Alaska Community Action on Toxics
505 West Northern Lights, #205, Anchorage, AK 99503, Phone (907) 222-7714
Fax (907) 222-7715, http://www.akaction.org

Ernesta Ballard, Commissioner;
Kristin Ryan, Director of Environmental Health;
Rosemarie Lombardy, Pesticide Program
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, Alaska 99501

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Comments on Proposed Permit Application of Klukwan Corporation to Aerially Spray Herbicides on Long Island, Alaska—Transmitted by Email and Hand-Carried to the Alaska Department of Environmental Conservation (please confirm receipt)

I. Introduction

Please accept the following comments on behalf of Alaska Community Action on Toxics (ACAT) and the other named organizations concerning the permit application received by the Alaska Department of Environmental Conservation from Klukwan Inc. (Long Island Trust) to aerially apply Arsenal (active ingredient Imazapyr) and Accord (active ingredient glyphosate) to 2,000 acres on Long Island. ACAT submits the following comments on Klukwan Inc.'s ("Klukwan") permit application to aerially spray pesticides on Long Island. Klukwan proposes to spray pesticides by helicopter on 1900-2000 acres across the island. The pesticides, Accord (active ingredient Glyphosate) and Arsenal (active ingredient Imazapyr), mixed with an Adjuvant R-11 and water will kill red alder and salmonberry to stimulate conifer growth. The target area includes fish habitat, subsistence and recreation areas. Klukwan proposes to spray during the busy subsistence and commercial fishing months of July and August.

We request that these comments and all of the documents cited herein be entered into the formal public record and that the Alaska Department of Environmental Conservation acknowledges receipt of our comments (submitted prior to the due date of June 21, 2004). ACAT endorses and incorporates by reference the comments submitted by the Southeast Alaska Conservation Council (SEACC) and the Hydaburg Community Association ("HCA"). We also incorporate by reference our comments on the original permit application by Klukwan, Inc. (June 15, 2001) and subsequent comments on the proposed pesticide regulations on May 1, 2003. We have attached as exhibits many of the cited documents. The remaining documents are available by contacting ACAT and should be considered by ADEC as part of the formal public record.

These comments are endorsed by the following organizations: Alaska Community Action on Toxics, Alaska Center for the Environment, Alaska Conservation Alliance, Alaska Forum for Environmental Responsibility, Alaska IMPACT, Campaign to Safeguard America's Waters—A Project of the Earth Island Institute, Eyak Preservation Council, Defenders of Wildlife, and listed individuals.

Alaska Community Action on Toxics is a statewide non-profit public interest 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.

Alaska Center for the Environment (ACE) was founded in 1971 and works to protect Alaska's natural environment and urban quality of life through education and grassroots activism. ACE is Alaska's largest home-grown citizen's group working for the sensible stewardship of Alaska's natural environment. With 8,000 dues-paying members from around the state, Alaska Center for the Environment is an important voice for public lands conservation, clean air, clean water, and livable places.

Alaska Conservation Alliance is a membership organization comprising 44 conservation organizations and small businesses. (ACA) mission statement**:** ACA empowers citizens and organizations to participate effectively in the civic arena, and informs public officials, media and the public about environmental as well as economic and community issues.

Alaska Forum for Environmental Responsibility is dedicated to holding industry and government accountable to the laws designed to safeguard the environment, provide a safe and retaliation-free workplace, and achieve a sustainable economy in Alaska.

Alaska IMPACT is an interfaith educational and legislative network for Alaskans who care about peace, justice and creation. It was established in 1989 as a non-profit corporation in the State of Alaska. Member organizations include: Alaska Missionary Conference of the United Methodist Church, Alaska Synod of the Evangelical Lutheran Church in America, Central Alaska Friends Conference, Chena Ridge Friends Meeting, Episcopal Diocese of Alaska, Midnight Sun United Church, and The Richard R. Gay Trust.

Campaign to Safeguard America's Waters is a project of Earth Island Institute and based in Haines, AK. Their mission: to close the "mixing zone" loophole in state and federal regulations that allows dischargers to circumvent the goals of the Clean Water Act and dump toxic chemicals into public waters.

Defenders of Wildlife is a national organization with a program office in Alaska to protect wildlife and plants in their natural communities.

The Eyak Preservation Council (EPC), based in Cordova Alaska, was formed in response to the tragic Exxon Valdez Oil spill. As a grass roots citizen's advocacy organization, EPC's mission is to preserve wild salmon habitat and Eyak ancestral lands and culture in the Prince William Sound and Copper River watershed regions in south-central Alaska. EPC is a member group of the Alaska Coalition, the Copper River Delta Coalition and the Prince William Sound Alliance.

ACAT submitted timely comments on the proposed pesticide regulations on May 1, 2003. The subsequently adopted regulations failed to meaningfully address those comments or demonstrate that the division took a hard look at the scientific information submitted or policy issues raised. Klukwan's permit application is the first example that demonstrates how the regulations fail to comply with applicable law. As such, the decision made about this permit will set a precedent for other decisions about the aerial applications of pesticides.

Based upon our analysis of Klukwan's permit application, and DEC's pesticide regulations, DEC must deny Klukwan's permit application. Not only did Klukwan fail to fully comply with the current regulatory requirements, but DEC will not meet its statutory obligations under the current regulatory framework as applied to Klukwan's permit. For the record, ACAT strongly opposes the issuance of Klukwan Inc.'s permit for aerial spraying. This project will result in unreasonable adverse effects to Alaska's renewable resources and the permit fails to contain sufficient conditions to protect human health, safety, or welfare, animals or the environment. The application fails to provide sufficient conditions to ensure the protection of renewable resources, the physical environment and human health and welfare.

Alaska Community Action on Toxics prepared comments on the 2001 permit application from Klukwan, Inc. We remain firmly opposed to the current proposed application of Klukwan, Inc. to aerially spray herbicides on approximately 2,000 acres of Long Island. We find that the company has not made substantive improvements to the permit application. Klukwan, Inc./Long Island Trust demonstrates a lack of responsibility and accountability in their permit application as evidenced by their egregious omissions about environmental and health effects. The company also assumes a pre-determined outcome of approval for its permit application in its refusal to consider use of a less-toxic surfactant than R-11 as requested by DNR. "As far as the type of adjuvant is concerned we have already purchased all of the chemicals for this project including an adequate amount of R-11 (Letter from Jim Tuttle, Klukwan, Inc. to Kristin Ryan, ADEC, May 3, 2004)." The company demonstrates a dismissive and indifferent attitude about public concerns: "Although the public notice is a prerequisite for an actual public meeting I am adamantly opposed to holding another one of these (Letter from Jim Tuttle, Klukwan Inc. to Rose Lombardi, ADEC, February 20, 2004).

We contend that the proposed herbicide spraying poses an unnecessary threat to water quality in the coastal zone, wildlife, and human health. The proposed permit does not meet the enforceable habitat and subsistence use protection standards of the Alaska Coastal Management Program (ACMP). We find that the proposed application of herbicides may cause significant ecological and health consequences. Studies show that these herbicides disrupt forest ecology and natural succession, damage soil productivity, and adversely affect non-target plant and animal species. Further, the herbicides Accord and Arsenal are likely to have synergistic and cumulative effects on environmental and human health. Glyphosate and imazapyr are persistent and toxic chemicals. Residues may harm people through contamination of traditionally harvested foods. Children are particularly vulnerable to exposure that may occur when they participate with parents and other adults in berry picking and other food-gathering activities.

Instead of considering those effects, Klukwan and the ADEC appear to assume that the permit will be granted on terms proposed by Klukwan. ADEC should not grant the permit to aerially spray pesticides because it has not considered all available peer-reviewed science detailing the toxicity of the chemicals to be applied, has not considered the health and environmental effects of the chemicals, and has not evaluated fully the potential transport and drift of the chemicals.

The State of Alaska must respect the resolutions and authority of the local federally recognized tribes in their opposition to the herbicide spraying. People engaged in traditional subsistence practices, including the gathering of foods and medicinal plants in the area will be the most directly and adversely affected by aerial herbicide applications. The Hydaburg Cooperative Association, for example, states that they will "not allow the herbicide glyphosate or imazapyr to be sprayed within our traditional use watershed." The Tribes have the right to assert their authority to protect traditional use areas and the health of their people. The Governor of Alaska, in facilitating the signing of the Millennium Agreement, announced: "the State of Alaska recognizes and respects the governmental status of the federally recognized Tribes within Alaska. This agreement also makes clear the State's commitment and policy to work…on a government-to-government basis with Alaska's Tribes." The State of Alaska must defer to the authority of the Tribes in this matter, in order to be consistent with the Governor's stated policy. The State of Alaska must respect the concerns and knowledge of the local tribes who use Long Island for traditional harvesting of berries, medicinal plants, and fish.

In their permit request, Klukwan, Inc. provided justification for their proposed aerial application of herbicides prepared by Bruce Alber of the Wilbur-Ellis Company. Mr. Alber presents misleading or false information about the environmental and health effects of the herbicides Accord and Arsenal. First, Mr. Alber is employed by the company that sells the herbicides and appears to have a conflict of interest in this matter. Second, he states that the Environmental Protection Agency rates glyphosate, the active ingredient in Accord, as "practically non-toxic." He also uses claims similar to those of the chemical manufacturers that "both of these products are less toxic in their concentrated form than aspirin, caffeine, bleach, and table salt." His assertions are not scientifically founded.

Monsanto has been caught at least twice for breaking the national pesticide law for false advertising about glyphosate. In 1996, the New York attorney general fined Monsanto and required the company to stop making certain claims in ads about glyphosate.[i] Monsanto made false claims that glyphosate products degrade "soon after application," are "safer than table salt," and cause no harm to people, pets, or the environment.[ii] EPA determined in 1998 that Monsanto's ads about Roundup, an herbicide with glyphosate as the active ingredient, contained "false and misleading" claims and that the ads violated the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).[iii] The EPA determined that glyphosate is "extremely persistent under typical application methods." EPA also found that their initial classification of non-carcinogenicity for glyphosate in humans "should not be interpreted as a definitive conclusion." [iv]

II. Inadequacies of the current permit application

We object to the implied premise of the Alaska Department of Environmental Conservation that it is incumbent upon the public to prove harm from the proposed aerial application of herbicides—although we provide more than enough evidence within these comments to justify denial of the permit. The corporation must bear the burden of proof to demonstrate the safety of the methods and products proposed for use—Klukwan has not demonstrated the safety of their proposed action. The ADEC must take a precautionary and protective approach in denying the Klukwan permit given the weight of evidence and likelihood of harm. We find that the applicant, Klukwan, Inc. and ADEC have used outdated, questionable, and inadequate information in the current 2004 permit application and in public statements in order to conclude claims of safety of the herbicide active ingredients glyphosate and imazapyr. The applicant ignores an important body of independent peer-reviewed scientific literature that documents serious environmental and health effects associated with exposure to these herbicides and, instead, relies on industry assertions of harmlessness. In a peer-reviewed research report published by the Lymphoma Foundation of America,[v] the author found that scientists employed by pesticide corporations are more likely than independent researchers to find no connection between pesticides and health outcomes—a pattern also consistent with studies funded by other chemical and pharmaceutical corporations.

Klukwan, Inc./Long Island Trust presents grossly outdated articles as justification for the environmental and health safety of glyphosate and imazapyr. Of the two purportedly peer-reviewed articles presented, one refers only to the herbicides 2,4-D, triclopyr, and picloram. The other article included by Klukwan presents incomplete and questionable conclusions. "Fate of Glyphosate in an Oregon Forest Ecosystem," is a 1984 article published in the trade journal of the American Chemical Society and partially funded by the chemical corporation Monsanto. Fact sheets about glyphosate and imazapyr included by Klukwan, Inc. in the permit application are also incomplete and outdated from 1996.

As noted in DNR comments on the initial permit application by biologist Mark Minnillo, Klukwan, Inc. then neglected to supply adequate information regarding special precautions to protect human health, safety, welfare, animals, and the environment, as required by the permitting process. The maps provided were too large to determine

treatment proximity to water bodies, and did not even list some known water bodies because of its size. Insufficient data was provided regarding the water holes to be used for pesticide dilution, and their relation to spawning areas for pink, chum and coho salmon. They also neglected to include data on the proposed spraying apparatus, and its nozzle size, type, and droplet size. In response to state requests, Klukwan supplied very limited information later in the process, although they fail to provide substantive information about the effects that will result or show any initiative in preemptively addressing those effects.

Specific informational and methodological deficiencies in the permit application that must be rectified by the applicant include:

- The applicant does not supply an MSDS or any other information about the chronic or acute toxicity of "low drift additive" called "In-Place." Their omission is unacceptable.
- The applicant provides no contingency plan in the event of a spill of the herbicide formulations on Long Island or in the potentially disastrous event of the aircraft being forced to dump its load of chemicals over water.
- Contrary to claims by the applicant about the short persistence of the herbicides in the environment following application, we present documented evidence of substantial persistence of these chemicals in soils, sediments, and water. ADEC does not have an adequate monitoring and enforcement program in place to ensure that drinking water sources, salmon habitat, subsistence use, and commercial fishing areas are not contaminated. Although Kristin Ryan claims that the residual effects of these chemicals cannot be tested for, we cite a number of studies below that show that tests for glyphosate and imazapyr and their degradation products can and should be monitored.
- The applicant fails to assess the effects of the herbicide application within the karst environment of Long Island, the particular sensitivities of the karst environment, confounding factors of high alkaline/pH waters in contact with the herbicides and surfactants and increasing toxicity.

III. Health Effects

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. Parental preconception exposure to glyphosate was associated with late abortion.[vi]" A growing body of evidence implicates glyphosate and its formulations with health problems thus far ignored by the applicant and ADEC. These credible independent scientific studies should factor in favor of ADEC's denial of the proposed aerial application of glyphosate and imazapyr.

Glyphosate

For the preparation of our comments on the current permit application, we reviewed original peer-reviewed journal articles concerning health effects in addition to the above-referenced document prepared by the Ontario College of Family Physicians. 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."[vii] 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."[viii] "The genotoxicity of glyphosate has been positive in *in vitro* cultures of bovine and human lymphocytes and weakly mutagenic in a *Salmonella* assay."[ix] 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."[x]

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."[xi], [xii] A 2003 study confirmed the association of glyphosate exposure with increased incidence of non-Hodgkin's lymphoma.[xiii]

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, including Ammo (Zeneca Agricultural Products, Wilmington, DE) and Ambush (Zeneca Agricultural Products) and the herbicides Banvel (Sanex, Inc., Burlington, Ontario, Canada), Cotoran (Ciba-Geigy Corporation, Greensboro, NC), Cyclone (Zeneca Agricultural Products), Fusilade (Zeneca Agricultural Products), Dual (Ciba-Geigy), and Roundup (active ingredient glyphosate)(Monsanto Co., St. Louis, MO**)** on endocrine system function, despite their widespread use." The authors conclude: "Roundup disrupted steroidogenesis in Leydig cells through a post-transcriptional reduction in StAR (**St**eroidogenic **A**cute **R**egulatory) 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."[xiv]

Dr. Warren Porter, a professor in physiological ecology of the University of Wisconsin, Madison states: "In 1945, a National Geographic photographer took a picture of a child walking through DDT that was being sprayed from a truck at New York's Jones Beach State Park. The side of the truck said, 'DDT. Powerful Insecticide. Harmless to Humans.' Since that time, herbicides like Roundup (glyphosate) have been touted for their safety. Yet, they are capable of modifying the most fundamental biological processes. For example, many people report experiencing severe digestive problems related to overexposure to Roundup. In fact, Finnish researchers showed that Roundup's active ingredient, glyphosate, decreases the defenses of enzymes of the liver and intestines.[xv] 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. A paper published in August 2000 shows that Roundup alters gene expression and inhibits necessary steroid production by disrupting a particular protein expression. In 2002, a paper shows that Roundup can also affect early cell division processes in embryos."[xvi]

Imazapyr

Although the amount of imazapyr required to kill mammals is relatively large after exposure orally, through skin, or by inhalation, other serious acute effects have been found in laboratory tests of rabbits, including bleeding and congested lungs.[xvii],[xviii],[xix] Laboratory tests also showed congestion of the kidney, liver, and intestine.[xx] Exposure to imazapyr can cause irritation and irreversible eye damage.[xxi] Rabbits dermally exposed to imazapyr in laboratory tests suffered reddening; scaling and crusting of the skin at all dose levels.[xxii] Female rabbits experienced stomach ulcers and intestinal lesions after oral administration over a 12-day period at most dose levels.[xxiii] Chronic effects in laboratory mice after exposure over a 2-year period included: fluid accumulation in lungs, increased incidence of kidney cysts in males, and an increase in the incidence of brain congestion in females.[xxiv] Evidence of carcinogenicity is inconclusive. The EPA hazards assessment for Arsenal is based mostly on tests of imazapyr as the active ingredient and not formulations including the other chemical ingredients. One of the breakdown products of imazapyr, quinolinic acid, is a neurotoxin, causes symptoms similar to Huntington's disease, as well as irritation of the eyes, respiratory tract, and skin.[xxv],[xxvi],[xxvii]

IV. Environmental Effects

The effects of herbicides extend beyond the intended target species. Herbicide formulations (including inert ingredients, carrier agents, and surfactants), chemical character, environmental conditions, and application techniques are among the parameters that determine the degree to which herbicides will affect non-target species and their ecosystems. Inert ingredient toxicity is little studied or understood. Scientific

studies have demonstrated lethal and sub-lethal effects of herbicide ingredients on many species. Sub-lethal effects on fish and wildlife from herbicides may occur at concentrations less than 1% of the LC50 value and include: reduced growth, decreased reproductive success, altered behavior (swimming, feeding, attraction-avoidance, predator-prey interactions), reduced resistance to stress, histological (e.g. degenerative necrosis of liver, kidney, and gill lamellae), and biochemical changes (e.g. blood enzyme and ion levels).[xxviii] Indirect exposure effects may result from surface and subsurface transport of herbicides. Potential adverse effects may include: habitat reduction in riparian vegetation, increased aquatic solar radiation, elevated stream temperatures, and reduced prey base. Loss of riparian vegetation may reduce essential nutrient inputs to the stream from organic material such as leaf litter. Loss of riparian vegetation may also increase stream sedimentation and bank stabilization, thus reducing cover for fish.

Glyphosate

Contrary to the applicant's claims, glyphosate is persistent in soils after application, especially in northern regions. In a Finnish study, the measured half-life of glyphosate was 249 days.[xxix] In Ontario, Canada, glyphosate had a half-life in forest soils of 24 days with detectable residues persisting for 335 days.[xxx] On 3 British Columbia forestry sites, glyphosate persisted 360 days.[xxxi] In a Swedish study, glyphosate persisted from one to three years on eleven forestry sites.[xxxii]

Glyphosate is a non-selective, broad spectrum herbicide. It is absorbed by leaves and translocated throughout the plant and disrupts photosynthesis by preventing the synthesis of amino acids required protein formation. 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).[xxxiii] Another reported degradation product of glyphosate is formaldehyde,[xxxiv]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.[xxxv] 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.[xxxvi] 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.[xxxvii] 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."[xxxviii]

Toxicity of glyphosate is affected by such environmental factors as water hardness, temperature, and pH. Toxicity increases at lower pH levels and higher temperatures.[xxxix] Surfactants may exhibit increased toxicity in alkaline waters,[xl] likely to occur within the karst environment of Long Island. In addition, glyphosate has an antagonistic effect on the toxic action of a surfactant.[xli] 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*).[xlii]

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.[xliii], [xliv] Rainbow trout fry were the most sensitive life stage followed by emergent fry.[xlv] After treatment with Roundup, aquatic macroinvertebrate density declined by 42% for a 1.5 year period.[xlvi]

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.[xlvii] It is acutely toxic (at concentrations ranging from 2-55 ppm) and causes sub-lethal effects on fish.[xlviii] Roundup is 20-70 times more toxic than glyphosate alone.[xlix] Toxicity increases with water temperature.[l] 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.[li] 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.[lii] A three-year study of treated forests in Maine demonstrated a decline in the abundance of songbirds.[liii] Declines in small mammal populations and adverse effects on moose, elk, and deer browse have also been documented.[liv] Glyphosate can adversely affect the health of soils and nutrient cycling by: 1) inhibiting nitrogen fixation[lv], 2) causing a decline of beneficial mycorhizal fungi[lvi], and 3) increasing the disease susceptibility of plants.[lvii]

Imazapyr

Field studies under various soil and climate conditions show persistence ranging from 60 to 436 days.[lviii] According to the EPA and based on laboratory tests, the half-life of imazapyr is 17 months.[lix] Measures of half-life in field studies find a range of persistence from 21 days to 49 months.[lx] In a 2004 study in Sweden, imazapyr persisted in soils with a half-life range of 67-144 days. The chemical was transported to lower soil levels and groundwater in amounts proportional to the amounts applied. Imazapyr was detected in groundwater even 8 years after application.[lxi] Studies that use plant injury as an end point found longer persistence than those relying on laboratory analysis, demonstrating that

imazapyr causes plant damage at levels below concentrations detectable by standard analytical methods.[lxii]

This chemical is a broad-spectrum herbicide that effectively kills non-target plants as well as "target" species such as red alder. According to the EPA: a number of terrestrial and aquatic plant species are listed as being in jeopardy from the use of herbicides and that "jeopardy will also occur from the use of Arsenal."[lxiii] Endangered and rare species of plants are at particular risk. The U.S. Fish and Wildlife Service reported that endangered species in 100 counties of 24 states east of the Mississippi could be threatened from the use of Arsenal in forest management. To date, USFWS has not published similar analyses for western states. Laboratory studies also demonstrate that imazapyr treatment of soils slows decomposition of cellulose (necessary for generation of soil nutrients) and inhibited soil microbe enzyme action on cellulose.[lxiv]

Imazapyr can damage plants at levels too low to detect in laboratories.[lxv] One study recorded 40-70% of the imazapyr applied in an area leaching to the deepest water depth tested. It can disrupt soil efficacy in plant decomposition.[lxvi]

Surfactant R-11

The surfactant R-11 significantly increases the toxicity of glyphosate compared to other available formulations. The LC50 of Roundup (glyphosate and Entry II surfactant) to fish is 5-26 ppm compared with the LC50 of glyphosate and R-11 to fish is 3.8 ppm.[lxvii] Compared with other surfactants, R-11 is more toxic and "has a range of effects that present themselves at the low parts per billion concentration range." R-11 is approximately 300 times more toxic, for example, than the surfactant Agri-Dex. NMFS recommends alternative surfactants that are much less toxic.[lxviii] R-11 is considerably more toxic to rainbow trout than the active ingredient glyphosate, with a 96 hour LC50 of 3.8 ppm.[lxix]

DNR biologist Mark Minillo, R-11 stated that R-11 "is reportedly toxic to fish." At the 2001 public hearing when Klukwan last proposed to use R-11 as a surfactant, Dr. Michael Newton, a pesticide researcher retired from Oregon State University who was brought to the hearing by Klukwan as a source of information, recommended against the use of R-11 because it would be detrimental to conifer seedlings" (Pesticide Permit Review Comments, March 23. 2004). Nonetheless, despite having made no showing that R-11 will not harm fish and wildlife on Long Island, Klukwan proposes to use it over the objections of DNR, because the surfactant has been purchased already.

V. Chemical Drift

"Toxic levels of chemicals may reach streams from storm runoff and wind drift even when best management practices are employed."[lxx] Proposed "pesticide-free zones" and buffers for the aerial application on Long Island are inadequate to protect salmon streams, riparian areas, and potential drinking water sources. Drift is defined by the Environmental Protection Agency (EPA) as the physical movement of a pesticide through air to any site other than that intended for application (often referred to as off-target). Pesticide droplets,

particles, and gas-phase chemicals are carried away from the intended application area by wind. Drift inevitably occurs whenever pesticides are applied, but especially during and after aerial applications. The Office of Technology Assessment estimates that about 40% of an aerial pesticide application leaves the "target area" and that 1% actually reaches the target pest (OTA, 1990). The National Research Council (NRC, 1993) characterizes the amount of drift as "considerable" and notes that the amount of drift varies from about 5% (under optimal low-wind conditions) to 60% (under more typical conditions).

Pesticide drift after aerial application typically ranges from 100 meters (330 feet) to 1600 meters (5250 feet). However, in virtually every study available and reviewed in the Journal of Pesticide Reform (16 articles), pesticides were detected as far away from the area of application as samples were taken.[lxxi] A 1994 report from the EPA Ecological Effects Branch states that during an aerial application, "a predictable percentage of spray will transport potentially as far as 2 or more miles from the treatment site."[lxxii] In a study of pesticide drift in central Washington, the herbicide 2,4-D drifted up to 50 miles from the application site in hilly terrain under windy conditions.[lxxiii]

Pesticide drift can poison people and cause serious economic damage. In June of 1993, 55 workers at the Cameron Nursery became ill when they were exposed to drift following the aerial application of the pesticides methamidophos, azinphos-methyl, and mancozeb.[lxxiv] After an aerial application of the herbicide 2,4-D in Newport, Oregon, a woman who was walking on her property became ill for the next two years, suffering from chronic fatigue, ovarian cysts, and endometriosis.[lxxv] In California where pesticide illness reporting is more complete than in other states, over 350 illnesses and injuries were reported as a result of drift in 1991.[lxxvi] Off-target transport of the herbicide sulfometuron methyl (Oust) caused several million dollars worth of crop damage on over 100,000 acres from an aerial application.[lxxvii] In the first well-documented large-scale Oust drift incident, wind transport caused over one million dollars of damage following a roadside application to over 700 miles of roadside in Franklin County, Washington. Over 300,000 young trees were damaged in one nursery.[lxxviii] Research has demonstrated that drift from sulfonylurea herbicides may "severely reduce both crop yields and fruit development on native plants, an important component of the habitat and food web for wildlife." Dramatic reductions in fruit production occurred at levels where there were no visible signs of damage to the vegetative parts of the plants.[lxxix] Imazapyr, an herbicide proposed for use by Klukwan on Long Island, is an imadazolinone herbicide with a similar mode of action as the sulfonylurea herbicides.

The State of Alaska should require non-chemical, least toxic measures as a protective and precautionary approach. ADEC must deny the proposed aerial application of herbicides on Long Island. Prohibit the use of herbicides in areas of traditional fishing, hunting, and gathering of greens, berries, medicinal plants, and basketry materials.

Comments prepared by Katie Bryson, Researcher, Alaska Community Action on Toxics and Pamela Miller, Biologist and Director of Alaska Community Action on Toxics.

Signatories to the above comments on the proposed permit from Klukwan Inc. to aerially spray herbicides on Long Island, Alaska:

Pamela Miller, Executive Director of Alaska Community Action on Toxics
505 West Northern Lights, Suite 205
Anchorage, Alaska 99503

Randy Virgin, Executive Director
Alaska Center for the Environment
807 G Street, Suite 100
Anchorage, Alaska 99501

Tom Atkinson, Executive Director
Alaska Conservation Alliance
P.O. Box 100660
Anchorage, Alaska 99510

Stan Stephens, President
Alaska Forum for Environmental Responsibility
P.O. Box 188
Valdez, Alaska 99686

Rev. Richard Heacock, Executive Director, Alaska IMPACT
3012 Riverview Drive
Fairbanks, Alaska 99709

Dune Lankard, Executive Director
Eyak Preservation Council
P.O. Box 460
Cordova, Alaska 99574

Gershon Cohen, Ph.D.
Campaign to Safeguard America's Waters—A Project of Earth Island Institute
P.O. Box 956
Haines, AK 99827

Karen Deatherage, Alaska Program Associate
Defenders of Wildlife
308 G Street
Anchorage, Alaska 99501

Individuals:
Jerry and Janet Brookman, Kenai, Alaska

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