Province of
British Columbia

Ministry of
Environment

ENVIRONMENTAL APPEAL BOARD
Victoria
British Columbia
V8V 1X5

APPEAL NO. 84/22 PES

J U D G E M E N T

Appeal by the Sunshine Coast Environmental Protection Project (SCEPP) against the Pesticide Control Act - Pesticide Use Permit 104-660-84/86 issued to the Minister of Forests for an application of Roundup (Glyphosate) for conifer release to 99 hectares in the Brittain River area of Jervis Inlet, by aerial (helicopter) and ground-based techniques, at 1.8 kg/ha. The total active ingredient is 178.2 kg. The target species are elderberry, salmonberry, big-leaf maple coppices and alder.

APPELLANT;

Sunshine Coast Environmental Protection Project
(SCEPP)

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DECISION:

The Environmental Appeal Board, authorized under the Pesticide Control Act and the Environment Management Act to hear the appeal by the Sunshine Coast Environmental Protection Project (SCEPP) against Pesticide Use Permit No. 104-660-84/86, issued to the Minister of Forests for an application of Roundup (glyphosate) for conifer release to 99 hectares in the Brittain River area of Jervis Inlet, has considered all of the evidence submitted to it at the hearing on November 14th, 1984, and has decided that the implementation of the program in accordance with the terms and conditions specified in the Permit will not cause an unreasonable adverse effect to mankind and/or the environment.

The appeal, therefore, is denied.

COMMENTS OF THE BOARD;

1) The Board hereby directs the Administrator of the Pesticide Control Act to amend Clause 5 of the Permit to read as follows:

> The effective date is August 2nd, 1984, and the pesticide use shall be carried out between August 20th, 1984 and October 31st, 1986.

2) The Board believes that there will be no runoff of Roundup from the herbicide application areas to the Brittain River, with the possible exception of the drainage from Streams 1 and 2 on Site No. 2. The concentration of any runoff from these streams, however, should be exceedingly low and, coupled with the flow of the Brittain River, should be below detection levels by the time any Roundup reaches the salmonid bearing section of the river. From the evidence of the Appellant's witness, Mr. Jim Morrison, during cross-examination, it also appears that he believes that any runoff concentration of Roundup to the Brittain River would be below a concentration which could be harmful to fish.

3) The Board is also convinced that if the precautions described by the Forest Service in regards to the buffer zones and aerial spraying operations are properly carried out, there will be no drift of the spray into the Brittain River. The Board further warns the Forest Service that it would be a mistake on their part not to take the utmost precautions in these matters, for the success or failure of these measures will affect the decisions of the Board in the future on other permits when they come under appeal.

4) The Board wishes to thank Mr. Jim Morrison of Fisheries and Oceans, Canada; Mr. Michael Wan of the Environmental Protection Service, Environment Canada; and Mr. Dan Cronin of the Pesticide Control Branch, Ministry of Environment, for coming to the hearing and giving the Board valuable evidence in connection with this permit.

5) The Board also wishes to thank Brad Hope and Jim Morrison for their excellent presentations on the characteristics and vulnerability of salmonids to herbicides.

6) All three of the men invited to the hearing by the Board were offered full-party status. Mr. Wan and Mr.Cronin accepted the offer and acted as representatives of their respective organizations. Mr. Morrison, however, turned down the offer and appeared as a witness for the Appellant, which meant that he assumed a posture of opposing the permit, which was opposite to the position taken by Fisheries and Oceans, Canada. Mr. Morrison's testimony, however, was directed to telling the Board of the concerns of Fisheries and Oceans, Canada, with respect to herbicide applications, and not to opposing the decision of his organization. The Board found the position he took to be somewhat confusing.

7) The Appellant's position was that the decision on whether the herbicide application should take place, or not, should be delayed until all of the detailed information on Roundup was known. The Board, however, cannot take this attitude. Very few decisions in life are made with hundred

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percent information. There is, however, enough known about the parameters of Roundup's characteristics for the Board to come to a proper decision, as the regulatory agents have already done in this case.

In Mr. Morrison's testimony, he indicated that no matter how much information he obtained on Roundup, he would never have all the information on this herbicide that he would like to have.

F. A. Hillier, P. Eng.,
Chairman,
Environmental Appeal Board

Victoria, B. C.
December 12th,1984.

SUMMARY:

The following pages of this Judgement contain a summary of the hearing details and principal points of evidence presented to the Board in the testimony of the parties to the appeal.

F. A. Hillier, P. Eng.,
Chairman
Environmental Appeal Board

December 12th, 1984

Appendix: Letter from Mr. M.L. Wan, P.Ag., of November 27th, 1984, with the residual analysis results requested by the Board at the Hearing.

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HEARING INFORMATION:

The hearing was held on November 14th, 1984, at the Driftwood Inn, Sechelt, B.C. at 9:00 a.m.

The members of the Board in attendance were:

Mr. Frank A. Hillier - Chairman
Mr. Wm. A. Venables - Member
Mr. Andrew J. Lynch - Member

Miss Shirley Mitchell - Official Recorder

GROUNDS FOR THE APPEAL;

The grounds for the appeal were as follows:

1. SCEPP feels, as do others, that,at present, there is insufficient data on long term toxicological effects of the pesticide in question: Roundup (glyphosate)

2. There is a possibility of contamination of Brittain River and its sidestreams from drift.

3. Other grounds that may be brought up at the hearing.

The particulars to the grounds of appeal were as follows:

1. There are studies in progress of Roundup's effects. The permit should be withdrawn until such time as the results of these studies are known.

2. Brittain River is a spawning, recreational fishing and boating site on Jervis Inlet. As it stands, this permit is for both ground and aerial application of Roundup, even though aerial spray is not planned until next year. Drift from the aerial application could have serious effects on the fish population in the area, directly and indirectly.

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REGISTERED APPELLANT:

The registered appellant was the Sunshine Coast Environmental Protection Project (SCEPP).

The Spokeswoman was Ms. Carole Rubin, of Roberts Creek, B. C.

The witnesses were as follows:

Mr. N. B. Hope
Mr. J.A. Morrison
Mr. G. R. Russell

RESPONDENT:

The respondent was the Ministry of Forests, represented as follows:

Mr. Ray M. Giza, R.P.F. - Spokesman
Operations Superintendent, Forestry
Sechelt Forest District

Mr. Mel Scott, R.P.F. - Witness
Stand Tending Co-ordinator
Vancouver Forest Region

Mr. Larry F. Meyers - Witness
Forest Technician
Sechelt Forest District

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INVITED PARTICIPANTS:

The Board invited the following persons to appear at the hearing and give evidence on the matter under appeal:

Mr. Dan E. Cronin, M.P.M.
Permit Co-ordinator, Pesticide Control Branch
Ministry of Environment

Mr. Michael T.K. Wan, M.Sc.
Biologist and Inspector
Environmental Protection Service
Environment Canada

Mr. James A. Morrison, B.Sc.
Project Manager, Marine Biology
Fisheries and Oceans, Canada

All three men were offered full party status, as representatives of their respective organizations. Mr. Cronin and Mr. Wan accepted, but Mr. Morrison declined, as he wished to appear as a witness for the appellant.

LIST OF EXHIBITS:

"A.1"- Coho Management - A Dilemma, by Bob Gunsolus, Anadromous Fish Co-ordinator, Department of Fish & Wildlife, State of Oregon, U.S.A.

"A.2"- Why Wild Coho? - by Harry Wagner, Assistant Chief, Fish Division, Department of Fish & Wildlife, State of Oregon, U.S.A.

"B" - Toxicity of the herbicide glyphosate and several of its formulations to fish and aquatic invertebrates, by L.C. Folmar, H.O. Sanders, and A. M. Julin, U.S. Department of the Interior, Fish & Wildlife Service.

"C" - Research Needs for New Forestry Pesticides, prepared by Fisheries and Oceans Canada.

"D" - Presentation from the Forest Service regarding the Appellant's "Grounds for Appeal", etc.

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EXHIBITS (Continued)

"E" - Residues and Persistence of Glyphosate in Irrigation Water - by R.D. Comes, V.F. Bruns, and A. D. Kelley, U.S. Department of Agriculture and Washington State University.

SUMMARY OF THE APPELLANT'S PRESENTATION;

Ms. Carole Rubin's testimony was as follows:

1 The Sunshine Coast Environmental Protection Project (SCEPP) was formed in July, 1984, as an ad-hoc committee, after a very large meeting of over 100 people from the Sunshine Coast was convened to protest the use of pesticides in the general area. At this meeting, the citizens of the area expressed their concerns regarding the possible adverse effects of pesticide applications. Financing of the efforts of SCEPP have been obtained through many local functions, such as garage sales, etc.

2) Ms. Rubin said that she and her witnesses would present evidence to demonstrate why the application of Roundup in the Brittain River area should not go ahead. Her main reasons were as follows:

a) Brittain River is a spawning ground for coho, pinks, chum and steelhead trout.

b) No data are available on Roundup's toxicity to salmon or steelhead trout. She said that neither she nor anyone else knew what effect the chemical would have on these species of fish.

c) On this basis, manual clearing is the only reasonable alternative. She said that there was high unemployment in the area (15.8 percent officially, and 35 percent unofficially), and, therefore, the necessary labour force would be readily available.

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Mr. Brad Hope's testimony was as follows:

1) He was the President of the B.C. Mariculture Association, a member of the Science Council of Canada's Task Force on Aquiculture, he owned and operated a private fish farm, he had worked with the Vancouver Aquarium and with the Biology Sciences Department at Simon Fraser University, and was currently bidding on a salmon enhancement project for the Puntledge River on Vancouver Island, B. C.

2) On his fish farm, he said that he raised coho, chinook, chum, pinks, steelhead and rainbow trout, from eggs through to spawning, and, in fact, even through the brood stock stage and back into another run.

3) He said that there are many differences in the characteristics of the various salmonids, some of which are as follows:

   a) Chinook and coho spawn in early November.

   b) Chum spawn later, even into late December.

   c) Pinks and chums spawn at a very short distance from the mouth of a river. Their eggs are not affected by salt water.

   d) Coho and steelhead spawn much further up the river. Their eggs are affected by salt water.

   e) All species hatch in the Spring.

   f) Pinks and chums go to sea as soon as they hatch.

   g) Coho stay a whole year in rivers, passing from the egg stage to yolk sac fry, to fresh feeding fry smolts, until a chemical change in their makeup allows them to be able to live in salt water.

   h) Steelhead stay two to three years in the rivers, or long enough to climatize themselves to the salt water.

4) He said that at the present time, the adult salmonids are now in the Brittain River in the spawning stage of their life cycle.

5) He said that there are many stages in the life cycle of salmonids. During some of these stages, they are extremely vulnerable, particularly to toxic substances. To illustrate his point, he gave the following examples:

a)	eggs before fertilization	- very hardy
b)	eggs after fertilization	- extremely sensitive
c)	when eggs become eyed	- very hardy
d)	yolk-sac fry	- incredibly sensitive particularly to toxic substances
e)	remainder of life	- varies from sturdy to vulnerable

6) He said that the different species are vulnerable at different times. He also said that the sub-lethal effects of hardship (i.e. chemicals) could affect the fish as much as years later.

7) He said that water chemistry was important. Some species of fish can stand a higher pH (acidity of the water) than others. Rainbow trout can take higher temperatures than salmon, but are less capable of standing a lower pH.

8) He said that the purpose of his foregoing testimony was to illustrate that a toxicity test on rainbow trout at one point in their life cycle had very little relationship to the toxicity of the pesticide at another stage of their life cycle, or for that matter, to any other species of fish.

9) He said he had applied for a salmonid enhancement program for the Brittain River from Fisheries and Oceans Canada, but had been turned down; the reason being that other areas were more endangered at this time and must be attended to first. The Brittain River has about 100 adult coho returning to it this year.

10) He said that the conditions in the Puntledge River on Vancouver Island were very precarious. Of the returning chinook salmon, only four made it back to the river this year.

11) He said that there is a marked difference between hatchery fish and wild fish. He also said that there were differences between the wild species of coho from one river to another on the Coast, and that the coho from the Brittain

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River were of a particularly good breed. He was fearful that if this herbicide application went ahead and contaminated the river, the Brittain River coho could be lost.

12) He said the wild fish have better characteristics than the hatchery stock. They exist in small numbers in the various small streams along the coast, but when all of these streams are considered together, the fish in them constitute a large fish population. He indicated that because of the small numbers of fish in these small streams, people did not seem to be too concerned when the fish population of one or two of these streams was destroyed. He said, however, that the people do not realize what the cumulative effect of the destruction of the fish in these small streams means in total numbers, year after year. He said that Fisheries and Oceans, Canada, were not winning the battle to preserve the salmon, in spite of all their good efforts and good personnel.

13) He said that there was a great deal of interest by the people of the Sunshine Coast in Mariculture for the Jervis Inlet. He said that there was also great concern about the adverse effects the herbicide application could have on Jervis Inlet in this regard.

14) He said that he was nervous about the safety of his invest- ment in fish production because of the many unknowns and the many problems with fish sensitivity, particularly if this herbicide application was to go ahead.

15) In support of his evidence, he brought several excerpts from Exhibit "A" to the Board's attention. Some of these excerpts were as follows:

a) Managing for wild fish encourages man to do what is best for the resource and it places environmental concerns ahead of proposed trade-offs.

b) The availability of wild stocks is fundamental to achieving our socioeconomic goals in coho salmon management now and in the future.

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It is now recognized that the narrow genetic base of our highly selected coho hatchery stocks can make them dangerously vulnerable to disease, competition, predation, and fluctuation in the physical environment that would limit their survival - and wild stocks that provide the genetic base for diversification have been severely reduced by man's activities.

c) A reason for some of the past stocking failures has been the using of fish that were poorly adapted genetically for the environment into which they were placed.

For example, the Nehalem River contains a protozoan parasite,"Ceratomyxa shasta", that is common in the Columbia River system, but has been found in only one other coastal stream, the Rogue River. Attempts to augment the coho and steelhead runs in the Nehalem River using stocks from the Alsea River failed. We now know that fish from the Alsea River are very susceptible to the parasite. An analogy would be the devastation of the Indian people when exposed to smallpox, measles, etc. brought to this country by Europeans. Indians had not evolved any resistance because of the absence of these disease organisms in their environment.

I do not believe that society will condone or can afford the continued loss of this genetic material in our remaining wild stocks.

Mr. Jim Morrison's testimony was as follows:

1) He was a graduate of U.B.C., with a B.Sc. degree in marine biology.

2) He had also been an emloyee of Fisheries & Oceans, Canada,, in Nanaimo, for the last ten years.

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Mr. Morrison's experience had been developed in the Marine and Estuarine Foreshore Development Section of Habitat Management, Pacific Region; in the position of Aquatic Pollution Biologist, Freshwater Section, Habitat Management, Pacific Region; and in his current position as Project Manager, Water Quality, South Coast Division.

As Project Manager, he currently is responsible for divisional review of all matters pertaining to aquatic quality within the geographic area of Vancouver Island and the mainland coast and associated watersheds from Cape Caution through to Port Mellon in Howe Sound. Activities include review of development proposals or existing government, industrial, commercial and private operations as they pertain to effluent discharges, landfills, pesticide treatments and ocean dumping, and measurements of the impacts of such uses and the effects of oil or chemical spills on water, sediment or biota of marine and freshwater ecosystems.

3) He said that the commercial formulation of Roundup contains the active ingredient, glyphosate, and the surfactant, which is the wetting agent and is like soap.

4) He then brought to the Board's attention a table in Exhibit "B", which showed the toxicity of glyphosate and Roundup on rainbow trout (i.e. LC50 mg/l in a 96-hr.test), which was as follows:

	pH	Toxicity
Glyphosate	6.5	140
	9.5	240
Roundup	6.5	7.6
	9.5	1.4

The purpose of bringing this information to the Board's attention was to show that the surfactant was the most toxic agent in the commercial formulation of Roundup.

5) He said that at this time, he had no information on the toxicity of Roundup on salmon species or steelhead trout. He also indicated that Fisheries and Oceans did not have this information, nor anyone else, with the possible exception of Monsanto, the manufacturer of the chemical. He said that

there was a rumour that Monsanto had the information but had not, as yet, released it to the public. Because there is no information, or because it has not, as yet, been released, Fisheries & Oceans Canada is very concerned about the use of this chemical in a forest setting.

6) He said that because of Fisheries & Oceans' concerns about the lack of information on Roundup, they have prepared a Draft Discussion Paper on the subject in conjunction with the International Pacific Salmon Fisheries Commission, the Environment Protection Service, Environment Canada, and the Fish & Wildlife Branch of the B.C. Ministry of Environment. Mr. Morrison filed this Draft Discussion Paper with the Board as Exhibit "C".

7) The Draft Discussion Paper was made up to show the information missing in connection with Roundup, but was also to be used as a discussion paper on all herbicides for use in a forest setting. The missing information on Roundup, according to Mr. Morrison, is as follows:

   a) There is no toxicity data on salmon species.

   b) There is no background information on the effects of the chemical on the food organisms on which salmon live in their stream environment.

   c) There is limited toxicological information in regards to variations in stream acidity and temperature.

   d) There is concern on the lack of information on the breakdown products of the chemical.

   e) There is concern on the lack of information on the sublethal effects the chemical may have on juvenile salmonids.

8) Mr. Morrison said that because of this lack of information, Fisheries & Oceans, Canada, have made recommendations to Agriculture, Canada, that the use of Roundup should be limited until the information is provided.

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9) Mr. Morrison then went on to describe the Carnation Creek tests currently taking place. He said they were only field tests and did not constitute a vigorous program of testing. They had been instigated at the request of the Forest Pest Management Institute, Environment Canada, about a year ago.

The Carnation Creek site is a watershed in the Alberni Inlet area which has been used by Fisheries & Oceans, Canada, for some 15 years to measure the physical effects and impacts of logging on stream environment and fish populations. The site was chosen for the Roundup testing because the researchers from the Biological Station at Nanaimo have a solid background on the stream's characteristics in that they know the following:

- nutrient flow;
- how many fish are present;
- what areas the fish use in the system;
- what the leaf fall is like;
- what the soil parameters are;
- how much fish food is in the system;
- how much algae is growing on the stream bottom;
- what the flow patterns are like;

In other words, the Carnation Creek area is an excellent area to monitor the effects of a Roundup application on the salmonid fish habitat and the surrounding environment. Any changes to the habitat or the environment from the herbicide application will be measurable. The Forest Pest Management Institute will obtain the following data:

- how much of the spray entered the stream system during the herbicide application;
- what the residue levels will be in the soil;

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- what the residue levels will be on leaves, and what the leaf fall pattern will be after the spray application;

- what sort of residues will show up after a storm event;

- measurements of drift; are the buffer zones adequate? the effects of microfoil booms on drift, etc.

Fisheries & Oceans, Canada, will obtain the following data:

- nutrient impact on the streams;

- detrital flow

- how much sediment appears in the gravel spawning beds;

- the effects on the invertebrate population;

10) Mr. Morrison then told the Board that the Carnation Creek tests were only a start. They did not answer all of the concerns of Fisheries & Oceans, Canada. They would not supply information on the toxicity of the chemical to salmon, and they would not provide information on the sublethal effects of the herbicide. He said that Fisheries & Oceans needed full life-cycle tests on the fish after they had been exposed to the spray. He asked the following questions:

a) Would the fish return to spawn?

b) Would they have any eggs in their bodies,or would the eggs be any good?

c) Would they be able to accept the salinity challenge, both on going to sea and coming back?

11) Mr. Morrison said that the way Roundup could enter the Brittain River was as follows:

a) overspraying of the herbicide buffer zones;

b) an accident which caused the herbicide to directly enter the river;

c) soil with the herbicide attached being washed into the river during storms;

d) leaves contaminated with the herbicide falling into the river;

e) contamination from ephemeral streams which have been sprayed by the herbicide when they were dry;

f) erosion of the 30 to 60 degree slopes caused by the defoliation of these slopes;

12) Mr. Morrison then said that because of the 30 to 60 degree slopes in the buffer zones, these zones should be increased to 110 to 130 meters (presumably measured along the slope).

13) Mr. Morrison then suggested that Creeks 1 and 2, shown on Map 2 of 2 of the permit application, did not need the 100-meter buffer zones, but should not be sprayed directly during the herbicide application if they were dry.

Mr. Gary Russell's testimony was as follows:

1) He was a local commercial fisherman, and President of Local 21 of the United Fishermen and Allied Workers' Union.

2) He said that he was angry and extremely upset about the proposed application of Roundup in the Brittain River Valley.

3) He said that most of the larger streams in the Jervis Inlet area are slowly being rehabilitated, and that the cover over these streams is being restored after some 40 years of clear-cut logging. The effects of clear-cut logging devastated most of the major streams in that inlet.

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4) He said that in the late 1940's, a very bad forest fire raged through both sides of the inlet.

5) Because of this forest fire, and past logging practices, the salmon runs of the inlet were drastically reduced. He said that at the present time, however, clear-cut logging in the area is finished, the worst logging practices are over, and the few fish in the area are being maintained.

6) Jervis Inlet is an important sport and commercial fishery area. The affected river (i.e. Brittain River) is also an important steelhead stream.

7) He said that the whole Jervis Inlet area has been assessed by knowledgeable people as having an unlimited potential in regards to the development of acquiculture. In order for a development of this nature to succeed, it must have pure, unpolluted water.

8) He then demanded that because the lasting effects of Roundup had yet to be completely documented regarding its toxicity to salmonid (from the egg to the spawning stage), the herbicide application must be set aside. He made this demand as a commercial fisherman.

COMMENTS MADE DURING THE CROSS-EXAMINATION OF THE APPELLANT:

1) Mr. Morrison indicated that in his opinion, society will never get to a point where it has all the answers on the effects of Roundup to fish and the environment. However, since the herbicide is proposed to be used on a long-term basis by the Forest Service, he hoped to get more information in the future.

2) Mr. Morrison said that he had no information specific to salmon, to date, that Roundup does, in fact, affect the behaviour of this species of fish, or has any other sub-lethal effects.

3) Mr. Morrison admitted to the fact that Fisheries & Oceans, Canada, has the opportunity for input into any permit, through the permit review process, before the permit is issued.

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4) Mr. Morrison then admitted that a representative of Fisheries & Oceans Canada, had made an inspection of the site in question with the representative of the Environmental Protection Service, and that they had jointly made recommendations through the Environmental Protection Service to the Administrator of the Pesticide Control Act for certain conditions to be included in the permit.

5) Mr. Morrison then said that these recommendations of Fisheries & Oceans Canada, to the best of his knowledge, had been included within the conditions of the permit. The Administrator of the Pesticide Control Act had substantially complied with all of the requests that Fisheries & Oceans had made in regards to this permit.

6) Mr. Morrison said that if he had felt strongly enough about any changes to this permit, he would have had the opportunity to make these views known before issuance of the permit. He then indicated that clearly this permit was not that unsatisfactory from his perspective.

7) Mr. Morrison said that he was aware that the permit called for notification of Fisheries & Oceans Canada before the actual application was made. He further indicated that it was possible that no one would attend the actual herbicide application from Fisheries & Oceans because of the other duties which Fisheries & Oceans' personnel had, which obviously carried a higher priority.

8) Mr. Hope said that the watershed which supplied his hatchery was within a couple of miles from the herbicide application site.

9) Exhibit "B", submitted to the Board with Mr. Morrison's evidence, reviews the results of a study made to determine the acute toxicity of Roundup on four aquatic invertebrates and four types of fish. A statement based on that study and made on the first page of this Exhibit was as follows: "Application of Roundup, at recommended rates, along ditchbank areas of irrigation canals, should not adversely affect resident populations of fish or invertebrates." This statement was made in relationship to spraying on ditchbanks, which is far different than holding the spray 10 meters back from a stream bank, as is the condition of Permit No. 104-660-84/86.

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10) Mr. Wan confirmed that in runoff tests on Roundup taken by EPS in the Chilliwack area, the worse case runoff concentration measured to date was 0.025 ppm. When Mr. Morrison was asked if he would be concerned about concentrations in that order, he said "No, at that concentration I would not be concerned. My concern rests with the lowest toxic level I have seen identified for rainbow trout, which is 1.10 ppm."

11) Mr. Morrison indicated that if conditions were right, any Roundup attached to soil particles in the runoff to the river would not be bio-available to salmon. He also said, however, that the process of chemical unavailability was reversible if there was enough phosphorus contained in the sediments in the bottom of the river.

12) Mr. Morrison said that where toxicity is concerned, trout are comparable to salmon, with the exception of possible adverse effects to the salt water challenge.

13) Mr. Morrison said that the degree of toxicity to rainbow trout for Roundup and 2,4-D, is as follows:

2,4-D Amine	80 ppm
Roundup	1.1 ppm
2,4-D Ester	0.5 ppm

14) Mr. Morrison said that he believed he was representing the concerns of Fisheries & Oceans Canada in appearing before the hearing. He further indicated, however, that his own concerns about the detrimental effects of herbicide were perhaps much greater than that of Fisheries & Oceans Canada.

15) Mr. Morrison then said that in regards to the permit in question, Fisheries & Oceans Canada, notwithstanding their concerns and the limitations of the available information on Roundup, have clearly taken the position that the spray program can go ahead in the Brittain Riuer area, provided the recommended precautions and buffer zones are adhered to.

16) Mr. Morrison indicated that static water toxicity tests were not directly comparable to the conditions which would apply in running or flowing streams. He did say, however, that they were a good indication, and a means of comparing one chemical to another.

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17) Mr. Morrison said the highest runoff rate he had seen for Roundup to date was equal to 1.85 percent of the material applied after the first storm event.

18) Mr. Wan noted that this herbicide application was a "one-shot deal", which is very different from a continuous outflow of chemical effluent from a pulpmill, particularly as far as the sublethal effects to fish are concerned.

19) Mr. Wan stated that the amount of chemical found in sediments and bound to soil particles in water from a "one-shot" Roundup application 574 days after the event was about 0.04 ppm. Mr. Wan further indicated that he believed that this material was not biologically available to fish degradation.

SUMMARY OF THE RESPONDENT'S PRESENTATION:

Mr. Giza's testimony was as follows:

1) The job of the Forest Service in the Sechelt Forest District is to manage the forests in the following manner:

   a) Maximize the annual production of timber;

   b) Also, make sure that opportunities are available for recreational use of the forests;

   c) Protect the fish and wildlife in the forest areas;

   d) Co-operate with those other government agencies who have a mandate to protect the fish and wildlife resources in the area.

2) The operations or priorities in the Forest District are as follows:

   a) After logging, the Forest Service must ensure that the regeneration of the forests in the District take place to a species most suitable for the sites involved;

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b) Log some 1500 hectares annually. Sixty percent of the area logged, or 900 hectares, will require planting. Forty percent of the area will regenerate itself naturally.

c) Insure that the plantations survive. In order to do this, twenty-five percent,or 360 hectares, will require some form of brushing, either manually or by herbicides.

d) The forest district currently has 12,000 hectares of backlog areas in which proper management of the forests has not taken place. The Forest Service is also required to bring these areas back into production. The Brittain River herbicide permit area is one of these sites.

3) The employment created within the Sechelt Forest District by the Forest Service operations is as follows:

	Direct Jobs	Indirect Jobs
a) Logging	1600	4800
b) Planting	6	18
c) Brushing	3	9
d) Backlog areas	100	300
Totals	1709	5127

4) Mr. Giza then showed the Board a series of slides which were typical of the herbicide application site. The slides depicted areas in which an invasion of alder and salmonberry had taken place, overtopping the fir trees. Some of the alder were 20 feet high. The fir trees varied in height, with the average perhaps about 10 feet. The trees were spindly in configuration.

5) Mr. Giza then showed the Board some aerial photos of the Brittain River area. He said the area had been logged some 30 years ago. In 1953, a very bad forest fire had swept through the area and had caused the logging operations to be shut down. A short time after the forest fire, about 1000 hectares were replanted but little else was done by the Forest Service until 1981. In 1981, the Forest Service saw an opportunity to rejuvenate the area, and as a consequence, from 1981 to 1983, this area was opened up, the alder removed and the sites replanted.

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6) Mr. Giza then went on to show the Board the physical properties of the application site or sites. Two sites were involved; the smallest one (28 hectares) was about a mile from the sea. The second site (70 hectares) was about six miles above the first site. Both sites are alongside of the Brittain River. Because of rapids, waterfalls, etc., about four miles up the river from the sea, salmon and steelhead runs cannot pass beyond this point.

Both sites have fairly steeply sloping ground, averaging about 20 to 30 degrees. Three creeks passed through the largest site, two which dry up in the summer and one which flows all year round. The photographs which were shown to the Board were taken on November 5th, 1984. Mr. Giza showed the Board the plan for both aerial and ground spraying, including the buffer zones.

7) Mr. Giza pointed out that the water drainage leading to Mr. Hope's fish farm was on the other side of the mountain.

8) Mr. Giza then presented a letter to the Board (Exhibit "D") which was an answer to the appellant's "Grounds for the Appeal" and "Orders Requested". The main points of the letter were as follows:

a) As outlined in the Handbook for Pesticide Applicators, Roundup is a relatively low-toxicity pesticide used for the control of a number of brush species. All reasonable precautions will be taken to enusre creeks in the area are not contaminated.

We accept the judgment of Agriculture Canada, the agency responsible for registration that when used as prescribed, Roundup will not have detrimental long-term effects.

b) All herbicide spray projects are closely supervised. By monitoring weather on site and by providing buffer zones beside all creeks, we are confident that drift will not contaminate any creeks.

c) The Forest Service is confident of Roundup's safety as it is now being applied. We do welcome further studies such as the one being undertaken at Carnation Creek. The more that is

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known about how this chemical reacts in the environment, the better we are able to manage against all possible negative effects as well as increase efficiency of use.

d) Brittain River has an important fishery. It supports runs of coho, chum and pink salmon as well as steelhead trout. It is a rather isolated river - being halfway up Jervis Inlet and accessible only by boat. It receives relatively infrequent use by sports fishermen. With the provision of 100 m.wide buffer strips beside the creeks on our aerial spray project, we are confident no drift will contaminate the creeks and the fishery will be protected.

e) The Pesticide Control Branch has the role of monitoring the permits it issues to ensure compliance. We will notify them as well as Federal Fisheries several weeks before the project commences. They will have the opportunity to be on site if they so choose.

f) The Forest Service will be monitoring the area for at least several years after treatment to ensure success of the project and the release of the planted trees from brush competition.

With respect to environmental impacts, the Environmental Protection Service in conjunction with the Pesticide Control Branch and Federal Fisheries monitor selected permits to test environmental impacts. We presume this will continue as well as such research projects as the Carnation Creek project.

9) Mr. Giza made an application to amend the final date for the pesticide program from October 31st, 1985 to October 31st, 1986. This amendment is to be made to Item 5 of the permit.

10) The flow of the Brittain River was estimated to be between 50 to 200 cubic feet per second.

COMMENTS MADE DURING THE CROSS-EXAMINATION OF THE RESPONDENT:

1) The forest information on the herbicide application sites was not the same as that described in Item 4 of Mr. Giza's evidence-in-chief. Alder in these blocks was 5 to 7 cms in diameter (dbh) and about 2 1/2 meters high. The height of the conifers was as follows:

Balsam - 8 inches average
Hemlock - 16 inches average
Cedar - 13 inches average

2) Site A has steeper slopes than Site B (about 50 percent to 60 percent).

3) There are a number of gullies on Site A,(the small site) and when it rains, water flows in these gullies, carrying down particles of soil. After the herbicide application, glyphosate or its breakdown products could also be carried along with this water, attached to the soil particles.

4) The two streams (No. 1 and No. 2) on Site B are reported to be dry from mid July to late August. The herbicide application will be made in late August.

5) The Fisheries & Oceans Canada's representative from Pender Harbour, who inspected the site, said that no salmon or steelhead are resident above the falls in the Brittain River. Forestry maps are incorrect in indicating these types of fish exist above the falls.

6) From tests taken by the Environmental Protection Service, Roundup or its breakdown products were found to be present in the sediments in over-sprayed creeks some 574 days after the application was made.

7) Exhibit "E" contains information which seems to indicate that about 41% of applied glyphosate remains in the soil as either the parent compound (9.3%) or aminomethylphosphonic acid (AMPA) (31.7%) 158 to 172 days after it has been applied.

8) Those portions of the application sites which are to be treated by aerial spraying do not have as much of a brush problem as those areas which will be treated by ground application techniques.

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9) The upper slopes on both sites are mostly overgrown with elderberry, salmonberry, thimbleberry and trailing blackberry vines. The Forest Service says it is not feasible or practical to remove this growth or the deciduous growth on either site manually or by mechanical means. An estimate of the costs, if it could be done, is about $2400 per hectare. Aerial spraying would cost about $250.00 per hectare.

10) The Forest Service is confident that only one herbicide application of the site will be necessary to satisfy their requirements.

11) The closest resident to the herbicide application site is 2.5 kilometers away. The closest domestic water supply is about the same distance.

12) Mel Scott said that before the Forest Service made a herbicide application, it laid down a demarkation line at the edge of the buffer zones. This was usually done from the air with a mixture of agricultural lime and latex paint.

13) Before and during a helicopter herbicide application, the Forest Service monitors wind velocity, temperature and relative humidity at the application site on a continuous basis, If the wind velocity exeeds 8 km/hour, the operation is not started, or if it is in progress, it is immediately stopped. The ground personnel in charge of monitoring are in radio contact with each other and the helicopter pilot.

14) In addition to the monitoring noted in Item 13, the Forest Service also puts out drift cards in the buffer zone area, placed at 10-meter centres across the buffer zones. Before application, the herbicide is coloured with a purple dye. During the herbicide application, any problem which may develop in maintaining the buffer zone can be immediately detected and corrected.

15) Mel Scott then showed the Board the density of a typical spray pattern on his briefcase. The briefcase had been left in a spray area during a previous application, and it was dotted with drop marks. From the pattern of these drops, it appeared that foliage would not be drenched, and that if the weed growth was dense, very little of the herbicide would reach the ground. The Board was told that provided it did not rain for six hours, most of the herbicide would be absorbed into the foliage, and it was unlikely that any appreciable amount would then be washed off by rainfall after the six-hour period.

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16) Mel Scott said that if the program was delayed for even a year, there was a real danger that some of the conifers would be lost.

17) The Forest Service specifies the spray nozzle size.

18) Mel Scott said that the usual practice in setting out drift cards in a buffer zone was to set out only one line, generally in the most sensitive area.

PRESENTATION OF THE PESTICIDE CONTROL BRANCH:

Dan Cronin made the following statement:

Because of the loss of the herbicide, Krenite, in 1982, and the tardy registration of Roundup for forestry use, the Forest Service has had to delay many herbicide applications. As a result, there is now a backlog of work that needs to be done if the forests are to be properly managed. The Pesticide Control Branch does not consider this site to be particularly sensitive to environmental damage.

STATEMENTS MADE DURING THE CROSS-EXAMINATION OF DAN CRONIN:

1) The Pesticide Review Committee, representing the Ministry of Health, Ministry of Agriculture, Ministry of Forests, the Fish and Wildlife Branch of the Ministry of Environment, Environment Canada and Fisheries & Oceans Canada, have approved the herbicide application in question.

2) Fisheries & Oceans Canada make their views known on permit applications through the Environmental Protection Service of Environment Canada.

3) In 1984, the Pesticide Control Branch processed about 500 applications for pesticide permits.

4) The Pesticide Control Branch has not issued any aerial herbicide permits without a proper site investigation during 1984.

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5) Mr. Cronin knows of no reason why the date in Item 5 of the permit cannot be extended. He thought that maybe the October 31, 1985 date was a typing error.

6) Mr. Cronin said that the reason that the use of Roundup was desirable in the forests over 2,4-D was because of its efficacy in killing certain weed species that 2,4-D will not kill, and its ability to bind to soil particles, thus reducing leaching, runoff, etc. The toxicity between 2,4-D and Roundup was not appreciably different (i.e. See Mr. Morrison's comments in Item 13 of the appellant's cross-examination).

PRESENTATION OF THE ENVIRONMENTAL PROTECTION SERVICE:

Mr. Wan's testimony was as follows:

1) Mr. Wan said he had a Master of Science Degree, and that his studies included the following:

a) General Agriculture;
b) Economic Entomology (Pests Identification, Life History, Control, Pesticides, Problems of Pesticide Pollution);
c) Applied Entomology;
d) Insect Physiology;
e) Biochemistry;
f) Pesticide Chemistry
g) Pesticide Toxicology

2) Mr. Wan said that his duties with the Environmental Protection Service included the following:

a) Analyzing Environmental Impacts of Contaminants;
b) Determining Need for Pest Control Programs;
c) Monitoring Pesticide Applications;
d) Policing Pest Control Operations;
e) Conducting Lab/Field Investigations of Water Quality;
f) Identifying Indicator Organisms;
g) Maintaining Knowledge of Relevant Legislation;
h) Supervising Staff;
i) Maintaining a Pesticide/Contaminants Storage Centre;
j) Preparation of Technical Reports;

3) Other than presenting his qualifications, Mr. Wan made no presentation.

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STATEMENTS MADE DURING THE CROSS-EXAMINATION OF MR. WAN:

1) Exhibit "C" is a Draft Copy of a Protocol. It is classified and should not have been made public at this time. Mr. Wan would, therefore, not discuss the document, but did say that he agreed with the need to establish the protocol.

2) Mr. Wan said that in the course of a study on a Roundup application, he had found that when it rained profusely, even up to a week after the application had been made, some runoff of the herbicide to a stream was evident. This study was done with no buffer zone. Additional sediments, with the metabolite, aminomethylphosphoric acid (AMPA), had turned up on the stream bottom. He said that the application rate had been 3 kg/ha. He further said that he had taken water and sediment samples for 574 days. He recorded maximum measurements of 0.04 ppm of glyphosate and 0.09 ppm of AMPA. He said that after two weeks, the water samples were below the detectable levels of 0.005 ppm. Further, when he treated the contaminated sediments with clean de-ionized water, he found that the sediments did not release any contamination to the clean de-ionized water.

3) Mr. Wan said that in a second study, with a buffer zone, the results after 75 days showed no contamination of the bottom sediments (i.e. above the detectable level). Had there been any fish present, they would not have been at risk.

4) Mr. Wan said that in monitoring quite a few operational projects in 1984, he had taken water samples before, during, shortly after the application and after the first heavy rainfall, and at no time was he able to find any contamination of these samples above the detection level of 0.005 ppm.

5) Mr. Wan also said that he had done 96-hour LD50 tests on rainbow trout with Roundup, and found the toxicity level was between 25 ppm to 32 ppm.

6) Mr. Wan said that he had inspected the herbicide application site in question with a representative of the Fish & Wildlife Branch, Ministry of Environment, and a representative from Fisheries & Oceans Canada. At that time, their appraisal of the situation was that there was no risk to the fish in the lower reaches of the Brittain River. In retrospect, Mr. Wan said that he is still convinced that there is no risk.
