the corridor 100 feet either side of the railroad centerline was intersecting such types of water bodies. We used the NHD hydrologic data layers (the best comprehensive set for Southcentral Alaska); the best AKRR centerline vector file and buffered it by 100 feet; the most current ADF&G anadromous fish point and vector datasets; and the NOAA Environmental Sensitivity Index (ESI) polygons to produce statistical and visible overlap of these themes, in a simplified real-world model of what would be occurring with pesticide application.

Data Collection and Usage in GIS:

To ascertain the areas planned for spraying by the AKRR, we downloaded and georegistered the USGS map figure from public meeting document "PR_2335 2009 IVM Board 6 - 2009 versus 2006.pdf" which showed the zones for spraying. Then we heads-up automated the same zones in our GIS, based on the quality (or lack thereof) of the USGS map figure provided to the public. (Please note: Those zones of interest are drawn in red on our own map figure, as well.) Our derived "spray zones" dataset was analyzed with respect to the ESI and ADF&G data using spatial overlay processing.

Results:

We discovered that the area of impact (acres) for this planned herbicide application was grossly understated by the AKRR, both within the Seward Rail Yard and for the "spraying zones" planned along the route from Indian to Seward. While the AKRR document says that the chemicals will be applied in the 8 feet next to the tracks and within the "spray zones", it is a well established fact that the chemicals migrate in water; which is probably why the AKRR claims it will avoid spraying within 100 feet of water bodies. At minimum, the AKRR should have published acreage figures that reflected separately the 8-foot spray buffer and the 100-foot

hydrography "avoidance" buffer. Instead, it appears that the AKRR has not fully reflected the difficulty of spraying anywhere inside their designed "spray zones" without violating the 100-foot avoidance buffer for hydrographic features.

The total acreage of the AKRR tracks from Indian to Seward (including the yard), within the 100-foot buffer, is approximately 2410 acres. The total acreage of the AKRR "spray zones" within the 100-foot buffer is approximately 848 acres, which calculates to just over 35% of the total acres. The total acreage of waterbodies impacted in the AKRR spray zones is approximately 39 acres – just as much as the acres which the AKRR stated would be sprayed in total outside the Seward Rail Yard. Furthermore, there are approximately 38 streams that are within the AKRR spray zones, based on the best NHD hydrography that is available. While the NHD hydrography is an established and representative USGS polygon and vector dataset available for Southcentral Alaska, it does not account for smaller standing water bodies and the smaller creeks and streams that will be encountered along the AKRR tracks between Indian and Seward. If anything, our analysis to estimate the percent of waterbodies affected by the herbicide spraying is on the low side of what the real impact would be.

Additionally, a high percentage of the NHD hydrography streams are anadromous streams, based on the digital representation of anadromous streams produced by ADF&G. While researching for the anadromous streams dataset (the Anadromous Waters Catalog, or AWC), we found a map produced by ADF&G of the entire USGS 1:250,000 scale Seward Quadrangle, which nicely highlights just the anadromous streams. That map figure clearly demonstrates the large number and significance of anadromous streams crossed by the AKRR tracks between Indian to Seward.

Within the 100-foot buffer zones along the AKRR that is *not* planned for spraying (i.e. the "non-spray zones"), out of 1562 acres (i.e. 2410 acres minus 848 acres), approximately 200 of the acres are waterbodies and larges creeks and rivers. And 62 smaller streams are crossed by the AKRR tracks. These "non-spray zones" are more highly influenced by hydrography than are the "spray zones". The analysis and mapping was conducted by Sharon Rudolph of Encompass Data and Mapping.

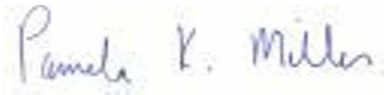
Critical Habitat for the Endangered Cook Inlet Beluga Whale

The Cook Inlet beluga whale has been listed as an endangered species under the Endangered Species Act (ESA) by the National Oceanic and Atmospheric Administration. Applications of herbicides, especially along Turnagin Arm, pose direct and indirect threats to the development, survival, habitats, and food resources of the endangered beluga whale that must be considered by the ADEC. The listing of the Cook Inlet beluga whale means any federal agency that funds, authorizes, or carries out new projects or activities that may affect the whales in the area must first consult with NOAA's Fisheries Service to determine the potential effects on the whales. A federal action must not jeopardize the continued existence of a listed species. The Railroad receives federal funding from the Federal Railroad Administration and Federal Transit Administration and therefore must comply with consultation and other provisions of the ESA.

In conclusion, the Railroad does not provide justification for use of the herbicide mixture in the permit application. ADEC must deny this permit request in order to meet its legal obligation to

protect vulnerable water bodies, aquatic habitat, subsistence resources, endangered beluga whales and other wildlife, and human health.

Sincerely,



Pamela Miller
Executive Director
Alaska Community Action on Toxics

H. River Gates
Conservation Chair
Arctic Audubon Society Chapter

Bob Shavelson
Executive Director
Cook Inletkeeper

Karla Dutton
Alaska Director
Defenders of Wildlife

Elise Wolf
Kachemak Bay Conservation Society

Nancy Berland
Conservation Director
Lynn Canal Conservation

Jennifer Gibbins
Soundkeeper
Prince William Soundkeeper

Russ Maddox
Board Member
Resurrection Bay Conservation Alliance

cc Commissioner Larry Hartig, ADEC
Kristin Ryan, Director, Environmental Health, ADEC

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