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## TRIBUTYLTINS/TBT

Tributyltins (TBT) have been called the most toxic compounds ever deliberately introduced by societies into natural waters.<sup>1</sup> A growing body of scientific research indicates that TBT may seriously affect non-target organisms and have unknown effects on humans who eat marine organisms containing TBT or are exposed to it in the workplace.

In the United States, many bodies of water have concentrations of TBT that have reached levels which may cause lethal and sublethal effects in non-target organisms. For example, TBT levels in San Diego Bay have been measured at levels which could cause lethal effects in fish, mollusks, crustaceans, and algae.<sup>2</sup>

TBT is used in antifouling paints and is primarily applied to boat and ship hulls to control the growth of fouling organisms such as barnacles, tubeworms, algae, bacteria, and sponges. These organisms increase hull friction and weight, which in turn increases fuel consumption by reducing vessel speed. The antifouling paints are also used to control fouling organisms on docks, buoys, and other marine structures. TBT has been used in antifouling paints for almost 10 years and replaced the copper-based antifouling paints. The paints with tributyltins last approximately 5-7 years, whereas the copper-based paints last approximately two years.

There are two types of antifouling paints containing TBT: copolymer paints and free association paints. The copolymer antifouling paints contain TBT which is chemically bonded to the paint polymer and is released through a chemical bond breaking process called hydrolysis. New TBT molecules are exposed and released by the gradual erosion of the paint as the vessel moves through the water. The release rate is slow except during the initial one month "conditioning" period and can be controlled by

altering the paint's water absorption characteristics. The free association paints contain TBT which is physically incorporated into the paint matrix; the TBT is released through diffusion as surface paint particles dissolve. This type of paint has a short time period of protection and is characterized by a high initial release.

Antifouling paints containing TBT are registered, in the United States, for use on aluminum, steel, fiberglass, wood and cement hulls.<sup>3</sup> These paints are used on commercial and recreational vessels and some military ships. However, the Navy is the major domestic user of antifouling paints. The Navy is planning to replace the copper-based paints it is currently using on its steelhulled vessels with antifouling paints containing TBT compounds. This Navy conversion would take approximately 5 years and add an additional 90,000 pounds of TBT active ingredients to the environment. Economically, if all the Navy ships are painted, it would annually save the Navy \$150 million.<sup>4</sup> However, this cost does not include the cost to the marine environment.

Currently, there are 340 federally registered antifouling paints containing TBT active ingredients. U.S. domestic usage of TBT in antifouling paints range from 250,000 to 300,000 pounds.<sup>5</sup> In addition to antifouling paints, TBT compounds are registered for use as disinfectants, textile biocides, wood preservatives, paper and pulp mills, leather processing and as plastics stabilizers, etc. In the United States, total usage of TBT pesticides (for all uses) ranges from 730,000 to 860,000 pounds of active ingredients.<sup>6</sup>

In 1981 France banned the use of TBT paints on all vessels less than 80 feet in length because of shellfish deformations, particularly in Arcachon Bay.<sup>7</sup>

England researched and then combined their studies with France's experience and banned the use of free association paints and copolymer formulations with more than 7.5 percent TBT on January 1, 1986.<sup>8</sup> Germany and Switzerland have banned TBT paints for fresh water usage. Japan has banned the use of TBT compounds in household products such as house paints and textiles, but has not restricted its use in vessel antifouling paints.<sup>9</sup>

In the United States, Senators Cohen and Tribble introduced Senate Resolution 272 in December 1985 calling for "public hearings to determine if further action is warranted with respect to the future use of TBT compounds" and "urging EPA to accelerate its investigation into the environmental and health effects of organotin bearing paints...." The resolution has been referred to the Senate Committee on Environment and Public Works.

On June 11, 1986 Congressman Parris introduced HR 5015, calling for a temporary ban on TBT-based paints on the hulls for commercial and recreational vessels until, "EPA has completed their ongoing studies to determine the safety of such paints and their impact on the aquatic environment.

Currently, only North Carolina has limited the input of TBT into its waters. North Carolina instituted regulations on January 1, 1985 to limit discharges from industries to 2 ppt for salt water and 8 ppt for fresh water.<sup>10</sup> These regulations were initiated because it was determined that hundreds of North Carolina companies were using TBT to control odor-causing bacteria in textiles or to control slime in piping. Some of the discharges from the textile mills were high enough to kill aquatic organisms.

On January 8, 1986, EPA commenced a special review of the nine most common TBT antifoulant paint formulations. EPA's support

document indicates that EPA is concerned about the acute and chronic toxicity potential of tributyltin compounds to nontarget aquatic organisms. Water samples have been found to contain TBT levels that may have direct effects on aquatic organism populations (mollusks). The TBT compounds may bioaccumulate in aquatic habitat and may pose a hazard to the food chain. Absorption of tributyltin compounds to sediment may have long-term toxicity effects on benthic browsing organisms such as crustaceans and snails. Contamination of estuarine areas at sublethal concentrations can influence the reproduction of several aquatic groups from fish to plankton, thus impacting the marine environment. The present use of tributyltin in antifouling paints presents a potential hazard to nontarget aquatic organisms.

The Pacific Fisheries Legislative Task Force, working in coordination with the Pacific Coast Federation of Fishermen's Associations, has passed three task force resolutions offered by Assemblyman Dan Hauser, the Task Force Vice Chairman, regarding TBT. The resolutions:

1. Urged and encouraged the Environmental Protection Agency to take the lead in creating a public information education brochure about TBT that could be distributed to every boat owner in America. The pamphlet concept is based on a similar project done in the United Kingdom entitled, Don't Foul Things Up. Short of a Congressional ban on the use of TBT, a nationwide public information awareness program is thought to be the next best alternative for controlling the amount of TBT introduced into the marine environment. It is thought by some scientists that this type of education program could reduce the amount of active TBT in the marine environment by 50%.<sup>12</sup>

2. Memorializes the Food and Drug Administration, the Environmental Protection Agency and the National Marine Fisheries Service to impose an immediate ban on all salmon imported into or produced in the United States in pens treated with TBT. This is important because TBT levels for safe human consumption have not been established. TBT was found in the flesh of salmon that were pen-reared in TBT-treated pens. Moreover, the study found that cooking does not remove the TBT from the fish.<sup>13</sup>
3. Memorializes Congress to enact an immediate ban on the use of TBT-based bottom paints on all military, commercial, and recreational vessels until such time, and if, methods of use of TBT-based bottom paints or derivatives of organotin paints are developed that pose no threat to the marine environment.

In addition to the resolutions passed by the task force, it is anticipated that the participating states may introduce state legislation to further regulate TBT usages in their states. Currently, efforts are underway to explore legislation to monitor dry docks, set water quality standards, ban or restrict the uses of TBT, or regulate the amount of TBT used in antifouling paints.

TRI-N-BUTYL TIN CAUSED MORTALITY OF CHINOOK SALMON, ONCORHYNCHUS  
TSHAWYTSCHA, ON TRANSFER TO A TBT-TREATED MARINE NET PEN

Jeffrey W. Short and Frank P. Thrower

Northwest and Alaska Fisheries Center, Auke Bay Laboratory  
National Marine Fisheries Service, NOAA  
P. O. Box 210155, Auke Bay, Alaska 99821

ABSTRACT

The median lethal concentrations ( $LC_{50}$ 's) of tri-n-butyltin oxide (TBTO) to juvenile chinook salmon, Oncorhynchus tshawytscha, adapted to seawater were determined in a static renewal bioassay.  $LC_{50}$ 's were 54, 20, and 1.5  $\mu$ g TBTO/l after exposures for 6, 12, and 96 h, respectively.  $LC_{50}$ 's decreased logarithmically with time for exposures between 12 and 96 h. Average tri-n-butyltin (TBT) concentrations in liver, brain, and muscle tissues of salmon that died during the bioassay were 7.0, 3.5, and 0.52  $\mu$ g TBT/g wet weight tissue, respectively. TBT concentrations in liver, brain, and muscle tissues of salmon that survived until day 4 of the bioassay were 4,300, 1,300, and 200 times exposure concentrations, respectively. Average TBT concentrations in liver, brain, and muscle tissues of salmon surviving transfer to a TBT treated marine net pen that killed 8.5% of the salmon transferred were 9.56, 3.44 and 1.24  $\mu$ g TBT/g wet weight tissue, respectively. Our results indicate TBT exposure was the cause of death of chinook salmon exposed to TBT-treated marine net pens at one aquaculture facility.

INTRODUCTION

Tri-n-butyltin (TBT) compounds are widely used in the salmon aquaculture industry to retard fouling of net pens by marine organisms. Salmon at aquaculture facilities are raised to market size in marine net pens for 1 to 3 years, during which they gain most of their body mass. Nets must be periodically cleaned or chemically coated to retard fouling by marine organisms; fouling will reduce seawater exchange and result in fish kills. Antifoulants are much more economical than manual cleaning and are therefore preferred by the industry. Several antifoulant formulations are used to treat nets, but TBT compounds are among the most effective active ingredients. These compounds have low solubility in seawater<sup>1</sup>, are exceptionally toxic to marine fouling organisms<sup>2</sup>, and can be formulated for slow release.

On several occasions, we observed high mortalities in groups of chinook salmon, Oncorhynchus tshawytscha, after transfer to newly TBT-treated marine net pens at an aquaculture research facility. The facility, operated by the National Marine Fisheries Service, is located at Little Port Walter (LPW), Alaska, near the southern end of

Baranof Island. Affected fish were examined for disease agents, but none were found. Exposure to TBT was therefore suspected as the cause of the mortalities.

To determine whether exposure to TBT could cause mortalities such as those observed at LPW, we determined the median lethal concentrations ( $LC_{50}$ 's) of TBT to juvenile chinook salmon at several exposure periods, and the TBT concentrations in liver, brain, and muscle tissues of juvenile chinook salmon that died during the bioassay. These results are compared with those of juvenile chinook salmon that had survived transfer to a TBT treated net pen at LPW that was suspected of killing some of the transferred fish due to TBT poisoning. Comparisons indicate TBT exposure as the cause of the mortalities observed at LPW.

METHODS

Bioassay Animals

Chinook salmon used in the bioassay tests were raised for 1 year in fresh water and acclimated to seawater for 4 months before testing. Fish were transferred to tanks supplied with seawater (salinity, 28‰; temperature, 4°C; flow rate 23 l/min), and were fed a diet of 3 mm Oregon Moist Pellet at a rate of 4% body weight daily until 5 days before the bioassay. Average wet weight of salmon used in the bioassay was 24.5 g (standard deviation = 16.43 g), and average fork length, 25.1 cm (standard deviation = 12.1 cm).

Bioassay

The bioassay was static, i.e., no water was replaced during the exposure period. Each of six 350 l fiberglass tanks contained one dose of TBT oxide (TBTO) and 10 randomly selected juvenile chinook salmon. A seventh 350 l fiberglass tank contained 10 similar chinook salmon, but no TBTO, and served as a control. The average ratio of wet weight of tissue to exposure volume was 0.0445 g/l. The seawater temperature was  $4 \pm 1^\circ\text{C}$  throughout the exposure period. Solutions were aerated slowly to ensure adequate oxygen concentrations (above 80% saturation).

A solution of TBTO dissolved in 5.0 ml glacial acetic acid was mixed with seawater in the six exposure tanks, and 5.0 ml glacial acetic acid was mixed with seawater in the control tank. Salmon

were then transferred by dip net to the tanks. Dead and stressed salmon were noted at 6, 12, 24, 48, 72, and 96 h of exposure. Following 96 h of exposure, clean seawater was flushed through the exposure tanks at a rate of 23 l/min, and the survivors were observed for five additional days to determine any subsequent mortality.  $LC_{50}$ 's were calculated using the method of Spearman and Kerber<sup>3</sup>.

The solutions of TBTO in glacial acetic acid were prepared to give nominal TBTO concentrations of 1, 4, 8, 16, 32, and 64  $\mu\text{g}$  TBTO/l exposure water. These doses were selected on the basis of trial exposures that determined approximate lethal doses. TBTO concentrations in exposure water were measured with atomic absorption spectrophotometry (AAS) immediately before salmon were placed in the solutions and, subsequently, once every 24 h. TBTO dose concentrations decreased to about 63% of those initially measured after 48 h of exposure; therefore, TBTO dissolved in 2 ml glacial acetic acid was added to each dose to increase the concentration to the original level. The 2 ml aliquot was added dropwise to the intake of a submersible pump in the exposure tank to minimize high localized concentrations of TBT. The TBTO dose concentration was measured just before and just after this addition of TBTO. We used the average of all measurements for each dose and exposure period to calculate the  $LC_{50}$  for each exposure period.

TBTO concentrations were measured by estimating the tin concentration of hexane extracts in the exposure water. One 50 ml aliquot of seawater was taken from each dose and extracted twice with two successive aliquots of 25 ml hexane each. Hexane extracts were combined and evaporated to dryness at 25°C on a rotary evaporator. The residue was taken up in 2 to 10 ml concentrated nitric acid and analyzed on a Perkin-Elmer model 5000 atomic absorption spectrophotometer equipped with a Zeeman background corrector. Concentrations of TBTO were estimated by comparison with standard concentrations of TBTO dissolved in hexane and processed similarly. With this method, recovery of TBTO from a TBTO concentration of 3  $\mu\text{g}/\text{l}$  seawater was determined to be 95%.

#### Animals Surviving a Suspected TBT Poisoning Incident at LPW

Chinook salmon were hatched in January 1985 and reared for 15 months before they were mistakenly transferred to a TBT coated net pen on 5 May 1986. Four hundred fish were transferred, having an average weight of 49 g. These animals had no known prior exposure to TBT. Within three days of transfer the fish displayed poor feeding response, darkened pigmentation, and tended to hang listlessly near the corners of the net pen. Thirty-four of the fish subsequently died. Personnel at LPW suspected TBT poisoning, and verified that the net material actually was treated with TBT by tracing invoice records. On 10 May 1986 these fish were transferred to an untreated net pen, and no further mortalities occurred. Six of these fish were killed, frozen whole and sent to

the Auke Bay Laboratory where they were stored frozen until analysis. Also sent were five controls of the TBT exposed fish that had never been exposed to TBT treated net pens as controls.

#### Tissue Sampling and Analysis

Salmon that died during the bioassay were removed and stored frozen in glass jars. After thawing, all of the liver and brain and approximately 1 g of muscle tissue were dissected for analysis. Each tissue was mechanically homogenized and then extracted with hexane, and the tin concentration of the hexane extract was measured by AAS. Results are reported as if all the tin in the hexane extracts were tri-n-butyltin, although possibly some of the tin may be di-n-butyltin. This method is more fully reported in Short and Thrower.<sup>4</sup>

#### RESULTS

Chinook salmon died in all doses of TBTO tested, but none died in the clean water control tank during or immediately after the bioassay. Only five salmon in the lowest exposure dose survived the bioassay; of these, three died within the next 24 h in clean seawater. The logarithm of the  $LC_{50}$  decreased linearly with time between 12 and 96 h of exposure (Fig. 1). The natural logarithm of the  $LC_{50}$  fits the following equation for a straight line for this exposure time period, using linear regression analysis:

$$\ln(LC_{50}) = -(0.031078)(T) + 3.363289 \quad (1)$$

where  $T$  is the exposure time in hours. The measured 96-h  $LC_{50}$  was 1.5  $\mu\text{g}$  TBTO/l seawater, whereas the measured 6-h  $LC_{50}$  was 54  $\mu\text{g}$  TBTO/l seawater.

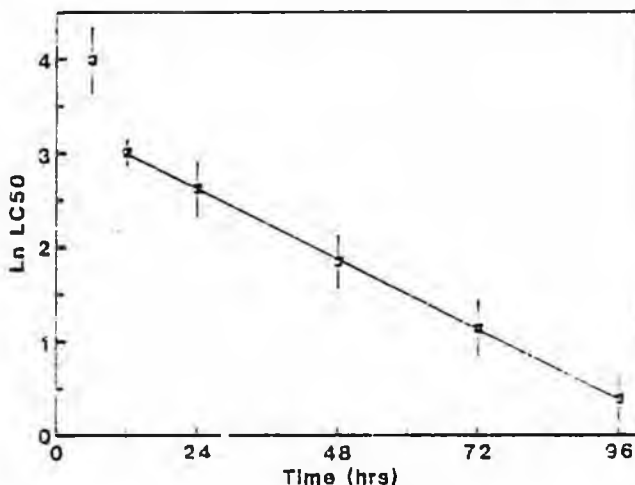


Fig. 1. Natural logarithm of TBT  $LC_{50}$  to juvenile chinook salmon, adapted to seawater, as a function of exposure time. Upper and lower ends of vertical bars indicate 95% confidence intervals. The solid line is derived from the linear regression of the natural logarithm of the  $LC_{50}$  with the exposure time.

All salmon that died during the bioassay displayed the same series of progressive signs: darkened pigmentation, apathy, loss of stability, hemorrhage of the gills and fin insertions, defecation, and finally death. Salmon in the lowest doses did not display any symptoms until near the end of the bioassay period. Death usually occurred within 24 h of the onset of darkened pigmentation. The two survivors in the lowest exposure dose had darkened pigmentation at the end of the bioassay, but they returned to normal pigmentation within 24 h after being placed in clean seawater and apparently recovered from TBTO intoxication.

Concentrations of TBTO tended to decrease at all dose levels with time (Fig. 2). Dose levels declined to an average of 80% of the initially measured levels after the first 24 h of the bioassay and to an average of 63% after the first 48 h. Dose levels resumed their decline after TBTO was added to restore the desired concentrations.

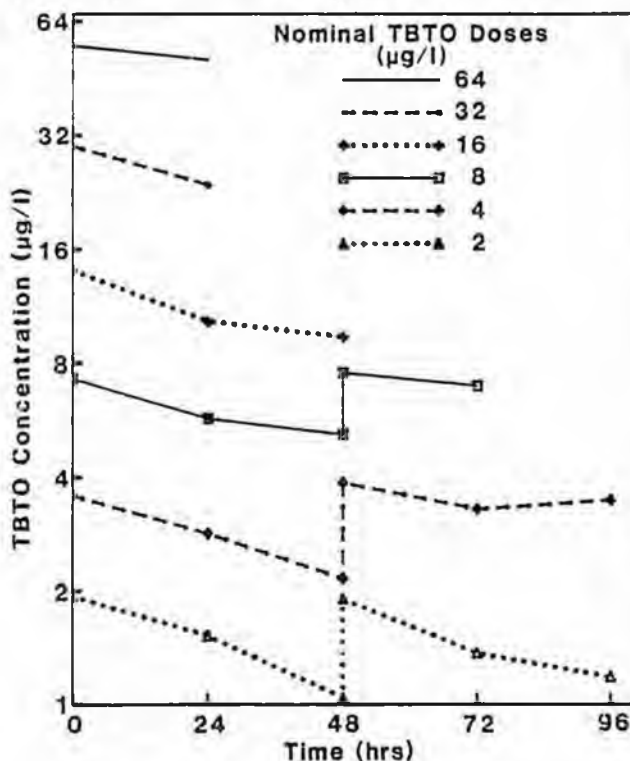


Fig. 2. TBTO concentrations measured in bioassay doses as a function of time. TBTO measurements were terminated in the higher doses after all the salmon in those doses died. The increase in measured TBTO concentrations of the lower doses at 48-h of exposure is due to the addition of TBTO to those doses at that time.

Average concentrations of TBT in tissues of salmon that died during the bioassay were highest in liver, intermediate in brain, and lowest in muscle tissues (Table 1). In liver and muscle tissues, the highest concentrations of TBT were in salmon killed by exposure to intermediate doses for intermediate exposure periods, and were about twice the concentrations found in salmon exposed to

either high doses for brief periods or low doses for longer periods. In contrast, brain tissue concentrations of TBT were highest in salmon killed by exposure to high doses for brief periods.

We calculated apparent bioconcentration factors of liver, brain, and muscle tissues for salmon that died between 72 and 96 h of exposure to the lowest bioassay dose. These factors were 4,300 for liver, 1,300 for brain, and 200 for muscle tissues, calculated as the ratio of the TBT concentration in tissue to the average exposure concentration of the lowest bioassay dose (1.49 µg TBT/l).

Average concentrations of TBT in tissues of salmon that survived transfer into the TBT treated net pen at LPW are not significantly different from concentrations in corresponding tissues of salmon that died during the bioassay (Table 1). In contrast, much lower average TBT concentrations were found in tissues of salmon that were cohorts of the LPW salmon exposed to the TBT treated net pens (Table 1).

#### DISCUSSION

Juvenile chinook salmon are very sensitive to TBT poisoning in seawater. We found the 96-h  $LC_{50}$  of 1.5 µg TBT/l to be lower than any reported for fish in a recent survey of the literature on acute toxicity of organotin.<sup>2</sup> The most significant difference between bioassay conditions in our experiment and those reported in Hall and Pinkney<sup>2</sup> was that in ours, water temperature was lower (4°C), which may be the cause for some of the sensitivity observed.

TBT concentrations in salmon that died during the bioassay were nearly constant for all doses, suggesting that TBT continues to accumulate until a threshold concentration is reached in critical tissues and causes death. This conclusion is supported by our observation that salmon exposed to low doses of TBT displayed no intoxication symptoms until late in the bioassay. The linear relationship between the logarithm of the  $LC_{50}$  and the exposure time (cf. Equation 1) indicates that significant mortalities may occur in salmon exposed for longer than 96 h to TBT concentrations lower than 1.5 µg/l.

The bioconcentration factors we measured are not equilibrium factors. Bioconcentration factors for salmon exposed to sublethal doses of TBT would be higher if the accumulation time was longer than in our study. However, our 96-h bioconcentration factors indicate that relatively brief exposure to TBT results in the accumulation of appreciable concentrations in salmon tissues.

The similarity of tissue TBT concentrations in salmon that died during the bioassay and salmon that survived transfer to the TBT treated net pen at LPW indicates that the transferred salmon were exposed to a nearly lethal dose of TBT. These results, together with the similarity of distress signs displayed by salmon tested in the bioassay and those transferred to the TBT treated net pen at LPW, indicate that TBT poisoning was the cause of death of the thirty-five salmon that died after

being transferred to the TBT treated net pen at LPW. The salmon that died represent the most sensitive individuals of the transferred group to TBT poisoning.

Table 1. Comparison of TBT concentrations in liver, brain, and muscle tissues of juvenile chinook salmon, adapted to seawater, that were killed by TBT exposure during the TBT bioassay, with survivors of a suspected TBT poisoning incident at LPW and with salmon from LPW that were not exposed to TBT. Concentrations are given as  $\mu\text{g TBT/g}$  muscle tissue (wet wt.), together with 95% confidence intervals. N = number of individual salmon analyzed.

Tissue	TBT of fish killed during bioassay	N	Transferred to TBT net pen at LPW	N	Control fish at LPW	N
Liver	7.44 $\pm$ 0.84	54	9.56 $\pm$ 2.91	6	0.13 $\pm$ 0.24	5
Brain	3.46 $\pm$ 0.33	53	3.44 $\pm$ 2.54	6	0.12 $\pm$ 0.18	4
Muscle	0.52 $\pm$ 0.21	49	1.24 $\pm$ 0.25	6	0.012 $\pm$ 0.007	5

TBT leaching from treated marine net pens may cause adverse effects that are more subtle than intoxication symptoms or death. Growth in salmon could be affected by TBT; Chliamovitch and Kunn<sup>5</sup> have suggested that TBT inhibits metabolic pathways in rainbow trout, *Salmo gairdneri*. Chinook salmon exposed for prolonged periods to sublethal doses of TBT in treated marine net pens may therefore grow more slowly than those in untreated net pens due to the additional energy required to compensate for such stress. A similar effect has been demonstrated in salmon exposed to prolonged sublethal doses of the water-soluble fraction of crude oil.<sup>6</sup> Low doses of TBT can impair the immune system of rats,<sup>7</sup> which suggests that salmon raised in TBT-treated marine net pens may be more susceptible to disease.

In summary, our results show that juvenile chinook salmon are very sensitive to TBT poisoning in seawater, that they rapidly accumulate TBT to high concentrations in tissues, and that lethal effects are dose and time dependent. For these reasons, TBT-treated net pens for salmon aquaculture applications should be used with caution.

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ACCUMULATION OF BUTYLINS IN MUSCLE TISSUE OF CHINOOK SALMON  
REARED IN SEA PENS TREATED WITH TRI-N-BUTYL TIN

Jeffrey W. Short and Frank P. Thrower

Northwest and Alaska Fisheries Center, Auke Bay Laboratory  
National Marine Fisheries Service, NOAA  
P. O. Box 210155, Auke Bay, Alaska 99821

ABSTRACT

Muscle tissue of chinook salmon, Oncorhynchus tshawytscha, reared for 3 to 9 months in sea pens treated with an antifouling biocide, tri-n-butyltin (TBT), contained organotin concentrations of 0.28-0.90 µg/g (as TBT). Organotins are present in some pen-reared salmon sold in the United States: Eleven of 15 salmon advertised as aquaculture products and purchased from public markets contained organotin concentrations of 0.081-0.20 µg/g. Preliminary analyses by GCAA indicate that these organotin concentrations are TBT. Most common cooking practices do not effectively destroy or remove butyltins from salmon muscle tissue. We believe this is the first evidence of entry of organotins into the human diet in the United States.

INTRODUCTION

Tri-n-butyltin (TBT) compounds are emerging as the leading compounds in the effective control of marine fouling of sea pens, a serious problem in the salmon farming industry. Fouling organisms restrict water flow through the sea pens and increase the risk of dangerously low oxygen levels occurring as a result of poor water exchange in the sea pens. TBT compounds have a low solubility in seawater<sup>1</sup>, are exceptionally toxic to marine fouling organisms<sup>2</sup>, and can be formulated for slow release. The recent increase in the use of TBT compounds could result in an environmental hazard in marine waters. Continued uncontrolled use is being debated; the U.S. Congress has prevented the U.S. Navy from implementing plans to begin using TBT compounds as bottom paint for their fleet in 1986. Their use is banned in some countries and states.

Following the industry practice, TBT-treated sea pens were used beginning in 1983 at Little Port Walter (LPW), near the southern end of Baranof Island in Southeast Alaska, where research on improving fish farming methods is carried out by the National Marine Fisheries Service. At that time, the intent was only to minimize marine fouling of the pens and any potential effects of TBT on salmon were not considered. On several occasions, unusually high mortalities were observed in populations of chinook salmon, Oncorhynchus tshawytscha, after transfer to newly TBT-treated sea pens. In one instance, 5555 (over 50% of the

population) yearling chinook salmon died within 2 weeks of transfer. These fish were carefully examined for disease agents, but none were found. As part of an effort to determine the cause of these mortalities, the survivors were analyzed for organotins. Also analyzed were the fish food and local seawater. Our results prompted us to look in the marketplace for organotin-contaminated salmon and, subsequently, to determine whether normal cooking processes destroyed these compounds.

In this paper, we present evidence that pens treated with TBT may contaminate the flesh of salmon with TBT and its metabolite di-n-butyltin (DBT). The butyltins may persist in the flesh to the marketplace, and most will not be destroyed by cooking.

METHODS

Four groups of chinook salmon reared at LPW were examined for organotins after mortalities associated with transfers to TBT-treated sea pens were observed in two of the groups, 1981 and 1982 brood-year salmon. LPW is a pristine area, unaffected by pollutants from industrial or urban sources: The only population centers within a 75 km radius are fishing villages of less than 500 people each, and less than 100 000 people live within a 1000 km radius. The 1981, 1982, and 1983 brood-year fish had different histories of exposure to TBT. The fourth group, cohorts from the 1983 brood, was a control group which had no exposure to TBT.

The 1981-brood fish had been placed in newly TBT-treated sea pens in May 1983 and subsequently transferred to newly TBT-treated sea pens in October 1983 and May and August 1984. The 1982-brood fish had been placed in newly TBT-treated sea pens in October 1983, and again in May and August 1984. The 1983-brood fish had been placed in used TBT-treated sea pens in October 1984. The control group had been reared in ordinary, untreated sea pens.

On 6 November 1984, two salmon were randomly taken for organotin analysis from each of two sea pens containing 1981-brood fish (average body weight 1700 g) and from each of four sea pens containing 1982-brood fish (average body weight 1200 g). Seven 1983-brood fish (average body weight 20 g) were randomly sampled from a single sea pen on 28 January 1985.

Twelve control fish (average body weight 160 g) were randomly taken for organotin analysis on 1 November 1985.

Muscle tissue samples were analyzed for organotin compounds. The sampled salmon were killed, frozen whole, and stored at  $-20^{\circ}\text{C}$  for up to 2 months. One to 5 g of muscle tissue was dissected from each, and care was taken not to include any skin, fat tissue, or portions of the lateral line. The dissected tissue was homogenized with a glass homogenizer in 10 ml of pH 7.5 phosphate buffer solution ( $[\text{PO}_4^{3-}] = 1.0 \text{ mM}$ ), and the homogenate was extracted with two 25 ml aliquots of hexane. Hexane extracts were combined and centrifuged at  $10\,000 \times g$ , and supernatant was evaporated to dryness under reduced pressure on a rotary evaporator at  $25^{\circ}\text{C}$ . The residue was taken up in a solution of 0.1 ml concentrated nitric acid diluted to 5.0 ml with glacial acetic acid.

Tin concentration in the acetic acid solution was measured by flameless atomic absorption (AA) on a Perkin-Elmer model 5000 spectrophotometer equipped with a Zeeman background corrector and an electrodeless discharge tin lamp. The manufacturer's suggested conditions and instrument settings were used for the analysis of tin in the acetic acid solutions. For the purpose of calculating organotin concentrations, we assumed that all tin found in the hexane extracts was present as TBT.

The method of standard additions was used to estimate organotin concentrations in muscle tissue. Our method is similar to that of M&T Chemicals Ltd. for the analysis of butyltins in fish tissues (Standard Test Method AA-33, M&T Chemicals, Inc., Rahway, NJ 07065). The M&T method involves hexane extraction of a hydrochloric acid digest, followed by solvent resolution of individual butyltins. The M&T method finds that only TBT and DBT are extracted by the hexane. Our method differs in that mechanical homogenization was used instead of acid digestion, the pH of our homogenate was higher (7.5), and we did not attempt to separate TBT from DBT. Use of mechanical homogenization may significantly lower the extraction efficiency of TBT and DBT, causing butyltin concentrations to be underestimated. Salmon muscle tissues spiked with  $0.60 \text{ } \mu\text{g TBT/g}$  and with  $0.52 \text{ } \mu\text{g DBT/g}$  have recoveries of 55% and 37%, respectively. The limit of detection was  $0.013 \text{ } \mu\text{g TBT/g}$  muscle tissue.

To determine whether organotins were inorganic tin complexed with ligands, three salmon from the control group were selected, and a 2 g portion of muscle tissue from each fish was processed using the modified M&T method described above, except that the buffer solution contained  $10 \text{ } \mu\text{g Sn(II)}$  (as  $\text{SnCl}_2$ ), and the homogenate was allowed to rest at room temperature for 4 h. This procedure was repeated using Sn (IV) (as  $\text{SnCl}_4$ ). No organotins were detected in either case. This rate of addition of inorganic tin is equivalent to  $10 \text{ } \mu\text{g Sn/g}$  muscle tissue, which is more than 10 times higher than the highest organotin concentrations found in the muscle tissue of LPW salmon reared in the TBT-treated sea pens. It is therefore very

unlikely that the organotins were derived from inorganic tin.

To verify the source of the organotins in LPW salmon, we analyzed the fish food and the seawater inside the sea pens. We extracted one 1.5 l. seawater sample from each of six TBT-treated sea pens with 0.5 l. methylene chloride and analyzed the tin content of these extracts. The extracts were all evaporated to dryness, and the residue was taken up with 5 ml of the acetic acid solution, which was analyzed by flameless AA as previously described. In seawater recovery experiments,  $15 \text{ ng TBT/l.}$  gave an average response of 0.009 absorbance-seconds on our instrument. We also analyzed three surface-seawater samples from Chatham Strait, Alaska, about 2 km east of LPW and, using the modified M&T method, analyzed muscle tissue samples from 10 wild chinook salmon caught by hook and line near Auke Bay.

To determine whether pan frying, boiling, or using a microwave oven destroys accumulated butyltins, we cooked a single 10 to 30 g portion of muscle tissue from a single LPW 1981 brood-year chinook salmon that had been analyzed for organotins, using each cooking method. Muscle tissue was cooked to an internal temperature of  $100^{\circ}\text{C}$ . Each cooked portion was subsampled five times for organotins and analyzed by the previously described method.

#### RESULTS AND DISCUSSION

All samples from the three groups of fish reared in TBT-treated sea pens, but none from the untreated sea pen, contained readily detectable concentrations of organotins (Table 1). Organotin concentrations ( $0.70\text{--}1.1 \text{ } \mu\text{g/g}$ ) in the 1981 and 1982 brood-year salmon were not significantly different ( $P = 0.81$ ) as determined by analysis of variance comparing all results from the 1981- and 1982-brood fish, suggesting that the time scale for accumulation in these fish is less than a year. The average organotin concentration in the 1983-brood fish was  $0.28 \text{ } \mu\text{g/g}$ . This lower concentration may result from the relatively brief exposure to the TBT-treated pen, which had in fact been soaking in seawater for more than 6 months before the 1983-brood fish were transferred to it. In contrast, no organotins were detected in the muscle tissue of the control group.

Table 1. Concentrations of butyltins in the muscle tissue of 1981, 1982, and 1983 brood-year chinook salmon reared in TBT-treated and untreated sea pens at Little Port Walter, Alaska. Butyltin concentrations, together with 95% confidence intervals, are based on wet tissue weights. Each fish was analyzed in triplicate. ND = none detected (detection limit is <0.013 µg TBT/g muscle tissue).

Brood year	Duration of residence in TBT-treated sea pens (months)	Muscle tissue concentration of butyltins, as TBT (µg/g)	Number of salmon analyzed
1981	19	0.90 ± 0.10	4
1982	13	0.82 ± 0.05	8
1983	3	0.28 ± 0.04	7
1983	0	ND	12

No organotins were detected in the fish food samples or in any of the 10 wild salmon caught by hook and line near Auke Bay, nor were any organotins detected in the three surface-seawater samples from Chatham Strait. However, organotins were detected in all six seawater extracts from the sea pens, at concentrations of 18-65 ng TBT/l.

Our results indicate that the source of the organotins in muscle tissue of LPW salmon was the TBT-treated sea pens. The only naturally occurring organotin compounds are methyltins<sup>3</sup>, and their concentrations in unpolluted seawater are probably less than 1 ng/l.<sup>4</sup> If naturally occurring or anthropogenic organotins from sources remote from LPW were significant, we would have expected to detect them in the control group or in the 10 wild chinook salmon. A local source is indicated because organotins were detected in all the marine water samples from inside the sea pens, but in none of the samples from Chatham Strait. At LPW, organotin compounds were only used to treat the sea pens.

The organotins present in our hexane extracts probably include TBT and DBT. The half life of TBT in water exposed to the environment is about 3 months.<sup>4</sup> Juvenile chinook salmon rapidly accumulate TBT immediately upon exposure to low concentrations: We have observed that juvenile chinook salmon exposed to 2 µg TBT/l. seawater for 72 h accumulated 0.3 ± 0.1 µg TBT/g muscle tissue (wet wt).<sup>5</sup> It is therefore likely that the salmon were exposed to only TBT and not to significant concentrations of any TBT degradation products. Once absorbed, TBT may be catabolized to DBT.<sup>6</sup> The organotins in our hexane extracts of muscle tissue from LPW salmon are therefore probably TBT and DBT (See footnote).

Our results imply that TBT is bioconcentrated to a great extent in the muscle tissue of chinook salmon. We cannot determine a bioconcentration factor with any precision from our data because LPW salmon were probably exposed to TBT concentrations higher than those found in the seawater samples. The leaching rate of TBT is highest when the treated nets are first placed in seawater and decreases roughly exponentially with time.<sup>7</sup> By the time we sampled the seawater in the sea pens at LPW, the nets had already been in seawater for at least 5 months. The 1981 and 1982 brood-year groups, on the other hand, had been repeatedly transferred into newly TBT-treated sea pens. However, chinook salmon probably bioconcentrate TBT in their muscle tissue to a greater extent than do sheepshead minnows, *Cyprinodon variegatus*, which bioconcentrate TBT by factors ranging from 740 to 1600.<sup>3</sup> Greater bioconcentration factors for chinook salmon are expected, because their muscle tissue is relatively high in lipids<sup>8</sup> and TBT has a high octanol-water partition coefficient.<sup>4</sup>

#### Market Survey

The readily detectable TBT concentrations found in the 1983 brood-year salmon, after a relatively brief exposure to a used TBT-treated sea pen, caused us to speculate whether organotins are present in aquacultured salmon in the U.S. marketplace. TBT compounds are widely used as a sea pen antifoulant in the salmon aquaculture industry. Therefore, we thought it likely that salmon reared in commercial aquaculture operations using TBT-treated sea pens may be subjected to a TBT exposure similar to that of the 1983-brood salmon reared at LPW.

We purchased eight salmonids from four markets in Seattle, Washington, and seven from one market in Portland, Oregon, in February, 1985. All the Seattle fish, consisting of chinook salmon; silver salmon, *Oncorhynchus kisutch*; and Atlantic salmon, *Salmo salar*, were advertised as imported products of aquaculture. The seven fish from Portland were silver salmon reared in the United States at a facility that used TBT-treated sea pens. Fish were analyzed for organotin concentrations in muscle tissue, using the previously described method; concentrations were 0.072-0.20 µg/g in four of the eight fish from the Seattle markets, and 0.059-0.10 µg/g in all seven Portland fish (Table 2). Fish from the Seattle markets that did not contain organotins were probably not reared in TBT-treated sea pens. Although the exact history of these market fish is unknown, our results from the LPW fish suggest that the market fish acquired their organotin burdens while being reared in TBT-treated sea pens (See footnote).

Table 1. Concentrations of organotin in salmonids purchased from fish markets in Seattle, Washington, and Portland, Oregon and advertised as products of aquaculture. Organotin concentrations, together with 95% confidence intervals, are based on wet tissue weights. Each fish was analyzed in triplicate. ND = none detected (detection limit is <math><0.013 \mu\text{g TBT/g muscle tissue}</math>).

Species	Number of fish analyzed	Muscle tissue concentration of organotins, as TBT ( $\mu\text{g/g}$ )
Seattle Market		
Silver salmon	1	0.20 = 0.11
Silver salmon	1	ND
Chinook salmon	3	ND
Atlantic salmon	3	0.081 = 0.031
Atlantic salmon	1	ND
Portland Market		
Silver salmon	7	0.061 = 0.009

Three common cooking methods for salmon did not eliminate butyltins from the cooked portions. Average percentages of butyltins remaining were 55%, 67%, and 76% for the microwave, pan frying, and boiling methods, respectively. These percentages are corrected for the loss of water that occurred during cooking. Results indicate that cooking is ineffective in eliminating butyltin concentrations in food.

#### SUMMARY

Rearing salmon in sea pens treated with antifoulant containing TBT compounds resulted in the accumulation of organotins in the muscle tissue of salmon. Organotins were detected in several fish from different countries purchased from the marketplace and advertised as products of aquaculture. Additionally, cooking was found to be ineffective in destroying or removing accumulated organotins. We believe this is the first evidence of entry of organotins into the human diet in the United States.

#### Footnote

Analysis of the samples on which the results presented in this paper are based have recently been repeated by one of us (JWS) using a gas chromatograph interfaced with an atomic absorption spectrophotometer (GCAA). Results of the GCAA analyses showed TBT concentrations in chinook salmon muscle tissues that were quantitatively similar to the organotin concentrations (expressed as TBT) presented in tables 1 and 2. In particular, DBT accounted for less than 1% of the TBT found by GCAA. A manuscript reporting these results more fully is in preparation.

#### ACKNOWLEDGEMENTS

We thank R. James Maguire, Vernon Hodge, and Stuart G. U'ren for their review of the manuscript and helpful discussions, and A. Moles and W. Whelan for their technical assistance.

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# COOPERATIVE EXTENSION SERVICE

UNIVERSITY OF ALASKA  
FAIRBANKS ALASKA 99701

Marine Advisory Programs  
2551 Providence Avenue  
Anchorage, Alaska 99504  
(907) 263-1890

June 29, 1981

## MEMORANDUM

TO: Brian Paust, Agent  
FR: John Ball, Safety Specialist *John*  
RE: Tricetyl-Tin-Fluoride (TTF)

This is a response to your question about the toxicity and special handling of this anti-fouling compound. Since it is not uncommon and is a nasty item, I am taking the liberty of circulating this information to other friends in MAP/CES/Sea Grant.

For more information on this or other compounds there are several places to turn to in the future:

- ① Carl Harmon, Environmental Engineer with the State Department of Environmental Conservation in Anchorage (the person who helped me with this)--phone: 274-2533.
- ② Environmental Protection Agency (EPA)--phone: 271-5083.
- ③ Poison Center at Providence Hospital in Anchorage--phone: 274-6535.
- ④ Chemical Transportation Emergency Center (CHEMTREC)  
Phones: (800) 424-9300 (supposedly toll free)  
(202) 483-7616 (call collect 24 hours a day).

I did not have the occasion to call the Coast Guard on this, but on materials that are recognized hazardous materials, the Coast Guard does have some references.

① It is not effective as a biocide and is not intended to be used on E.A.-D and agent orange. ② It functions as an anti-fouling agent by breaking down the cell walls of living tissue. It will do this in people too. ③ It can be absorbed through the skin, inhaled, ingested, etc. ④ If it gets into the eyes and remains there for any appreciable period of time, it can affect vision and cause blindness. ⑤ Using this material in a confined space can lead to unconsciousness and presumably death. ⑥ For physical as well as health reasons this material should not be applied in a spray. It should be painted onto the surface to be protected (and I would go try to find my worst enemy to do the work).

Erin Paust  
Page 2  
June 29, 1981

The material collects in fatty tissue and therefore has a considerable impact upon kidneys and livers.

If one is going to use it, it is recommended that the use be under controlled conditions, in open air (so others can breathe in the vicinity), with a respirator, protective clothing, gloves, etc.

I did not get the recommended solvent, but at all cost one ought to avoid getting this material in contact with the skin and it might be a good idea to be prepared with the recommended solvents and eye washes.

Basically, the stuff sounds almost too dangerous to use. The only other thing to add is that several brands have been removed from the market, and one ought to check with the CHEMTREC number above to see if specific brands are even allowed in the market anymore. Apparently, many of the earlier editions have been recalled. Keep the stuff in Petersburg, eh?

Hope this helps.

ee

JAN 5, 1987

University of Hawaii Sea Grant Extension Service would like to contact anyone in the sea grant network familiar with the environmental and biological effects resulting from use of organotin (i.e., tributyltin or TBT) antifouling paint. US Navy plans to experiment with TBT application on its hulls at Newport, Rhode, and Pearl Harbor, Hawaii. Purposes of the study are to track and measure leaching of TBT into marine environment and assess environmental effects. USN claims TBT would be more cost-effective than copper-based paints. US Environmental Protection Agency is presently conducting a lengthy review of TBT use on vessels, triggered by recent ban of TBT in United Kingdom and France due to "malformations" observed in shellfish.

State Department of Health is presently reviewing existing information and obtaining views of local agencies including NMFS, USFWS, state CIB program, and UH Sea Grant. A meeting is being planned for January 15, 1987 in Honolulu at which the US Navy will brief local agencies about their plans and address concerns.

If there is any researcher or extension agent especially familiar with TBT, please contact Ray Tabata, marine extension specialist, UH Sea Grant Extension Service, 1000 Pope Rd., MSE 205, Honolulu, HI 96822; phone -- (808)

*Handwritten notes:*  
 -  
 a look for  
 news and literature  
 related to this -  
 If you want to  
 send me a copy  
 can put it on the  
 DoNET computer  
 network to  
 Hawaii -  
 Thanks,  
 Fuller

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# TBTs: Acronym For Poison?

French oystermen say anti-fouling paints are responsible for the demise of a once lucrative shellfishery near Bordeaux.

The Navy says a new version of the anti-fouling paints, designed to keep barnacles from clinging to ship hulls, can save them millions of dollars annually. They dispute claims that use of the paints will decimate the already threatened marine life in Chesapeake Bay.

Anti-fouling paints contain a toxic compound, tributyltin (TBT). Until recently, no reliable test existed that would measure its presence in the tin that leeches out of the paints. Now, funding from the National Science Foundation, the Environmental Protection Agency, and the National Sea Grant College Program, has enabled a researcher at the University of New Hampshire to develop just such a test.

Jim Weber is a chemist whose work has taken him to Bordeaux, near Arcachon Bay, an important source of oysters in France. In recent years, however, the oysters in Arcachon Bay have been ailing. Weber says, "They're definitely sick. There is less flesh. In some cases, the shells adhere to the flesh. They're not edible."

Boats, from fifty meter yachts to small outboards, are also abundant on Arcachon Bay, and the French government suspected that tributyltins were leaching from anti-fouling paints on boats and poisoning shellfish.

Tin itself is harmless. After all, Weber points out, we store much of our food in tin containers. Only when tin is combined with butyl is it lethal, and then it is lethal in very small parts per billion. It doesn't take much tributyltin to harm or kill something, but there has been no way to measure small amounts of the compound and prove that it was not in dangerous levels in the water.

The anti-fouling paint used in the French binned oyster beds, and on all vessels that sail over waters long or under, the paint manufacturers protested a lack of scientific verification.

The situation parallels one being worked out on the James River and Chesapeake Bay in this country. The Navy, according to an Associated Press report, wants to paint 450 surface ships at the Newport News, Virginia, shipyard with a paint formula that contains tributyltin. Since the formula requires less frequent re-painting, the estimated

savings to the Navy would be some \$200 million each year.

The Navy says that its formula contains less tributyltin than commercially available paints, but the shipping question is located near a prime Chesapeake spawning ground for oysters and crabs. Anti-fouling paints are intentional biocides; they are meant to kill the marine life that attaches to boat hulls. The issue is whether, after killing seaweeds and barnacles, they continue down the water column, injuring non-target organisms such as mussels, clams, crabs, and oysters.

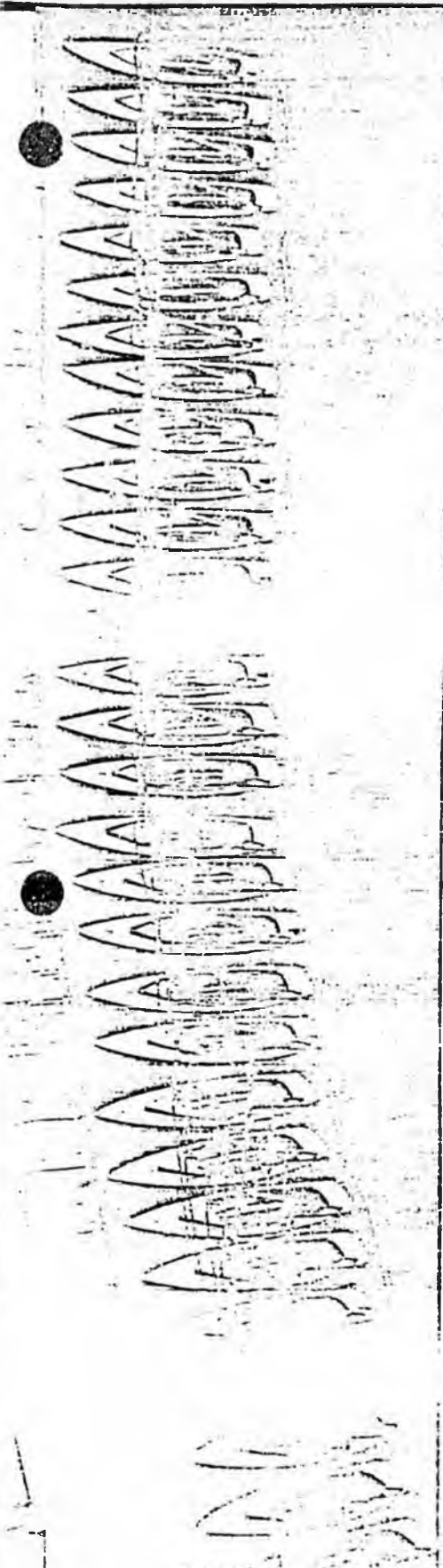
Weber's test can be used to do such a determination. It developed out of a Sea Grant-funded project sought to discover what happens to toxic substances such as organotin compounds in the water of Portsmouth's Great Bay estuary. Using an earlier technique, Weber had a system that can assess the presence in shellfish of tin, but let amounts of tributyltin add do a few steps than previously needed.

"Former technicians found a good deal of sample manipulation," Weber says, noting that in the process of preparing samples, the tin content of the contamination was lost. "This work takes an hour to add one chemical and measure tributyltin."

Weber has been in the process of technique at a separate, complex organotin compound laboratory in Washington, D.C., as a participant in part of "Ocean '86," a biennial conference sponsored by the Marine Technology Society, the Institute of Technical and Engineering Sciences, the Oceanic Engineering Society, and the National Geographic Society.

The UNH researchers, working in the past year to develop a test for organotin, was visited in February specifically to learn the technique to apply it to the Arcachon Bay oysters. Weber is also continuing to market his own research to determine just how much tributyltin is in the New Hampshire's Great Bay estuary.

Already there is prominent evidence that anti-fouling paint is a local contributor to organotin. Weber did sampling in March and June. "Weber says, "and butyltin only in March showed up only in June. Butyltin," he points out, compares to a few dollars out on the estuary in March.



Anti-fouling paint on the hull of a boat. Photo by [unreadable]

### **EPA Warns Vessel Owners of TBT Paint**

The Environmental Protection Agency has begun a special review of the use of the pesticide tributyltin (TBT) in antifouling paints to determine whether it should be banned or restricted because of its toxicity to fish and shellfish. Between 250,000 and 300,000 pounds of TBT is used in vessel paints each year. Water samples taken in several U.S. ports contained relatively high concentrations of TBT prompting the investigation. While no decision has been made EPA is advising all vessel operators that:

"It would be most prudent to use copper-based antifouling paints containing no TBT."

15-1-78  
March 1978

## HEARING HELD ON TRIBUTYLTIN

The use of tributyltin (TBT) in antifoulant marine paints was the subject of a U.S. House of Representatives, Merchant Marine and Fisheries Sub-Committee hearing on Sept. 30. Three expert panels from academia, the TBT and TBT paint producing industries and the Environmental Protection Agency provided testimony. The objective of the hearing was to explore the facts about TBT, issues requiring further study and possible action to be taken.

Scientists from John Hopkins University and VIMS presented data indicating that TBT levels in water samples taken from several sites in in-shore Maryland and Virginia waters were higher than those levels found to be toxic to shellfish larvae in laboratory experiments. They further noted that shellfish are known to bioaccumulate TBT. Although acknowledging the existence of certain data gaps, including some in the area of public health implications, the researchers recommended immediate restrictions on TBT paint use.

Testimony from industry representatives pointed out that no real problems have been observed that can be directly attributed to TBT. It was noted that two types of TBT-based paints are produced and marketed: a "copolymer" type, which has been observed to leech TBT very slowly, and a "free associated" type, which has a quicker release. It was suggested that the latter could be restricted or banned, alleviating much of TBT release into waters.

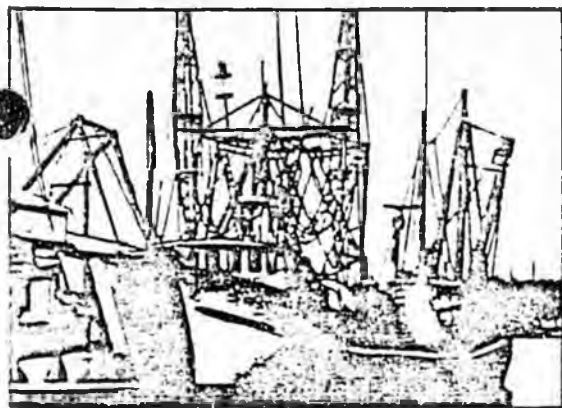
The EPA representative testified that the EPA is currently undertaking a complete review of TBT antifoulant paints. While completion of the entire study may require three to five years, EPA could rule on restrictions regarding usage of high release paints by spring 1987. Congressman William Carney (NY) noted that there is little chance that legislative action on TBT use could be taken before June 1987, and requested that the EPA official keep the Committee advised on the progress of its review.

*Source: National Fisheries Institute "Flashes"  
October 1986*

*M. D. Mandamer (Cal. Sea Grant)*

*2/16/85*

Marine Advisory Program  
University of Alaska  
P.O. Box 100  
Fairbanks, Alaska 99703  
Tel. 772-1111



# Commercial Fishing Newsletter

VIRGINIA SEA GRANT COLLEGE PROGRAM AT  
VIRGINIA INSTITUTE OF MARINE SCIENCE

Vol. 5, No. 4

Fall 1985

## VIMS Contests Navy Plan to Use TBT Until Scientific Studies Prove Its Safety

by Susan Schmidt

Dr. Frank Perkins, director of the Virginia Institute of Marine Science (VIMS), recommends against the use of tributyltin (TBT) to paint Navy ships until better data on environmental effects are assembled.

The Navy says that mixing organotin with copper-based paint to kill barnacles and retard algal slime could save \$150 million a year in maintenance and fuel costs. VIMS is concerned that there is insufficient scientific data on the environmental impacts of TBT and has started testing toxic effects of this chemical on oysters and clams.

VIMS is charged with advising the Commonwealth on protecting estuarine resources, and in particular, species for commercial and recreational harvest in the Chesapeake Bay. At the same time, VIMS is uniquely qualified to study a toxic chemical, because of the experience of chemists at the Institute and their sophisticated testing equipment.

Dr. Robert Huggett, head of the chemical oceanography department at VIMS, says TBT is one of

"We believe that the protection of human health and the high economic value of recreational and commercial fishing warrant the postponement of this program until the risks can be fully assessed."

### Virginia Protests Naval Plan

In an environmental assessment released in June 1985, the Navy said that TBT is 7 to 40 times more toxic than the copper-based paint now in use. After consultation with VIMS, the Virginia Council on the Environment responded to the Naval proposal in August, requesting more research.

Keith Buttleman, administrator of the Council, said,



Surf breaking over the VIMS Ferry Pier during the November 4th storm washed away several scientific experiments.

In August a Virginia Congressional delegation wrote a letter protesting the Naval plan to use TBT. In September Sen. Paul Trible set up a meeting with Navy Secretary John Lehman, attended also by Sen. John Warner, and Reps. Herbert Bateman, William Whitehurst, and Norman Sisisky. They asked the Navy to stop its plan to use paint containing TBT until VIMS' intensive study of environmental effects could be completed. Dr. Perkins and Dr. Huggett of VIMS attended the meeting.

Citing VIMS' concerns, in October the U.S. House of Representatives Appropriations Committee has encouraged the Navy to postpone fleetwide implementation until impacts on estuarine marine life and on human health are determined.

### Risks to Environment and Human Health

One of VIMS' concerns is the effect of TBT on shellfish. Naval vessels are concentrated in only a few harbors, one of which is Norfolk, Va. Norfolk Naval facilities and the Newport News Shipbuilding and Dry Dock Company are within a tidal cycle of major oyster seed beds in the James River and crab spawning areas in the mouth of the Chesapeake Bay. The Navy report does not list the effect of TBT on shellfish species near Norfolk harbor.

The Virginia Department of Health says TBT accumulates in aquatic organisms. In oysters, TBT can be magnified 1000 to 6000 times, and in mussels, 2700 times over water concentrations. Experimental tests on rats indicate TBT causes skin sores and severe eye damage. Possible effects on workers exposed to TBT are problems with eyes, skin, lungs, liver, nervous system, abdominal pain, nausea, headaches, and unconsciousness. Because of the risk to workers, the Newport News Shipbuilding and Dry Dock Company says it will not use TBT in the future until its effects on workers and the environment are known.

### History of Anti-foulants

Three thousand years ago Phoenicians used copper on their ships. In the 19th century arsenic and mercury enhanced the activity of copper until environmental concerns banned their use.

Fifteen years ago organotins were added to marine paint, because they were thought to be less toxic than mercury and arsenic and more effective than copper. This paint is efficient at protecting against fouling because the poison is released slowly over time. In some of the newer co-polymer paints, hulls do not have to be scrubbed or repainted for years. Furthermore, a layer of paint sloughs off when the vessel is underway. In fact, the Navy says

no better alternative exists to the co-polymer mixture of tin and copper.

### Naval Readiness

By increasing fuel efficiency with cleaner hulls, the Naval fleet can travel farther and faster. By reducing time in drydock, the Navy can respond more quickly in an emergency. Initial Naval tests say that ships may be able to stay out of drydock for five years. In addition to using TBT to kill barnacles and algal slime that retard ship speed and increase fuel consumption, the Navy says it needs to use TBT on aluminum hulls to avoid corrosion caused by copper-based paints.

The Navy started using TBT in the late 1960s, discontinued use in the mid-1970s and resumed use again in 1977. So far 19 Naval vessels have been painted with TBT. On a continuing test basis, the Navy wants to paint two to five more ships with TBT in the next year. The Navy proposes that all 550 vessels would be painted with TBT marine paint by the 1990s.

### Recreational and Commercial Use of TBT

For about 10 years TBT has been used on private and commercial boats in the United States. However, in France and Great Britain its use is restricted on small pleasure craft. France has banned use of marine paints with more than 3 percent organotins on boats less than 25 meters (about 80 feet). Great Britain forbids TBT on small, shallowdraft vessels, and Japan bans TBT on household textiles and paints.

TBT is a biocide, which literally means killer of life. Besides marine paints, the other uses of TBT are on textiles to kill fungus, in cooling water to kill algae, on plastics and foam to control mildew, and in food preservatives and disinfectants.

### Standards and Testing

The Navy sets allowable levels at 50 parts per trillion (ppt). North Carolina has set standards for TBT at 10 ppt in seawater and 3 ppt in freshwater. In a preliminary 1980 water sample from a small creek near several pleasure craft marinas, VIMS scientists found a potentially dangerous level of 100 ppt as TBT or 190 ppt as TBT. Similar preliminary sampling in the Elizabeth River near the Norfolk Naval Base yielded concentrations exceeding the Navy's proposed allowable level of TBT.

Over the next year VIMS scientists will conduct an intensive study of the impacts of TBT on the estuarine resources, so that at the assessment as to whether it is advisable for the Navy to paint its fleet with TBT based on accurate scientific evidence.

## Government studying TBT-paint hazards

The U.S. Environmental Protection Agency has begun a review of some tributyltin (TBT) pesticide compounds after determining they may endanger mussels, clams, oysters and fish. There is no evidence that TBTs harm humans who eat seafood containing TBT residues, and the EPA has not banned their use.

TBTs have been used for 20 years in the manufacture of anti-fouling paints applied to ship and boat hulls to inhibit the growth of barnacles, tubeworms and other marine life considered harmful to vessels. Small quantities of TBT paints also are used on lobster pots and buoys.

The EPA's review was prompted by laboratory studies showing that TBT at minute levels is highly toxic and potentially lethal to marine and freshwater organisms. Data measuring TBT in the Great Lakes and coastal waters show levels at concentrations that adversely affect laboratory animals.

Until the EPA investigation is concluded, the agency recommends using copper-based anti-fouling paints containing no TBT, even though copper-based paint, while effective against the same organisms as TBT-based paint, tends to be corrosive to metal, especially aluminum, and doesn't protect as long. At the same time,

without copper, it triggers the growth of organisms that TBT-based anti-fouling paints will not. In TBT-free paints, generally, the TBT toxicity is slower.

## TBT bottom paints face EPA action

Lawmakers in the U.S. House of Representatives have agreed to consider imposing restrictions on the use of popular tin-based bottom paints that contain tributyltins, or TBT. Such anti-fouling coatings are believed to pose serious environmental threats, particularly to shellfish.

In a hearing Sept. 30, House members agreed to ask the Environmental Protection Agency (EPA) to decide if TBT paints should be restricted or banned from use while further scientific studies are performed.

Two scientists from the Virginia Institute of Marine Science (VIMS) and Johns Hopkins University told a House Merchant Marine and Fisheries subcommittee that early scientific analysis showed that highly toxic TBT residues from the boat paints are increasingly being found in the sediment and water column of productive estuaries like Chesapeake Bay. These scientists, whose testimony was disputed by representatives of two marine paint companies, recommended immediate restrictions on the use of TBT paints.

Since the 1970s, TBT paints have become very popular, with estimates showing that upwards of 70% of all recreational vessels and more than 80% of all commercial vessels now use the product.

In the past six years, however, scientific studies have shown that the TBT paints are leaching into the environment, par-

ticularly in areas of heavy boat traffic. In Europe, where the pesticide is used to ward off aquatic growth on boat hulls, it has been found to impede the growth of shellfish, particularly oysters.

In this country, EPA opened a massive national study into TBT's effects just last January (see NF March '86, p. 10). The investigation is expected to continue through the end of the decade.

But Thomas J. Gibbons, director of marine marketing for International Paint Co. in Union, N.J., said significant questions about the allegedly harmful effects of TBT use must be answered before any restrictions are imposed.

He noted that two forms of TBT paints are currently being used: one is a "free-association" mix, which has a higher rate of release into the water, and the second is a copolymer, which leaches very little into the environment.

"A ban on all TBT-based paints in U.S. waters would create economic havoc as well as great enforcement problems," said Gibbons, "since some 70% of all oceangoing vessels are coated with TBT copolymer anti-fouling paints."

John A. Moore, assistant administrator for pesticides and toxic substances at EPA, said the agency might take interim steps — such as imposing limited restrictions on TBT use — before its lengthy federal studies are completed.

— Christopher Simpson

# Toxic chemical detected in farm salmon

A spokesman for B.C.'s ministry of the environment confirmed Nov. 7 that there are no controls in this province on the use of a toxic anti-fouling agent that has been detected in farmed salmon.

The substance is called tributyltin, or TBT, and is one of the most toxic substances known to man. Popular as an anti-fouling paint for boat bottoms, it has been banned in a number of European countries because of the damage it inflicts on the environment.

Now TBT has been detected in pen-reared salmon sold in U.S. seafood markets. According to *Friday*, the publication of the Pacific Coast Federation of Fishermen's Associations, aquaculture products from Puget Sound and Norway purchased in public markets contained concentrations of .28 to .9 micrograms per gram of TBT.

TBT, sometimes used to treat netting used in salmon pens, can be toxic in levels as low as five parts per trillion. Two scientists working for the National Marine Fisheries Service found the substance in baby coho sold in public markets.

"We have no controls on the use of anti-fouling agents," B.C. environment ministry spokesman Michael Coon told *The Fisherman* Nov. 7. "We're in the process of collecting samples. We're trying to assess the problem. It's something we don't know very much about."

Evidently the pan-sized fish are not exposed to the TBT for long enough to die from its effects. The chemical concentrates over time in certain parts of the body.

Coon said the toxic effects of anti-fouling agents are a concern. "It's in everyone's interest to make sure fish aren't contaminated."

UFAWU secretary-treasurer Bill Frocopation said the threat of TBTs is another example of the chaos surrounding the B.C. fish-farming industry. "We'll need more than a 30-day review to establish regulations to prevent this kind of damage," he said.

The two American researchers also studied the effect of low concentrations of TBT on juvenile salmon, concluding that exposure to low doses may increase susceptibility to disease.



• UFAWU secretary-treasurer Bill Procopation, (left) and Gibsons troller Gary Russell (right) were among fishermen who appeared at hearings of the B.C. Finfish Aquaculture Inquiry chaired by David Gillespie, a Kamloops lawyer.

## Province, DFO to probe TBT contamination from fish farms

Both the federal and provincial governments have undertaken studies of the impact of tributyltin anti-fouling paints on farmed salmon in the wake of a UFAWU call for a ban on the use of the chemical.

In a supplementary brief to the B.C. Finfish Inquiry, UFAWU researcher Geoff Meggs reported that tributyltin, or TBT, was in widespread use in the salmon farming industry under the brand name Flexguard.

TBT is extremely toxic, especially to marine organisms like mussels. It has been detected in farmed fish on sale in the United States.

In a telegram to Fisheries Minister Tom Siddon, the union called

for an immediate investigation to ensure no TBT-contaminated salmon is for sale in Canada.

The union also called for a freeze on the shipment of any salmon from farms using TBT-treated pens and permanent inspection and labelling regulations to ensure that farmed fish is marked as such at the retail level.

In an interview Dec. 9, provincial fisheries branch director Gordon Halsey said "we've advised and asked individual farm sites where we think there is an immediate need to stop using" TBT.

Meanwhile, the province has at last committed funds complete a study on TBT that was begun

during the summer. Halsey said the province has "general concerns about TBT" although "no one has said for certain TBT is a problem."

TBT is banned in France for use on most vessels and under strict controls in several other countries.

Rudy Chang, of the federal fisheries inspection branch, said Dec. 9 his department is developing studies to allow regular inspection of farmed fish for TBT.

He said there are no plans to require the labelling of farmed fish. Siddon told the UFAWU earlier this year the department does not believe such regulations are necessary.

The Province  
1976 12 12

# Anti-fouling paint

A SHOCK report by British Ministry of Agriculture, Fisheries and Food scientists that certain anti-fouling paints can be deadly to many types of fish and shellfish is causing growing concern to shellfish growers and inshore fishermen in England.

Ministry scientists have established a fatal link between anti-fouling paints containing toxic TBT (tributyl tin) compounds and the death or deformity of thousands of estuarine fish or shellfish.

South Devon fishing communities are worried that this new source of pollution is causing poor growth of oysters in the River Dart and at Salcombe — areas now used for mooring yachts.

The claim is now being made that the livelihoods of local fishermen are being threatened.

One shellfish farmer at Salcombe estimates that he has lost stock worth more than £25,000 and Captain Philip Gibbon of Offshore Farms, Totnes, has been moving thousands of threatened oysters to unpolluted rivers.

Local men also claim that the disappearance of winkles, cockles, mussels and shrimp from certain Devon estuaries may have been caused by the chemicals from anti-fouling paints.

Ministry experts have been quick to point out that, while small concentrations can prove fatal to marine life, it is harmless to humans when it is so diluted. But they have no doubt that it is toxic to fish and shellfish. Mrs. Mire Waddock of the MAF Fisheries Laboratory, Burnham-on-Crouch, confirmed that even 0.1 milligrams of TBT in one litre of water can be deadly to many kinds of marine life.

Oyster samples taken from the Dart showed a high level of TBT and this might explain the poor growth rates experienced in recent years. Pacific oysters are particularly sensitive to this chemical which causes shell thickening and slows down growth, and the local oyster industry — once expanding — seems to be affected by

## scare in England

this toxic paint.

The Shellfish Association of Great Britain was hard at work last month lobbying government departments and certain MPs to ban the use of paints containing TBT. Protest letters have been sent to Westminster from river users, conservationists and anglers.

Devon Euro-MP Lord

O'Hagan is being asked to back the case for banning TBT and to investigate the case made by the French who banned its use in 1982.

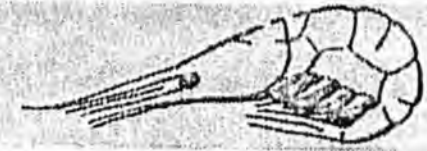
British government departments concerned with fishing, pollution and the environment are holding joint talks about whether changes in the legislation are necessary.

## WATCH ON TIN

THE fisheries departments in Britain recognise that there is evidence to show that tributyl tin in anti-fouling paints can inhibit the cultivation of shellfish.

Asked in the House of Commons what steps will be taken to ban tributyl tin compound in anti-fouling paints, the minister responsible for fisheries, John MacGregor, said that the Ministry of Agriculture, Fisheries and Food was considering with other government departments what action might be appropriate.

# On the shellfish scene



With Dr. Eric Edwards, Director, Shellfish Association of Great Britain

FROM January 13, boatowners in Britain are not able to buy certain types of antifouling paints which contain high levels of organo-tin compounds, including tributyl tin (TBT).

Scientists now agree that TBT — the active ingredient of many yacht paints — is one of the most toxic substances deliberately discharged by man into the marine environment.

The British government through its Department of the Environment, aware of these dangers, has introduced some curbs on the use of TBT under the Control of Pollution (Anti-fouling Paints) Regulations 1985.

It is now a criminal offence to use the worst offenders among the organo-tin paints including those copolymer paints containing more than 7.5 per cent tin.

"Free association" paints in which the tin is not bound to resin have also been withdrawn.

Until recently the case against TBT paints centred on their stunting effect on the growth of Pacific oysters (*Crassostrea gigas*), which today form the basis of commercial oyster fisheries in Britain.

Scientists from the Fisheries Laboratory, run by the Ministry of Agriculture, Fisheries and Food at Burnham-on-Crouch, Essex, carried out field and laboratory trials from 1982 to 1984.

Their work has shown conclusively that even low

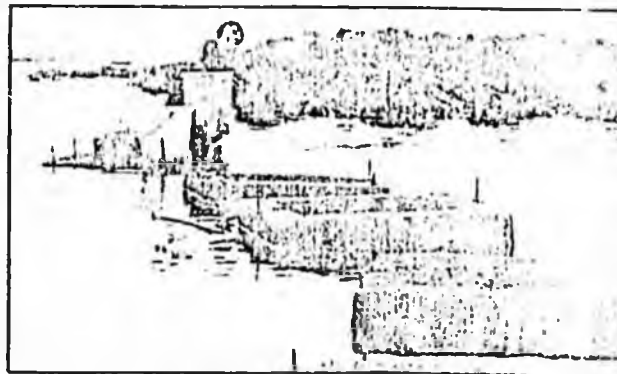
levels of TBT in an estuary can cause shell thickening and malformation in Pacific oysters to such an extent that they become unsuitable for sale.

But there is growing evidence that TBT pollution has wider effects. Researchers at the University College of North Wales have found that the growth of phytoplankton is severely retarded and barnacle larvae can only survive a very short time in minute traces of TBT. (1 microgram of TBT per litre of seawater).

## Enough

Some marine larvae were affected at one tenth of this concentration and a level of 0.5 micrograms of TBT per litre — a concentration found in estuaries with plenty of pleasure craft — was enough to reduce the population of the common mussel and to kill shrimps.

Environment Minister William Waldegrave, explaining the problem to yachtsmen, said: "Less than one teaspoonful of TBT in a million gallons of water is



Concrete cages for rearing ormers off Guernsey.

sufficient to stop the growth of phytoplankton — the marine equivalent of grass."

The Shellfish Association campaigned hard to press for controls on the use of TBT in anti-fouling paints. The French, greater connoisseurs of shellfish than the British, banned the use of TBT on boats that are less than 25 metres long in 1982. Biologists there had found that oyster shells were deformed, reproduction rates were reduced, and larvae stood less chance of surviving close to marinas and boat moorings.

Despite France's three-year-old ban, Britain has decided to move slowly. But the introduction of controls under the new anti-fouling rules is a start. Mr Waldegrave has promised parliament that these levels "will be reviewed in time for the 1987 yacht painting season" and a Government seawater monitoring programme is underway.

What has disappointed me is the general lack of interest in protecting the marine environment shown by the yachting fraternity. Their main concern was to ensure that their favourite brand of paint would be on sale in their chandlery. Why should they bother if their boats kill the phytoplankton or reduce the life expectancy in mussel larvae?

## Sea dump

As I wrote last month, the sea is too often used as a dumping ground for toxic wastes. At least the UK has made some attempt to begin controlling lethal organo-tins now proven to affect the marine environment.

In tropical and warm climes gastropods such as conchs or abalones are a favourite seafood. The northern European cousin of the Californian abalone and

the Japanese awabi is the ormer (*Haliotis tuberculata*) found around the Channel Islands and parts of the north Brittany coast. In Guernsey and Jersey the ormer is a favourite seafood but unfortunately, since the late sixties, this large grey sea-snail has been mysteriously disappearing from their beaches.

Overfishing is blamed. The shore-gatherers accuse the divers of robbing islanders of their birthright by scooping up large hauls of the shellfish which are sold for high prices in France. In turn, the divers claimed that unrestricted shore-gathering had hit the shore population but there were plenty left in deep water.

In 1983 Guernsey's parliament decided to put a three-year ban on ormering and the island's Sea Fisheries Committee brought over a Japanese expert, Ikuo Hayashi, to study the biology and life cycle of this elusive gastropod.

Diving for ormers is now banned and Guernsey only allows them to be caught on 24 days in the year. But, despite these controls, *Haliotis* continues to get scarcer and some experts believe that a temperature drop in the English Channel over the past 20 years is causing ormers to retreat south to warmer areas.

Channel Islanders must have their ormers and fortunately Dr. John Mercer, of Galway University's Shellfish Research Laboratory at Carna, Ireland, is now rearing them in a pilot scale hatchery. He has supplied over ten thousand juveniles for the Channel Islands' farming trials.

## Nurseries

On Guernsey, Sea Fisheries Officer John Lintell has set up ormer nurseries at five sites and one of his routine jobs is to ensure these vegetarians have plenty of tender seaweeds to graze upon.

As far as I know, the Guernsey ormer trial has been successful and the survival rate, to edible size, is between 80 and 90 per cent. The aim now is to encourage a private investor to start farming ormers commercially. No doubt some of the farmed animals will be used to restock the island's natural population but others will be exported to France where they fetch prices of £12-14 a dozen.

This is another example of low marine farming under controlled environmental conditions can help boost natural stocks. Well done to the Carna Shellfish Laboratory and the Guernsey Sea Fisheries Committee for this initiative!

TRIBUTYL TIN ANTI-FOULING AND OYSTERS

or

"There's tin on them thar hulls"

▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲

Recent work in Europe and the United States has indicated that recently developed tin based anti-fouling paints may have deleterious effects on oyster larvae development and shell growth. These new paints use bis-tributyltin oxide (fluoride, sulphide) as the active ingredient. These substances are highly toxic, with a half-life in seawater of 2-3 weeks.

Alzieu et al (1982), stated that "anomalies of calcification, show an obvious correlation between the extent of malformation and the vicinity of boat concentrations". Experimental work by Waldock and Train (1983) showed C. gigas spat grew less well and exhibited pronounced thickening of the upper valve compared to controls. As well, at low concentration levels, (0.15 ug/l) bioaccumulation factors of 10000 times were recorded.

Earlier work by Waldock showed that, generally, concentrations of TBT in the water column were related to the intensity of use by boat traffic levels of organotin which resulted in growth irregularities (0.15 ug/l) were found to occur commonly while levels as high as 2.25 ug/l were recorded. Waldock suggests that levels of TBT which would have no effect on C. gigas would be below 0.08 ug/l.

Currently TBT anti-fouling paints are banned on vessels <25m in France and are also restricted in California.

In recent years, spatfall in Pendrell Sound has become less reliable than in the past and post-settlement mortalities appear to be increasing. While no accurate records are kept, Pendrell Sound is a popular stopover point for recreational boaters. During peak periods, 50-60 boats anchor at the head alone.

In light of the problems occurring in Europe and Pendrell Sound, Marine Resources carried out a small survey of anti-fouling paint use on boats anchored at the head of Pendrell. The following results were obtained:

Type of Bottom Paint:

Copper based	30
Tin based	7
Antimony based	2
Unknown	11
None used	2
	<u>52</u>

Ratio of use  
by percent (n=39): 77 (copper): 18 (tin): 5 (antimony).

Mean length of stay for boats with tin based anti-fouling: 1.5 days.

Water line (wetted length) for boats with tin paint: x 30 feet.

it seems unlikely that the relatively low percentage of vessels utilizing tin based paint are alone sufficient to have major deleterious effect on spatfall success in Pendrell Sound. Whether tin based paints are one of a number of interactive factors affecting spatfall is a question outside the scope of current financial and staff availability.

Robert K. Cox  
Shellfish Unit  
Marine Resources Section

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## Oysters in danger from paint

RECENT research at the MAFF Fisheries Laboratory in Burnham-on-Crouch, England, has shown that tributyl tin (TBT) compounds unused in anti-fouling paints can cause excessive shell thickening in Pacific oysters.

Native oysters (*O. edulis*) do not appear to be affected in this way but toxicity tests indicate that the larval stages of oysters and crustacea can be killed with low concentrations of TBT.

Reporting this in its latest newsletter, the Shellfish Association of Great Britain, says that the work has established that TBT levels in some estuaries, used for mooring pleasure craft, are at a level which can cause problems to certain shellfish.

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# Britain may move on killer paints

**TOUGHER** controls on certain antifouling paints containing tributyl tin (TBT) compounds, which can kill or retard the growth of estuarine fish and shellfish, are being considered in Britain.

Consultation is now taking place between government departments, the Shellfish Association and environmental groups. The plan is to include all antifouling paints in new pesticide regulations, and to bring in tighter screening procedures.

Manufacturers of antifoul-

ing paints would have to have them tested to ensure limited toxicity to the environment, putting them on the same footing as pesticides used by farmers.

The shellfish industry has already suffered badly from this antifouling pollution with many growers facing

financial losses due to poor shell growth in oysters and mussels.

Research has also proved that toxic antifoulants can cause a wide range of environmental problems, especially in shallow enclosed estuaries where even minute traces of TBT are known to kill the young larvae of most estuarine fish or shellfish. Tests have also shown that phytoplankton — the 'grass

of the sea' — is destroyed by TBT.

Regulations, which came into force in January, make the retail sale of most yacht antifouling paints, which contain high levels of TBT, illegal. But because of the complexity of finding acceptable antifouling replacements, it seems likely that there will be a long lead-in time before the new regulations come into operation.

## Paint curb welcome

THE British Department of the Environment's new regulations to limit the use of antifouling paints containing tributyl tin (TBT) have been well received by the shellfish industry.

The industry has suffered badly because dangerous levels of TBT in antifouling paints is accumulated by oysters and can cause shell thickening to such an extent as to make oysters unsaleable. Growth rates of oysters have also been adversely affected in some estuaries.

Additional evidence proves that even minute levels of TBT can kill the young stages of soles, shrimps, crabs, and mussels, as well as oysters.

Plans to expand the UK

production of Pacific oysters, and the struggle to maintain beds of native oysters, have been seriously affected by TBT contamination. At least one specialised oyster and clam nursery in a recreational area has had to close and employment in the industry has suffered.

The Shellfish Association of Great Britain has urged both the Ministry of Agriculture, Fisheries and Food and the Department of the Environment to ban the use of TBT in antifouling paints sold in the UK. The French government took action in 1982 when it prohibited its use in boats less than 25 metres in length and reports confirm that their shellfish industry has already benefited from this control.

# Navy studies paint risks

TWO-PACK and 'coal tar' epoxy paints, which are widely used aboard ships, have recently attracted some suspicion about their possible effects on users' health. These effects may not be permanent, but they are very unpleasant and it is best to adhere strictly to the paint manufacturers' instructions.

The latest issue of the *Journal of the Royal Naval Medical Service* discusses a study of work-related symptoms and lung function in a group of painters working in a British naval dockyard. They were exposed to organic solvents and epoxy-resin-containing paints used during refitting work.

The study was triggered by complaints of asthma in another dockyard, and it was suggested that the organic solvents and epoxy resins could be a health hazard.

There are several possibilities involved. For example, the epoxy resins can cause dermatitis, and the curing agents, such as ethylene amines, aliphatic polyamines, phthalic anhydride and trimellitic acid anhydride, have been associated with occupational asthma. Also, chronic low exposure is thought to have produced harmful neuropsychiatric effects.

These possibilities are made more ominous by reports that almost three quarters of the men involved at some time had to stop work and get into fresh air. It was not surprising that smokers did not come out of the tests too well and were found to suffer more from shortness of breath, phlegm and cough. But a large proportion of almost 100 men involved said that they regularly suffered from irritations, coughing and stomach trouble while painting.

Figures show that 65 per cent suffered from eye irritation, 70 per cent lightheadedness, 50 per cent throat irritation and 40 per cent nausea. Also 71 per cent complained of a taste of solvents in their mouths, and many suffered from a combination of these unpleasant effects.

The critical symptoms affecting the men who were forced to stop work were

lightheadedness and sore or runny eyes.

It was very likely that the levels of solvents were quite high in the confined quarters where the paint was being applied. Most paint makers do advise that there is proper ventilation and that breathing apparatus is used when necessary.

Many of the painters disliked the full-face air-fed masks which were supplied, saying they were too heavy and bulky for comfort. When they used half-face masks they suffered problems with irritants getting into their eyes.

The survey concluded that several approaches could be made to the problem. These included making the painters aware of the risks involved in not using the face-masks, using paints with less volatile solvents, and improving ventilation.

One leading paint maker said that it would be difficult to make paints with less solvents, and the only way to cut down on curing agents would be to use heat to cure the paint. This would be unsatisfactory in a confined space.

Obviously there has not been strict enough control of painting practices in the particular dockyard concerned, and although things are now being tightened up there it is clear that other painters will also suffer unless they are very careful.

Similar problems have been found in the past with welders in dockyards. They have suffered from metal fume fever, and a study by the Institute of Naval Medicine showed that this was largely due to their reluctance to wear suitable protective masks.

According to the officer who conducted the paint survey, it is likely that the effects are only temporary, but this is not guaranteed.

# Boat paints are killing estuaries and fisheries

by Andrea Granahan

Scientists are warning fishermen and pleasure boaters that the bottom paints they are using on their boats is highly toxic and is killing off life in marinas, and estuaries.

"This is not environmental red flag waving. This is serious. The compounds we are looking at are much worse than DDT and may be the environmental problem of the 1980s and 1990s," said Paul Siri, manager of the Bodega Marine Laboratory in California.

The culprit is tin. Anti-fouling boat paints have switched from a copper base to tin in recent years. Now there is evidence that the tin based paints are responsible for the death of a major oyster fishery in Europe.

Britain and France have already severely curtailed the use of the paints.

A report funded by the California Department of Water Resources and the Environmental Protection Agency has been issued by Scripps Institute of Oceanography. Dr. E. Goldberg, a leading marine chemist, studied a number of American marinas and determined tin compounds, tributyltin and dibutyltin, are turning estuaries into "sterile deserts."

A general alert has gone out to those who use the paints. Some marine suppliers have appealed to paint companies to come up with a substitute. The EPA is reviewing Goldberg's alarming report. Marine scientists are calling for a ban of the product.

# Antifoulant

# search

# takes

# a new turn

ATTEMPTS to find an alternative to the toxic organotins used in anti-fouling paints have taken a new turn, reports ROBIN BURTON. Scientists in the USA and Britain are beginning to concentrate on formulae which deter foulants from settling, rather than poisoning them and the surrounding water.

A British research team from the oil company Shell last year announced the development of silicone rubber coating impregnated with ordinary mineral oil. It is about 5 mm thick, and marine life is unable to get a grip on it and goes away.

It is open to question whether bacteria will develop to beat the repellent, but after six years of testing there has been no sign of the necessary genetic mutations.

The US Naval Research Laboratory has developed an experimental coating of powdered polytetrafluoroethylene, more widely known as Teflon, dispersed in fluorinated polymers. It is meant to have the same effect as a non-stick frying pan.

A sample coating was applied to the hull of a tug-boat, and the results were promising. The coating has been found to be effective in preventing marine life from taking a grip.

This paint is said to have several advantages. Apart from being non-poisonous and long-lasting it can be

easily cleaned off underwater with a power brush.

Further research at the University of Delaware has studied the rate at which bacteria attach to various plastic, glass and metal surfaces, and how foulants protect themselves from each other. It has been found that sessile organisms, such as

sponge, which cannot move, protect themselves by producing secondary metabolites.

Several natural marine products have also been found to contain halogen elements, such as bromine, chlorine and iodine. These halogens are known as poisons, but are proving effective

as antifoulants at low concentrations which have a minimal affect on the marine environment.

Overall, scientists are hoping that their efforts at 'stealing' chemical systems from the natural world will result in better ways of controlling fouling on ship-hulls.

## **ADDITIVE MAKES PAINT SAFER**

THE Star Brite Corporation claims to have developed an antibiotic marine paint additive which will satisfy the demands of skippers and environmentalists. Compound X increases the life of anti-fouling paints without giving off the toxic materials which can be harmful to marine life and to humans.

Despite being a very costly operation, bottom painting is important to fishing vessels as it provides a safeguard against fouling, which ultimately increases drag and fuel consumption, and reduces profits. But a constant problem with anti-foulants is that their toxic materials are not biodegradable and continue to create a menace.

Dr. Ralph Grams of the Department of Pathology at the University of Florida has been working on these problems for several years. He selected a series of compounds thought to be active underwater and added them to existing paint formulae. One of these compounds proved to be highly active, adding six or seven months to the lifespan of most anti-foulants in the tidal flow areas off Florida.

Further tests on the compound showed that what toxicity it possessed self-destructed in 12 to 24 hours, and although it does not work indefinitely it has been proved to double the life of most antifouling paints.

HB

149

# STATE OF ALASKA

## DEPARTMENT OF COMMERCE & ECONOMIC DEVELOPMENT

### DIVISION OF INSURANCE

BILL SHEFFIELD, GOVERNOR

P. O. BOX D  
JUNEAU, ALASKA 99811-0800  
PHONE: (907) 465-2515

March 23, 1987

Honorable Adelheid Herrmann  
Alaska House of Representatives  
P. O. Box V  
Juneau, AK 99811

Dear Representative Herrmann:

Re: House Bill 149 Insurance for Oil Terminals

This is in response to the inquiry of your aide, Rena, of March 20.

At the present time the Division of Insurance is talking with a Lloyds of London broker to explore the following options.

How much would it cost to the fuel deliverer to buy a wharfman's policy that would insure his activity in fueling up an on-land storage unit. By transferring this liability to the fuel deliverer, it would lessen the liability of the utility. Presently a typical Lloyds policy excludes this activity for the fuel deliverer. The Lloyds of London broker is presently exploring the possibility of how much it would cost to take out this exclusion and make it a part of the policy.

The second option the Lloyds of London broker is exploring is how much would it cost to have the same policy that is in force right now for those fuel tanks in Ushigak and Naknek on Lloyds of London paper. I should know by Wednesday, March 25.

The broker is also evaluating the cost impact of a wharfsman's policy on a policy presently in force.

Sincerely,



Christian Ulmann  
Insurance Market Analyst  
Commercial Lines

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032387b

NUSHAGAK ELECTRIC COOPERATIVE, INC.  
P. O. Box 350  
Dillingham, Alaska 99576  
Phone: 842-5251

My name is Jeri Nelson. I'm office manager for Nushagak Electric Cooperative, Inc. in Dillingham, Alaska. I'm here to speak in support of HB 149, exempting electric cooperatives operating oil terminal facilities from compliance with Alaska Statute 46.04.040.

Dillingham exists because of the resident herring and salmon commercial fisheries. Many of our Co-op members are directly involved in these fisheries as commercial fisherman. Most others are involved in municipal, state or federal service programs that have evolved because this resident commercial fishery exists.

Of the seven elected members of our Board of Directors, only three are not directly involved in the fisheries as commercial fishermen.

My husband and I came to Dillingham 25 years ago so he could accept employment as Area Management Biologist for the Alaska Dept. of Fish & Game in Bristol Bay. Every resident in Dillingham is there, in one way or another, because of the fisheries.

I tell you these things so you will recognize that the cleanliness of our natural environment and the waters of Bristol Bay is of vital importance to every member of our Cooperative. Habitat protection is the number one priority in maintaining the fisheries resources.

As you know, Alaska Statute 46.04.040 requires cooperatives operating fuel storage tanks in excess of 10,000 barrels (420,000 gallons) to submit proof of financial responsibility for oil spill clean-up in the amount \$1,000,000 in order to store or off-load fuel.

Nushagak Electric Cooperative, Inc., falls under the provisions of this statute because of action we took in 1985 to gain some relief from the sky-rocketing cost of fuel being supplied to us by CHEVRON, the local distributor. At that time, using State grant monies, we constructed two 500,000 gallon fuel storage tanks on utility property adjacent to our powerhouse.

To briefly comment on that construction and our bulk facilities, the tanks are located in a diked enclosure with 5 ft. steel retaining walls. In conjunction with the tank construction, a 6 inch pipeline was buried at depths of 3 to 8 feet connecting the tank farm to the City Dock, located some 3600 feet away, where a 6 inch check valve and gate valve are installed on the terminating header.

The pipe itself is a combination of Schedule 40 and Schedule 80 steel pipe. All connections were welded by a certified pipeline welder and Schedule 80 pipe was used under all street crossings and under the Dock loading zone area for added strength. When completed, the entire pipeline was pressure tested at 250 pounds per square inch. This pressure held for about 6 weeks, at which time the pressure was manually released.

There are two one-way check valves located in the 6 inch line before it enters the diked enclosure and one one-way check valve in the enclosure itself. In addition, there are three 6 inch outside screw and yoke gate valves in the line and one at each tank. Our facilities were carefully engineered and inspected and are really "first class."

Regarding the measures we have taken to protect the environment and to deal with any problem that might arise, in 1985, NEC completed a Coast Guard approved OIL TRANSFER OPERATIONS MANUAL and a DEC required OIL SPILL CONTINGENCY PLAN. Our General Manager and powerhouse personnel have been trained in implementation of these documents as required by the U. S. Coast Guard and DEC. In addition, the Cooperative has entered into contracts for potential clean-up services with ALASKA OFFSHORE INC. and CROWLEY ENVIRONMENTAL SERVICES.

Since the tank and pipeline project was completed in the fall of 1985, the Cooperative has received two fuel deliveries averaging approximately 900,000 gallons each. During each delivery, a U.S. Coast Guard representative was present and no spills or any other adverse environmental incidents occurred.

During fuel transfer operations, which normally take place over a 34 hour period each year, trained utility personnel are present both at the dock where the actual off-loading takes place and at our tank farm, some 3600 feet distant. They are in radio contact at all times. In addition, the fuel barge always has a least one man, and usually more than one, present at all times during the loading process. A Coast Guard representative oversees the entire operation.

Considering our previously stated concerns about the health of the environment, why are we asking for relief from compliance with this statute which only requires assurance of financial responsibility for oil-spill clean-up?

WE MUST HAVE THE FUEL. But, in order to off-load our fuel, it is possible that we will, in the future, be forced to violate Alaska Statute 46.04.040 as it is written, a problem shared with utilities in Naknek, Kotzebue and Nome.

1. In 1985, we were able, at the last minute, to secure spill insurance coverage through the ALASKA RURAL ELECTRIC COOPERATIVE'S INSURANCE EXCHANGE for the first \$500,000 and a letter of credit from the NATIONAL RURAL UTILITIES COOPERATIVE FINANCE CORPORATION for the remaining \$500,000.
2. In 1986, ARECA couldn't secure this liability coverage. With the help of our attorney and the State of Alaska, we were able, again at the last minute, to find a commercial market for a \$1,000,000 limit oil spill insurance policy at a premium cost to our Co-op of \$10,400.
3. Our broker has warned us that in the future, it is likely that it will be impossible to secure this type of insurance at any cost, the trend in the insurance market being to exclude losses related to environmental exposures.

For our own protection, we would, of course, purchase such insurance if it were available, even though the premium seems somewhat excessive for approximately 34 hours of exposure each year.

If this coverage is not available, however, we would have no choice but to off-load in violation of statute or to abandon our tank farm facilities and purchase fuel through the local distributor at a per gallon cost 15-20 cents higher than the low-cost product we have been able to barge into Dillingham for the past two years. Of course, this higher priced fuel would significantly raise the PCE credit available to our customers which would, in turn, result in a substantial additional and unnecessary drain on the State's limited financial resources -- to the tune of approximately \$6,000 per month, a 12.5 % increase (using December figures under existing program guidelines).

NEC currently holds over \$1,000,000 equity in its system, an amount that exceeds the \$1,000,000 assurance required by Statute. NEC has taken all preventative measures suggested or requested by DEC, the U.S. Coast Guard and common sense, as outlined previously. In the unlikely event that a spill should occur, NEC's members and directors would expect and demand that their Cooperative do everything within its resources to clean-up the environment.

One of two things must happen in order for NEC to continue to legally procure and off-load fuel at competitive prices: (1) We must be relieved from compliance with AS 46.04.040 in order to make necessary commitments for purchase and delivery at a time when availability of insurance is uncertain, or (2) We must be assured that adequate oil spill liability insurance is available to us in a timely manner each and every year.

Unfortunately, the State does not control the insurance markets; consequently, we seek your support of HB 149, exempting electric cooperatives operating as oil terminal facilities from compliance with AS 46.06.040.

Thank you.



# ALASKA RURAL ELECTRIC COOPERATIVE ASSOCIATION, INC.

237 E. FIREWEED LANE • SUITE 301  
ANCHORAGE, ALASKA 99503 • (907) 276-3235

January 15, 1986

Representative Adelheid Herrmann  
Alaska State Legislature  
Pouch V (MS 3100)  
Juneau, Alaska 99811

Dear Representative Herrmann:

Last November, Claude Franke and Dave Bouker wrote you about a problem they were having -- and expecting to get worse -- caused by a statutory requirement that they buy strict liability insurance for oil spills. Both NEC and NEA have increased their fuel storage capacity in recent years in order to buy competitively priced oil and store it themselves. It was increasing their tank capacity above 10,000 barrels that makes this statute apply to them.

For 1985 we went through great difficulty to find a way to help these two small coops comply with the law. Their regular policy for general liability insurance issued by the ARECA Insurance Exchange provided \$500,000 of oil spill insurance. There was no other oil spill liability insurance available for them to buy at any price.

To get the additional \$500,000 in coverage for them, what we had to do was to get them to indemnify the Exchange and post an irrevocable letter of credit payable to the Exchange to cover costs of oil spills between \$500,000 and \$1 million, and the Exchange then issued the insurance policy. This insurance policy met the DEC requirements, but the coops were fully responsible for any losses exceeding \$500,000 which might have occurred. This arrangement cost them the fee for the letter of credit and the expenses incurred by the Exchange for setting it up. Much more importantly, this approach tied up a major part of their credit capacity which then could not be used for normal business requirements.

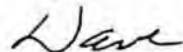
For 1986, even the ARECA Insurance Exchange is completely unable to provide oil spill insurance because it is not possible for us to buy reinsurance covering oil spills. This means that the only way for NEC and NEA to comply with the law is go through the cumbersome and expensive process of retaining the

entire risk of the \$1 million policy limit, and have the Exchange issue the \$1 million policy. But this would use nearly their entire line of credit! They might not even be able to borrow the money to buy the fuel which they would have sole responsibility to clean up if they spilled some of it.

This is an absurd situation which requires a legislative solution this session. Claude and Dave sent you a draft providing an easy way of resolving the problem. Our idea is that a certificate of public convenience and necessity for a utility should be proof in itself of financial responsibility. A utility isn't going anywhere. If a spill occurs, they will still be there and have the financial ability to pay for the clean up.

After consulting with the attorney who drafted it, I have slightly reorganized the proposed statutory amendment. We hope you will introduce a bill to resolve the problem being experienced by NEC and NEA and push it through to passage.

Sincerely,



David Hutchens  
Executive Director

DH/CF

cc: Claude Franke, NEA  
Dave Bouker, NEC

cc: KEN JOHNSON

# STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

BILL SHEFFIELD, GOVERNOR

Telephone: (907) 465-2653

Address: Box 0

Juneau, Alaska 99811

January 27, 1986

JAN 29 1986

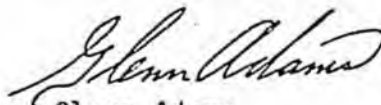
Mr. Dave Hutchens  
ARECA Insurance Exchange  
237 East Fireweed Lane, Suite 301  
Anchorage, AK 99503

Dear Dave:

During your phone call last week to myself and Paul O'Brien, Manager of the Oil Pollution Program, problems of obtaining adequate insurance coverage for oil pollution damages were discussed. Paul agreed that I would review our files and send you the names of insurance underwriters that have current policies in force. I reviewed the files and came up with four underwriters and information on what other fuel handling companies are doing (enclosed); I am also sending a copy of the report from the Task Force on Insurance Availability and Pricing.

The Department of Commerce and Economic Development, Division of Insurance said they can provide "special market assistance" to the broker, their address is on the Task Force report. We will continue to work with the industry in every way that we can.

Sincerely,



Glenn Adams  
Oil Pollution Control  
Division of Environmental Quality

cc: Keith Kelton, Director  
; Bill Ross, Commissioner  
.. Representative Adelheid Herrmann  
Representative Rich Yehling  
Senator Fred F. Zharoff

January 23, 1986

### INSURANCE INFORMATION FOR FUEL STORAGE FACILITIES

The following information is taken from current files that require proof of financial responsibility for oil pollution for "fuel storage facilities." This information is not an endorsement or recommendation but is provided in an attempt to help locate insurance coverage that will comply with Sec. 46.04.040(e) and 18 AAC 20.065.

Insurance underwriters and brokers that have currently active policies:

1. Lloyd's London and various companies  
Broker - Pacific International Brokers, Ltd.
2. Employers Mutual Casualty Company  
Broker - Mutual Marine Office, Inc.
3. National Union Fire Insurance Company of Pittsburgh, Pa.  
Broker - Alaska 100 Insurance
4. Midlands Insurance Company, Inc.  
by West Coast Marine Managers, Inc.  
Broker - Nasman and Associates, Inc.

The 34 files (representing 67 facilities) are broken down to show how many are using other means of providing proof of financial responsibility.

Surety Bonds	4
Guaranty	3
*Self-Insurance	12
Government	3
Insurance	8
Other	7

\* Some use this means to cover deductible or financial records requirements for guaranty.

Of the eight showing insurance as their preference, five have policies that expired this December and January and are trying to renew their policies. There are seven new owners/operators that have not returned their application forms or shown what means of proof they intend to use.

Glenn Adams  
Oil Pollution Control



# ALASKA RURAL ELECTRIC COOPERATIVE ASSOCIATION, INC.

237 E. FIREWEED LANE • SUITE 301  
ANCHORAGE, ALASKA 99503 • (907) 276-3235

February 21, 1986

Representative Mike Davis, Chairman  
House Special Committee on Oil & Gas  
Alaska State Legislature  
Pouch V (MS 3100)  
Juneau, Alaska 99811

Dear Mike:

As I indicated in our brief conversation yesterday afternoon, we would really like to get HB 628 moving and hope you will schedule it at the earliest opportunity. This letter is in response to a request from Jonathan for additional information.

Enclosed is a copy of my letter to Representative Herrmann asking that this kind of legislation be introduced. It gives the background to the problem, specifically for Naknek Electric and Nushagak Electric. Both are cooperatives and members of our organization.

Also enclosed is a copy of correspondence from Glen Adams, of the Department of Environmental Conservation, suggesting some other places to look for means of complying with the statute. When I received the letter from Glen, I gave a copy to our insurance consultant and broker, Corroon & Black, Dawson and Company. After they checked out each suggestion, Joe Piccione wrote me a letter detailing their findings. A copy of this letter is enclosed. It indicates conclusively that in today's insurance market, compliance is simply impossible.

Jonathan also asked which utilities have this problem, what are their tank capacities, and how often do they fill their tanks.

At present, Nushagak Electric and Naknek Electric are the only utilities which have had dealings with DEC on this issue. Kotzebue Electric also has new tank capacity sufficient to bring them into the same problem, but DEC has not yet made an issue of it with them. Nome Joint Utilities, a municipal utility, is negotiating to lease tank space to use in 1986. If their negotiations are successful, they will have sufficient capacity to face the same problem. (I hope that my responding fully to Jonathan's questions will not cause problems for Kotzebue or Nome.)

DEMOCRACY IN ACTION

Representative Mike Davis  
February 21, 1986  
Page 2 of 2

The tank capacities for these four utilities will vary from approximately 20,000 to 35,000 barrels. They typically fill their tanks only once a year. That is why they need so much tank capacity in these ice-bound communities.

We understand that DEC has offered to "look the other way," but even a non-willful violation of this statute is a Class B Misdemeanor. Each day of non-compliance is a separate violation. This is a serious business that simply must be resolved legislatively.

Thank you for your interest. If you have additional information, please let me know.

Sincerely,



Dave Hutchens  
Executive Director

Enclosures

DH:ph

# STATE OF ALASKA

**BILL SHEFFIELD, GOVERNOR**

## **DEPT. OF ENVIRONMENTAL CONSERVATION**

*Telephone: (907)*

*Address:*

OFFICE OF THE COMMISSIONER  
P. O. BOX 0, JUNEAU, ALASKA 99811-1800

(907) 465-2600

March 25, 1986

The Honorable Mike Davis  
Alaska State House  
P. O. Box V  
Juneau, AK 99811-3100

Dear Representative Davis:

During the last several weeks, the Department has testified before the Oil and Gas Subcommittee on HB 628 and has worked with your office and staff from Representative Herrmann's office in addressing the difficulties faced by electric cooperatives in meeting the Department's oil pollution financial responsibility requirements. We have also been working closely with the Division of Insurance and representatives from the rural electric cooperatives in this matter. Based upon numerous discussions with legislative staff, the Division of Insurance, and a representative of the electric cooperatives, I believe that we have identified ways to resolve these issues.

Such a resolution is largely dependent upon the Department addressing two items: 1) amending our financial responsibility regulations to accept claims made insurance policies, and 2) clarifying the types of damages that are covered under the financial responsibility requirements. This letter is intended to show the steps I am preparing to take to satisfy these concerns, thereby enabling the cooperatives to meet the Department's financial responsibility requirements in a cost effective manner.

First, I am prepared to amend the Department's financial responsibility regulations to add claims made insurance policies as an option for oil facility operators such as the electric cooperatives. We have worked closely with the Division of Insurance on this change and have already drafted language to this effect. At the same time that we reevaluate our insurance requirements, we will be looking at the other options available for demonstrating proof of financial responsibility to determine if any other revisions to the regulations are necessary.

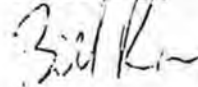
March 25, 1986

With regard to the second issue requesting clarification of the types of damages covered under the financial responsibility requirements, my staff has been in contact with the Attorney General's office on this matter. We have been assured that the Department's financial responsibility regulations apply to the operator's liability to others, i.e. third parties. Therefore, insurance policies should be available for this type of coverage. There has also been concern expressed by the cooperatives that insurance is not available to cover the civil damages and penalties referenced under the financial responsibility statutes. This position is predicated on the assumption that insurance will not pay for penalties of a punitive nature. However, the civil penalty and damage statutes referenced under AS 46.04.040 are not punitive. In fact, they are used for compensatory and remedial purposes associated with liquidated damages to the State. It is my understanding that insurance is available to cover these types of damages.

We have made substantial progress in identifying the issues and we have worked to resolve the financial responsibility problem that has been brought before the Legislature by the electric cooperatives. I believe that the action I have outlined above will solve the difficulty in obtaining insurance.

It should also serve to provide more flexibility in the regulations and make it easier for facility operators to satisfy the Department's financial responsibility requirements.

Sincerely,



Bill Ross  
Commissioner

cc: Representative Adelheid Herrmann  
Representative John Sund  
Christian Ulmann, Division of Insurance  
Dave Hutchins, ARECA Insurance Exchange

# STATE OF ALASKA

BILL SHEFFIELD, GOVERNOR

## DEPARTMENT OF COMMERCE & ECONOMIC DEVELOPMENT

POUCH D  
JUNEAU, ALASKA 99811  
PHONE: 465-2515

### DIVISION OF INSURANCE

April 24, 1986

Honorable Mike Davis  
Alaska State House  
House Special Committee  
on Oil and Gas  
P.O. Box V  
Juneau, AK 99811-3100

Dear Representative Davis:

Re: HB 628. Oil pollution insurance availability  
for electric cooperatives

After receipt of Commissioner Bill Ross's letter of March 25, 1986, which clarified the types of damages covered under the financial responsibility requirements, we were in a position to identify potential markets and have shared that information with the Alaska Rural Electric Cooperative Association (ARECA). Additionally, we contacted several underwriters in an attempt to generate interest in ARECA.

We found several possible options which are, at the present time, being checked out by ARECA's insurance broker:

The International Surplus Lines Insurance Company is the only writer of monoline pollution liability insurance at a reasonable rate. It appears that the electric utilities have a good chance to obtain insurance through this outfit.

The Pollution Liability Insurance Association (PLIA) is a reciprocal pool that arranges reinsurance for its member companies covering pollution liability. Alaska Statutes 21.75.020 and 21.39.110 do not prohibit ARECA from joining such an arrangement. ARECA might wish to check out the requirements for becoming a member. Since ARECA is not a member of PLIA, PLIA will write pollution liability in connection with the general liability only if the whole risk has been submitted by a member company. For ARECA, that means that they might have to split the accounts where pollution liability is required.

Honorable Mike Davis

-2-

April 24, 1986

Further, we found other insurance companies that would write under the conditions outlined by Commissioner Bill Ross of the Department of Environmental Conservation. However, they did not seem to be very cost efficient. We also made recommendations on how to limit the liability exposures and, consequently, obtain a better rate.

We will continue to touch base with the insurance companies and ARECA and try to improve communications.

If you want or need more discussion, I will be happy to expand on this letter.

Very truly yours,



Christian Ulmann  
Insurance Market Analyst  
Commercial Lines

CU/ss0242Z

042486a

cc: Representative Adelheid Herrmann  
Representative John Sund  
Commissioner Bill Ross, Department of Environmental Conservation  
Dave Hutchens, ARECA Insurance Exchange

# STATE OF ALASKA

STEVE COWPER, GOVERNOR

## DEPT. OF ENVIRONMENTAL CONSERVATION

Telephone: (907)  
Address:

### POSITION PAPER

Bill No. HB 149

Date: March 20, 1987

Title: An Act relating to certain oil terminal operators.

Contact: Randy Bayliss  
465-2600

### Department's Position

We do not support the bill. Insurance and other means of providing proof of responsibility requirements are available to electric cooperatives for satisfying the department's requirements under AS 46.04.

### Effect of the Bill

HB 149 amends the department's oil pollution statutes (AS 46.04) to exempt all electric cooperatives that operate an oil terminal facility with a storage capacity of 10,000 barrels or more from demonstrating proof of financial responsibility to the department. Under AS 46.04.040, all operators of offshore oil exploration and production facilities, tank vessels, oil barges, and oil terminal facilities with a storage capacity of 10,000 barrels or more must show to the department that they are financially capable of compensating for damages that might result from oil spills at their facilities. The amount of financial responsibility required under AS 46.04 for oil terminals, such as those operated by electric cooperatives, is \$10 per barrel of storage capacity or \$1 million, whichever is greater. Financial responsibility may be demonstrated by self-insurance, guaranty, insurance, or surety bond.

### Impact on the Agency

HB 149 will have no fiscal impact on the department.

  
Dennis D. Kelso  
Commissioner



# NAKNEK ELECTRIC ASSOCIATION, INC.

POST OFFICE BOX 118 • NAKNEK, ALASKA 99633 • PHONE (907) 246-4261

November 1, 1985

Rep. Adelheid Herrmann  
P.O. Box 63  
Naknek, AK 99633

Sen. Fred Zharoff  
P.O. Box 405  
Kodiak, AK 99615

RE: STATUATE COMPLIANCE TO FINANCIAL RESPONSIBILITY

Your Honors Herrmann & Zharoff:

This past and previous year extreme problem has arisen with this Association, Naknek Electric Association, (N.E.A.) and our neighboring cooperative, Nushagak Electric Cooperative, (N.E.C.) and the Alaska Department of Environmental Conservation. (D.E.C.)

Compliance satisfaction with the Department to Section 1 as 46.04.040 (e) "Financial Responsibility" as formed in the law provides a very constraining element for a small rural utility to provide \$1,000,000 in financial responsibility, or bonding, or assurity.

We are put into this situation due to our geographic and economic location. With the requirements of providing economic and reliable electric service to our given service areas, we must have fuel; our fuel requirement constitutes near 50% of our production costs.

In an effort to reduce our costs, large volume storage vessels have been constructed by our respective utilities to facilitate bulk fuel procurement by joint bidding. One time a year we have delivery in our ice bound ports providing a year round supply along with reducing the exposure of handling fuel several times a year outside of our property.

The net result has brought down fuel costs per gallon to .8714 for this years fuel. This saving reduced the delivered kilowatt hour by .02¼¢ for each delivered kilowatt hour to the consumer. Likewise the first 750 kilowatt hours cap for Power Cost Equalization (PCE) has realized the same reduction of .02¼¢, saving the PCE fund \$168,885 for the two cooperatives. This saving is for the State of Alaska by prudent action of the cooperatives.

PAGE TWO  
HERRMANN & ZHAROFF  
November 1, 1985

Now then, the D.E.C. comes forth with unbending rules, regulations, and law forcing expenditures for premium of unobtainable insurance and or surity bonding, irrevocable line of credit or proof of financial responsibility; of course, the last being the most desirable but hereto unobtainable. If we do not have one of the previous required surities we are outside of the law and subject to severe penalty as well as being unable to obtain the necessary permit to off load fuel.

This year, after spending nearly 10 months searching the insurance market, (even from firms suggested by D.E.C., which incidentally flatly denied or did not respond to our broker) we were able to provide D.E.C. with unconventional one time surity for this years fuel off loading at our facilities. We have been put on notice that the same coverage will not be available next year. We, too, anticipate conventional underwriting will not be available nor will we be able to prove to satisfaction our financial responsibility to the unbending D.E.C.

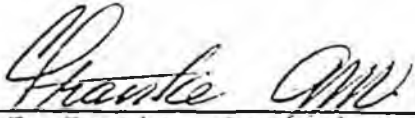
The law as written seems to be directed to non-permanent principals in the business of transporting fuel rather than permanent facilities such as ours. (N.E.A. and N.E.C.) These two cooperatives have taken due and concerned steps to build the best fuel and service systems we could with total attention to safety and integrity.


We and all utilities have every intention of continued existence with address to our responsibilities. What we are saying is, if we have a spill, we most certainly will clean it up without the constraints of the law imposing financial burden upon us, and more important yet, all of our consumers are members of the community, and our members derive their livelihood from the sensitive fishery environment and will see to it that we clean up any spill which may occur.

With all this discourse, hopefully, the stage is set to request your legislative efforts to amend Section 1 & 2 of AS. 46.04.040 (e) to read as attached.

If you have questions with our request for legislation, please feel free to contact us.

Sincerely,

  
C.E. Franke, General Manager  
Naknek Electric Assoc., Inc.

  
Dave Bouker, General Manager  
Nushagak Electric Cooperative

CEF/sp

cc: Dave Hutchens, Executive Director, A.R.E.C.A.  
Roger Kempel, N.E.A. & N.E.C., counsel  
KEMPPEL, HUFFMAN, & GINDER

(e) Financial responsibility may be demonstrated by self-insurance, insurance, surety, possession of a certification of public convenience and necessity issued under AS 42.05, or guarantee, under terms the department may prescribe. An action under AS 45.03.73a, 45.03.73b, or 45.03.73c may be brought in a court of law directly against the insurer or other person providing evidence of financial responsibility. The applicant, and an insurer, surety, or guarantee shall employ an agent for service of process in the state. An insurer must either be authorized by the Department of Commerce and Economic Development to sell insurance in the state or be an unauthorized insurer listed by the Department of Commerce and Economic Development as not disapproved for use in the state.

\* Section 2. This Act takes effect immediately in accordance with AS 01.10.070 (c).



ALASKA RURAL ELECTRIC COOPERATIVE  
ASSOCIATION, INC.

237 E. FIREWEED LANE • SUITE 301  
ANCHORAGE, ALASKA 99503 • (907) 276-3235

January 15, 1986

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Alaska State Legislature  
Pouch V (MS 3100)  
Juneau, Alaska 99811

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Sincerely,



David Hutchens  
Executive Director

DH/CF

cc: Claude Franke, NEA  
Dave Bouker, NEC

cc: KEN JOHNSON

# STATE OF ALASKA

BILL SHEFFIELD, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION

Telephone: (907) 465-2653

Address: Box 0

Juneau, Alaska 99811

January 27, 1986

JAN 29 1986

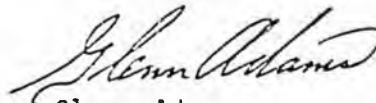
Mr. Dave Hutchens  
ARECA Insurance Exchange  
237 East Fireweed Lane, Suite 301  
Anchorage, AK 99503

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Sincerely,



Glenn Adams  
Oil Pollution Control  
Division of Environmental Quality

cc: Keith Kelton, Director  
Bill Ross, Commissioner  
Representative Adelheid Herrmann  
Representative Rich Yehling  
Senator Fred F. Zharoff

January 23, 1986

### INSURANCE INFORMATION FOR FUEL STORAGE FACILITIES

The following information is taken from current files that require proof of financial responsibility for oil pollution for "fuel storage facilities." This information is not an endorsement or recommendation but is provided in an attempt to help locate insurance coverage that will comply with Sec. 46.04.040(e) and 18 AAC 20.065.

Insurance underwriters and brokers that have currently active policies:

1. Lloyd's London and various companies  
Broker - Pacific International Brokers, Ltd.
2. Employers Mutual Casualty Company  
Broker - Mutual Marine Office, Inc.
3. National Union Fire Insurance Company of Pittsburgh, Pa.  
Broker - Alaska 100 Insurance
4. Midlands Insurance Company, Inc.  
by West Coast Marine Managers, Inc.  
Broker - Nasman and Associates, Inc.

The 34 files (representing 67 facilities) are broken down to show how many are using other means of providing proof of financial responsibility.

Surety Bonds	4
Guaranty	3
*Self-Insurance	12
Government	3
Insurance	8
Other	7

\* Some use this means to cover deductible or financial records requirements for guaranty.

Of the eight showing insurance as their preference, five have policies that expired this December and January and are trying to renew their policies. There are seven new owners/operators that have not returned their application forms or shown what means of proof they intend to use.

Glenn Adams  
Oil Pollution Control



# ALASKA RURAL ELECTRIC COOPERATIVE ASSOCIATION, INC.

237 E. FIREWEED LANE • SUITE 301  
ANCHORAGE, ALASKA 99503 • (907) 276-3235

February 21, 1986

Representative Mike Davis, Chairman  
House Special Committee on Oil & Gas  
Alaska State Legislature  
Pouch V (MS 3100)  
Juneau, Alaska 99811

Dear Mike:

As I indicated in our brief conversation yesterday afternoon, we would really like to get HB 628 moving and hope you will schedule it at the earliest opportunity. This letter is in response to a request from Jonathan for additional information.

Enclosed is a copy of my letter to Representative Herrmann asking that this kind of legislation be introduced. It gives the background to the problem, specifically for Naknek Electric and Nushagak Electric. Both are cooperatives and members of our organization.

Also enclosed is a copy of correspondence from Glen Adams, of the Department of Environmental Conservation, suggesting some other places to look for means of complying with the statute. When I received the letter from Glen, I gave a copy to our insurance consultant and broker, Corroon & Black, Dawson and Company. After they checked out each suggestion, Joe Piccione wrote me a letter detailing their findings. A copy of this letter is enclosed. It indicates conclusively that in today's insurance market, compliance is simply impossible.

Jonathan also asked which utilities have this problem, what are their tank capacities, and how often do they fill their tanks.

At present, Nushagak Electric and Naknek Electric are the only utilities which have had dealings with DEC on this issue. Kotzebue Electric also has new tank capacity sufficient to bring them into the same problem, but DEC has not yet made an issue of it with them. Nome Joint Utilities, a municipal utility, is negotiating to lease tank space to use in 1986. If their negotiations are successful, they will have sufficient capacity to face the same problem. (I hope that my responding fully to Jonathan's questions will not cause problems for Kotzebue or Nome.)

Representative Mike Davis  
February 21, 1986  
Page 2 of 2

The tank capacities for these four utilities will vary from approximately 20,000 to 35,000 barrels. They typically fill their tanks only once a year. That is why they need so much tank capacity in these ice-bound communities.

We understand that DEC has offered to "look the other way," but even a non-willful violation of this statute is a Class B Misdemeanor. Each day of non-compliance is a separate violation. This is a serious business that simply must be resolved legislatively.

Thank you for your interest. If you have additional information, please let me know.

Sincerely,



Dave Hutchens  
Executive Director

Enclosures

DH:ph

**DEPT. OF ENVIRONMENTAL CONSERVATION**

Telephone: (907)

Address:

OFFICE OF THE COMMISSIONER  
P. O. BOX 0, JUNEAU, ALASKA 99811-1800

(907) 465-2600

March 25, 1986

The Honorable Mike Davis  
Alaska State House  
P. O. Box V  
Juneau, AK 99811-3100

Dear Representative Davis:

During the last several weeks, the Department has testified before the Oil and Gas Subcommittee on HB 628 and has worked with your office and staff from Representative Herrmann's office in addressing the difficulties faced by electric cooperatives in meeting the Department's oil pollution financial responsibility requirements. We have also been working closely with the Division of Insurance and representatives from the rural electric cooperatives in this matter. Based upon numerous discussions with legislative staff, the Division of Insurance, and a representative of the electric cooperatives, I believe that we have identified ways to resolve these issues.

Such a resolution is largely dependent upon the Department addressing two items: 1) amending our financial responsibility regulations to accept claims made insurance policies, and 2) clarifying the types of damages that are covered under the financial responsibility requirements. This letter is intended to show the steps I am preparing to take to satisfy these concerns, thereby enabling the cooperatives to meet the Department's financial responsibility requirements in a cost effective manner.

First, I am prepared to amend the Department's financial responsibility regulations to add claims made insurance policies as an option for oil facility operators such as the electric cooperatives. We have worked closely with the Division of Insurance on this change and have already drafted language to this effect. At the same time that we reevaluate our insurance requirements, we will be looking at the other options available for demonstrating proof of financial responsibility to determine if any other revisions to the regulations are necessary.

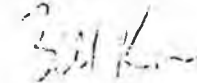
March 25, 1986

With regard to the second issue requesting clarification of the types of damages covered under the financial responsibility requirements, my staff has been in contact with the Attorney General's office on this matter. We have been assured that the Department's financial responsibility regulations apply to the operator's liability to others, i.e. third parties. Therefore, insurance policies should be available for this type of coverage. There has also been concern expressed by the cooperatives that insurance is not available to cover the civil damages and penalties referenced under the financial responsibility statutes. This position is predicated on the assumption that insurance will not pay for penalties of a punitive nature. However, the civil penalty and damage statutes referenced under AS 46.04.040 are not punitive. In fact, they are used for compensatory and remedial purposes associated with liquidated damages to the State. It is my understanding that insurance is available to cover these types of damages.

We have made substantial progress in identifying the issues and we have worked to resolve the financial responsibility problem that has been brought before the Legislature by the electric cooperatives. I believe that the action I have outlined above will solve the difficulty in obtaining insurance.

It should also serve to provide more flexibility in the regulations and make it easier for facility operators to satisfy the Department's financial responsibility requirements.

Sincerely,



Bill Ross  
Commissioner

cc: Representative Adelheid Herrmann  
Representative John Sund  
Christian Ulmann, Division of Insurance  
Dave Hutchins, ARECA Insurance Exchange

STATE OF ALASKA



POUCH V  
JUNEAU, ALASKA 99811  
(907) 465-4941

HOUSE SPECIAL COMMITTEE ON OIL AND GAS

April 2, 1986

Commissioner Bill Ross  
Department of Environmental Conservation  
P.O. Box 0  
Juneau, Alaska 99811-1800

Dear Commissioner Ross,

The House Special Committee on Oil and Gas recently held a hearing on HB 628 and, subsequent to this hearing, conducted several work sessions on the topic of the availability of oil pollution insurance to electric cooperatives. Members of your department, Rep. Herrmann's staff, the Division of Insurance, the Alaska Rural Electric Cooperative Association, and my office identified regulatory measures that could be taken to allow electric cooperatives to meet oil pollution financial responsibility requirements.

Your letter of March 25 acknowledged that the department would be willing to make appropriate regulatory changes as an alternative to the passage of HB 628. It is also my understanding that the department is willing to take the following actions in this regard:

1. Amend 18 AAC 20.065 to allow for the submission of policies issued on a "claims made" basis in addition of "occurrence" policy forms.
2. Secure an Attorney General's opinion clarifying that the financial responsibility requirements apply only to third-party liabilities and not to damages to their own premises or to penalties or punitive damages, and supply that opinion to the electric cooperatives and their insurers.
3. As appropriate, either adopt regulatory changes through the emergency regulatory procedure or enter into an emergency compliance order with the affected utilities.

Thank you for your assistance and responsiveness in attempting to resolve this matter.

Sincerely,

A handwritten signature in cursive script that reads "Mike".

Rep. Mike Davis, Chairman  
House Special Committee on Oil and Gas

**DEPARTMENT OF COMMERCE &  
ECONOMIC DEVELOPMENT**

POUCH D  
JUNEAU, ALASKA 99811  
PHONE: 465-2515

*DIVISION OF INSURANCE*

April 24, 1986

Honorable Mike Davis  
Alaska State House  
House Special Committee  
on Oil and Gas  
P.O. Box V  
Juneau, AK 99811-3100

Dear Representative Davis:

Re: HB 628. Oil pollution insurance availability  
for electric cooperatives

After receipt of Commissioner Bill Ross's letter of March 25, 1986, which clarified the types of damages covered under the financial responsibility requirements, we were in a position to identify potential markets and have shared that information with the Alaska Rural Electric Cooperative Association (ARECA). Additionally, we contacted several underwriters in an attempt to generate interest in ARECA.

We found several possible options which are, at the present time, being checked out by ARECA's insurance broker:

The International Surplus Lines Insurance Company is the only writer of monoline pollution liability insurance at a reasonable rate. It appears that the electric utilities have a good chance to obtain insurance through this outfit.

The Pollution Liability Insurance Association (PLIA) is a reciprocal pool that arranges reinsurance for its member companies covering pollution liability. Alaska Statutes 21.75.020 and 21.39.110 do not prohibit ARECA from joining such an arrangement. ARECA might wish to check out the requirements for becoming a member. Since ARECA is not a member of PLIA, PLIA will write pollution liability in connection with the general liability only if the whole risk has been submitted by a member company. For ARECA, that means that they might have to split the accounts where pollution liability is required.

Honorable Mike Davis

-2-

April 24, 1986

Further, we found other insurance companies that would write under the conditions outlined by Commissioner Bill Ross of the Department of Environmental Conservation. However, they did not seem to be very cost efficient. We also made recommendations on how to limit the liability exposures and, consequently, obtain a better rate.

We will continue to touch base with the insurance companies and ARECA and try to improve communications.

If you want or need more discussion, I will be happy to expand on this letter.

Very truly yours,



Christian Ulmann  
Insurance Market Analyst  
Commercial Lines

CU/ss0242Z  
042486a

cc: Representative Adelheid Herrmann  
Representative John Sund  
Commissioner Bill Ross, Department of Environmental Conservation  
Dave Hutchens, ARECA Insurance Exchange

# MEMORANDUM

RECEIVED AUG 25 1986  
State of Alaska

TO: Hal Brown  
Attorney General  
Department of Law

DATE: July 17, 1986

FILE NO:

TELEPHONE NO: 465-2600

FROM: Bill Ross  
Commissioner  
Department of Environmental  
Conservation

SUBJECT: Legal Opinion Re:  
Financial Responsibility  
Statutes AS 46.04.040

During the 1986 Legislature, legislation was introduced to exempt electric cooperatives from the Department of Environmental Conservation's oil pollution financial responsibility requirements. The filing of this bill was triggered by the difficulties that the cooperatives were experiencing in obtaining oil pollution insurance to meet the financial responsibility requirements of AS 46.04.040. This Department, the Division of Insurance, and the Department of Law worked closely with legislative staff and representatives from the electric coops to identify and resolve the insurance problems.

During hearings and discussions on this legislation, the electric cooperatives, raised concerns that the types of oil spill damages that they believed to be included under the financial responsibility regulations make it difficult to obtain insurance. Insurance representatives for the cooperatives indicated that insurance is not available for damages to the insured's own property or for penalties or damages of a punitive nature. The insurance industry maintains that insurance is only available for oil spill damages caused to third parties.

Consequently, during discussions of the bill, your office advised me that financial responsibility requirements did, in fact, extend only to third party liabilities. We were also informed that the Department's oil spill penalty and damage statutes are clearly not punitive but instead are used for compensatory and remedial purposes. I indicated my understanding of this advise in a March 25 letter to Representative Mike Davis.

As part of my effort to resolve this issue administratively, I agreed to request an Attorney General's opinion confirming the oral advise on the scope of damages that are compensable under our financial responsibility statutes. However, since the legislative session ended, we have found in our files a memorandum of advice dated May 13, 1982 that addressed most of the questions regarding financial responsibility that have been raised by the insurance representatives for the electric coops. Consequently, the only questions that remain to be answered concern the issue of third party liability coverage under the financial responsibility statutes. Specifically, I would appreciate your opinion on the following questions:

- ° What kind of oil spill liability (e.g. third or first party) is incurred by an oil operator demonstrating proof of financial responsibility under AS 46.04.040(i)? In other words, does the law require the operator to provide proof of financial responsibility to cover oil spill damages to the operator's own premises?

Attached are copies of HB 628, my March 25, 1986 letter to Representative Davis, his response of April 2, 1986, and the 1982 memo of advice for your information. If your staff has any questions on this matter, Paul O'Brien, oil spill program manager, can provide additional information. Thank you for your assistance.

Attachments

cc: Doug Mertz

PO/bb



ALASKA

## NUSHAGAK ELECTRIC CO-OPERATIVE, INC

P. O. BOX 350 DILLINGHAM, ALASKA 99576 . AREA CODE (907) 842-5251

January 28, 1987

Senator Fred Zharoff  
Representative Adelheid Herrmann

Thank you for giving us the opportunity to share some thoughts with you this date. Unfortunately I have a prior commitment and so will not be able to communicate with you in person but hopefully this short note will be better than nothing.

There are two major issues that are of concern to Nushagak Electric as well as to most of the rest of the rural utilities to some degree.

2. The second issue involves the financial responsibility insurance required for "terminal operators" as outlined in AS 46.04.040. This statute adversely impacts Naknek Electric, Nushagak Electric, the City of Nome and Kotzebue Electric because it requires that "terminal operators" I.E., those entities having over 10,000 barrels of fuel storage to purchase financial responsibility

insurance for the trans-shipment of fuel oil across the dock to the tank farm.

For Naknek Electric and Nushagak Electric, this process takes about 36 hours each and in 1986 we each had to buy insurance costing \$10,400 to comply with the statute. This cost each one of Nushagak Electric consumers about \$10.00 each.

This issue was raised in HB 628 which was sponsored by Herrmann and Adams last year. Unfortunately it did not go anywhere. However the problem is still with us. It seems to me that the statute was originally intended for oil terminals and shippers who may have been characterized as being of a more temporary nature. We, the utilities, are not temporary. We are a permanent part of the community and providing a necessary community service. In doing this, we have complied with all Federal and State regulations relevant to fuel handling. The U.S. Coast Guard oversees our fuel loading process. With all of the precautions taken, I find it difficult to reason why the State Statutes should require these rural communities to provide evidence of financial responsibility when they are least capable of doing so and when the U.S. Government does not require it.

Thank you again for your time and consideration of our concerns. I know I speak for all of the NEC Board of Directors and Membership of the Co-operative when I wish you a productive session this year in Juneau.

Yours very truly,

*Adelheid Herrmann*

## Oil Spill Financial Responsibility Requirements

1. Who must prove financial responsibility for potential oil spills.

AS 46.04.040(a) - Everyone who operates an oil terminal facility.

AS 46.04.120(11) defines oil terminal facility as anyone who transfers, processes, refines or stores oil on or near water.

AS 46.04.050 exempts facilities with less than 10,000 barrels of storage capacity.

2. Liabilities for which financial responsibility must be proved.

18 AAC 20.035 requires proof of financial ability to respond to damage for each pollution incident covered by AS 46.04.040(i)

AS 46.04.040(i) simply refers to the following:

AS 46.03.760(e) - Liability to the state for full amount of direct and indirect cleanup costs.

AS 46.03.822 - Strict liability (without regard to fault) for damages to persons or property (public or private) resulting from an oil spill unless the operator can prove the spill resulted from an act of war, intentional or negligent act of an unrelated third party, negligence by the U.S. Government or State of Alaska, or an Act of God.

AS 46.03.258 - Liability to the state for penalties of:

\$10.00 per gallon of oil in fresh water;

\$2.50 per gallon of oil in an estuary;

\$1.00 per gallon of oil in unconfined saltwater.

Penalties can be multiplied by 5 as punitive damages.

AS 46.03.760(a) - Liability to the state for civil penalties of \$500 to \$100,000 for a violation and \$5,000 per day for each day the violation continues.

3. Amount of financial responsibility which must be proved.

AS 46.04.040(a) requires \$10 per barrel of storage capacity or \$1 million, whichever is greater.

4. How an operator can prove financial responsibility.

18 AAC 20.045 - Possession of Federal Maritime Commission certificate. Not applicable to utilities.

18 AAC 20.055 - Self-insurance. To qualify, an operator must maintain "working capital and net worth" in the amount required in AS 46.04.040(a)-(c)--(\$1 million). In the Statute, AS 46.04.040(a), the term "working capital and net worth" are not used. The Statute speaks of "ability to respond."

18 AAC 20.065 - Insurance. Underwriter must be an admitted carrier or approved by the Division of Insurance. The policy must be written on an occurrence policy form.

18 AAC 20.075 - Surety Bond. The surety must be registered to do business in Alaska, possess a current U.S. certificate and have sufficient underwriting capacity.

18 AAC 20.085 - Guaranty. This permits some other entity to qualify as a self-insurer and then guarantee the operator's financial responsibility.

5. Criminal penalties for violations.

AS 46.03.790

(a) Violation is a Class B misdemeanor.

(b) Wilful violation is a Class A misdemeanor.

(c) Each day of violation is a separate violation.



# NAKNEK ELECTRIC ASSOCIATION, INC.

POST OFFICE BOX 118 • NAKNEK, ALASKA 99633 • PHONE (907) 246-4261

November 1, 1985

Rep. Adelheid Herrmann  
P.O. Box 63  
Naknek, AK 99633

Sen. Fred Zharoff  
P.O. Box 405  
Kodiak, AK 99615

RE: STATUATE COMPLIANCE TO FINANCIAL RESPONSIBILITY

Your Honors Herrmann & Zharoff:

This past and previous year extreme problem has arisen with this Association, Naknek Electric Association, (N.E.A.) and our neighboring cooperative, Nushagak Electric Cooperative, (N.E.C.) and the Alaska Department of Environmental Conservation. (D.E.C.)

Compliance satisfaction with the Department to Section 1 as 46.04.040 (e) "Financial Responsibility" as formed in the law provides a very constraining element for a small rural utility to provide \$1,000,000 in financial responsibility, or bonding, or assurity.

We are put into this situation due to our geographic and economic location. With the requirements of providing economic and reliable electric service to our given service areas, we must have fuel; our fuel requirement constitutes near 50% of our production costs.

In an effort to reduce our costs, large volume storage vessels have been constructed by our respective utilities to facilitate bulk fuel procurement by joint bidding. One time a year we have delivery in our ice bound ports providing a year round supply along with reducing the exposure of handling fuel several times a year outside of our property.

The net result has brought down fuel costs per gallon to .3714 for this years fuel. This saving reduced the delivered kilowatt hour by .02¢ for each delivered kilowatt hour to the consumer. Likewise the first 750 kilowatt hours cap for Power Cost Equalization (PCE) has realized the same reduction of .02¢, saving the PCE fund \$168,885 for the two cooperatives. This saving is for the State of Alaska by prudent action of the cooperatives.

PAGE TWO  
HERRMANN & ZHAROFF  
November 1, 1985

Now then, the D.E.C. comes forth with unbending rules, regulations, and law forcing expenditures for premium of unobtainable insurance and or surety bonding, irrevocable line of credit or proof of financial responsibility; of course, the last being the most desirable but hereto unobtainable. If we do not have one of the previous required sureties we are outside of the law and subject to severe penalty as well as being unable to obtain the necessary permit to off load fuel.

This year, after spending nearly 10 months searching the insurance market, (even from firms suggested by D.E.C., which incidentally flatly denied or did not respond to our broker) we were able to provide D.E.C. with unconventional one time surety for this years fuel off loading at our facilities. We have been put on notice that the same coverage will not be available next year. We, too, anticipate conventional underwriting will not be available nor will we be able to prove to satisfaction our financial responsibility to the unbending D.E.C.

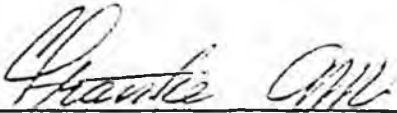
The law as written seems to be directed to non-permanent principals in the business of transporting fuel rather than permanent facilities such as ours. (N.E.A. and N.E.C.) These two cooperatives have taken due and concerned steps to build the best fuel and service systems we could with total attention to safety and integrity.

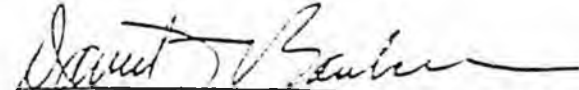
We and all utilities have every intention of continued existence with address to our responsibilities. What we are saying is, if we have a spill, we most certainly will clean it up without the constraints of the law imposing financial burden upon us, and more important yet, all of our consumers are members of the community, and our members derive their livelihood from the sensitive fishery environment and will see to it that we clean up any spill which may occur.

With all this discourse, hopefully, the stage is set to request your legislative efforts to amend Section 1 & 2 of AS. 46.04.040 (e) to read as attached.

If you have questions with our request for legislation, please feel free to contact us.

Sincerely,

  
C.E. Franke, General Manager  
Naknek Electric Assoc., Inc.

  
Dave Bouker, General Manager  
Nushagak Electric Cooperative

CEF/sp

cc: Dave Hutchens, Executive Director, A.R.E.C.A.  
Roger Kemppe, N.E.A. & N.E.C., counsel  
KEMPEL, HUFFMAN, & GINDER





ALASKA RURAL ELECTRIC COOPERATIVE  
ASSOCIATION, INC.

237 E. FIREWEED LANE • SUITE 301  
ANCHORAGE, ALASKA 99503 • (907) 276-3235

January 15, 1985

Representative Adelheid Herrmann  
Alaska State Legislature  
Pouch V (MS 3100)  
Juneau, Alaska 99811

Dear Representative Herrmann:

Last November, Claude Franke and Dave Souker wrote you about a problem they were having -- and expecting to get worse -- caused by a statutory requirement that they buy strict liability insurance for oil spills. Both REC and REA have increased their fuel storage capacity in recent years in order to buy competitively priced oil and store it themselves. It was increasing their tank capacity above 10,000 barrels that makes this statute apply to them.

For 1985 we went through great difficulty to find a way to help these two small coops comply with the law. Their regular policy for general liability insurance issued by the ARSMA Insurance Exchange provided \$500,000 of oil spill insurance. There was no other oil spill liability insurance available for them to buy at any price.

To get the additional \$500,000 in coverage for them, what we had to do was to get them to indemnify the Exchange and post an irrevocable letter of credit payable to the Exchange to cover costs of oil spills between \$500,000 and \$1 million, and the Exchange then issued the insurance policy. This insurance policy met the D.C. requirements, but the coops were fully responsible for any losses exceeding \$500,000 which might have occurred. This arrangement cost them the fee for the letter of credit and the expenses incurred by the Exchange for details in so. Much more importantly, this approach cost a major part of their credit capacity, which then could not be used for normal business requirements.

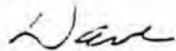
For 1985, even the ARSMA Insurance Exchange is reportedly unable to provide oil spill insurance because it is not possible for it to buy reinsurance covering oil spills. This means that the only way for REC and REA to comply with the law is to undergo the cumbersome and expensive process of retaining the

entire risk of the \$1 million policy limit, and have the Exchange issue the \$1 million policy. But this would use nearly their entire line of credit! They might not even be able to borrow the money to buy the fuel which they would have sole responsibility to clean up if they spilled some of it.

This is an absurd situation which requires a legislative solution this session. Claude and Dave sent you a draft providing an easy way of resolving the problem. Our idea is that a certificate of public convenience and necessity for a utility should be proof in itself of financial responsibility. A utility isn't going anywhere. If a spill occurs, they will still be there and have the financial ability to pay for the clean up.

After consulting with the attorney who drafted it, I have slightly reorganized the proposed statutory amendment. We hope you will introduce a bill to resolve the problem being experienced by NEC and NEA and push it through to passage.

Sincerely,



David Hutchens  
Executive Director

DH/CF

cc: Claude Franke, NEA  
Dave Bouker, NEC

cc: Ken Johnson

# STATE OF ALASKA

BILL SHEFFIELD, GOVERNOR

## DEPT. OF ENVIRONMENTAL CONSERVATION

Telephone: (907) 465-2653

Address: Box 0

Juneau, Alaska 99811

January 27, 1986

JAN 28 1986

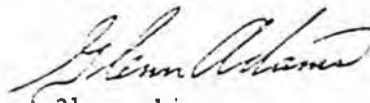
Mr. Dave Hutchens  
ARECA Insurance Exchange  
237 East Fireweed Lane, Suite 301  
Anchorage, AK 99503

Dear Dave:

During your phone call last week to myself and Paul O'Brien, Manager of the Oil Pollution Program, problems of obtaining adequate insurance coverage for oil pollution damages were discussed. Paul agreed that I would review our files and send you the names of insurance underwriters that have current policies in force. I reviewed the files and came up with four underwriters and information on what other fuel handling companies are doing (enclosed); I am also sending a copy of the report from the Task Force on Insurance Availability and Pricing.

The Department of Commerce and Economic Development, Division of Insurance said they can provide "special market assistance" to the broker, their address is on the Task Force report. We will continue to work with the industry in every way that we can.

Sincerely,



Glenn Adams  
Oil Pollution Control  
Division of Environmental Quality

cc: Keith Kelton, Director  
Bill Ross, Commissioner  
Representative Adelheid Herrmann  
Representative Rich Yenling  
Senator Fred F. Charoff

January 23, 1986

### INSURANCE INFORMATION FOR FUEL STORAGE FACILITIES

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Glenn Adams  
Oil Pollution Control



# ALASKA RURAL ELECTRIC COOPERATIVE ASSOCIATION, INC.

237 E. FIREWEED LANE • SUITE 201  
ANCHORAGE, ALASKA 99503 • (907) 276-3235

February 21, 1986

Representative Mike Davis, Chairman  
House Special Committee on Oil & Gas  
Alaska State Legislature  
Pouch V (MS 3100)  
Juneau, Alaska 99811

Dear Mike:

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Jonathan also asked which utilities have this problem, what are their tank capacities, and how often do they fill their tanks.

At present, Nushagak Electric and Naknek Electric are the only utilities which have had dealings with DEC on this issue. Kotzebue Electric also has new tank capacity sufficient to bring them into the same problem, but DEC has not yet made an issue of it with them. Nome Joint Utilities, a municipal utility, is negotiating to lease tank space to use in 1986. If their negotiations are successful, they will have sufficient capacity to face the same problem. (I hope that my responding fully to Jonathan's questions will not cause problems for Kotzebue or Nome.)

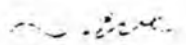
Representative Mike Davis  
February 21, 1986  
Page 2 of 2

The tank capacities for these four utilities will vary from approximately 20,000 to 35,000 barrels. They typically fill their tanks only once a year. That is why they need so much tank capacity in these ice-bound communities.

We understand that DEC has offered to "look the other way," but even a non-willful violation of this statute is a Class B Misdemeanor. Each day of non-compliance is a separate violation. This is a serious business that simply must be resolved legislatively.

Thank you for your interest. If you have additional information, please let me know.

Sincerely,

  
Dave Hutchens  
Executive Director

Enclosures

DH:pn

BILL SHEFFIELD, GOVERNOR

**DEPT. OF ENVIRONMENTAL CONSERVATION**

Telephone: (907)  
Address:

OFFICE OF THE COMMISSIONER  
P. O. BOX 0, JUNEAU, ALASKA 99811-1800

(907) 465-2600

March 25, 1986

The Honorable Mike Davis  
Alaska State House  
P. O. Box 7  
Juneau, AK 99811-3100

Dear Representative Davis:

During the last several weeks, the Department has testified before the Oil and Gas Subcommittee on HB 628 and has worked with your office and staff from Representative Herrmann's office in addressing the difficulties faced by electric cooperatives in meeting the Department's oil pollution financial responsibility requirements. We have also been working closely with the Division of Insurance and representatives from the rural electric cooperatives in this matter. Based upon numerous discussions with legislative staff, the Division of Insurance, and a representative of the electric cooperatives, I believe that we have identified ways to resolve these issues.

Such a resolution is largely dependent upon the Department addressing two items: 1) amending our financial responsibility regulations to accept claims made insurance policies, and 2) clarifying the types of damages that are covered under the financial responsibility requirements. This letter is intended to show the steps I am preparing to take to satisfy these concerns, thereby enabling the cooperatives to meet the Department's financial responsibility requirements in a cost effective manner.

First, I am prepared to amend the Department's financial responsibility regulations to add claims made insurance policies as an option for oil facility operators such as the electric cooperatives. We have worked closely with the Division of Insurance on this change and have already started language to this effect. At the same time that we reevaluate our insurance requirements, we will be looking at the other options available for demonstrating proof of financial responsibility to determine if any other revisions to the regulations are necessary.

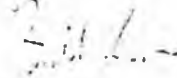
March 25, 1986

With regard to the second issue requesting clarification of the types of damages covered under the financial responsibility requirements, my staff has been in contact with the Attorney General's office on this matter. We have been assured that the Department's financial responsibility regulations apply to the operator's liability to others, i.e. third parties. Therefore, insurance policies should be available for this type of coverage. There has also been concern expressed by the cooperatives that insurance is not available to cover the civil damages and penalties referenced under the financial responsibility statutes. This position is predicated on the assumption that insurance will not pay for penalties of a punitive nature. However, the civil penalty and damage statutes referenced under AS 46.04.040 are not punitive. In fact, they are used for compensatory and remedial purposes associated with liquidated damages to the State. It is my understanding that insurance is available to cover these types of damages.

We have made substantial progress in identifying the issues and we have worked to resolve the financial responsibility problem that has been brought before the Legislature by the electric cooperatives. I believe that the action I have outlined above will solve the difficulty in obtaining insurance.

It should also serve to provide more flexibility in the regulations and make it easier for facility operators to satisfy the Department's financial responsibility requirements.

Sincerely,

  
Bill Ross  
Commissioner

cc: Representative Adelheid Herrmann  
Representative John Sund  
Christian Ulmann, Division of Insurance  
Dave Hutchins, ARECA Insurance Exchange

STATE OF ALASKA



POUCH V  
JUNEAU, ALASKA 99811  
(907) 465-4941

HOUSE SPECIAL COMMITTEE ON OIL AND GAS

April 2, 1986

Commissioner Bill Ross  
Department of Environmental Conservation  
P.O. Box 0  
Juneau, Alaska 99811-1300

Dear Commissioner Ross,

The House Special Committee on Oil and Gas recently held a hearing on HB 628 and, subsequent to this hearing, conducted several work sessions on the topic of the availability of oil pollution insurance to electric cooperatives. Members of your department, Rep. Herrmann's staff, the Division of Insurance, the Alaska Rural Electric Cooperative Association, and my office identified regulatory measures that could be taken to allow electric cooperatives to meet oil pollution financial responsibility requirements.

Your letter of March 25 acknowledged that the department would be willing to make appropriate regulatory changes as an alternative to the passage of HB 628. It is also my understanding that the department is willing to take the following actions in this regard:

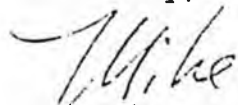
1. Amend 18 AAC 20.065 to allow for the submission of policies issued on a "claims made" basis in addition of "occurrence" policy forms.

2. Secure an Attorney General's opinion clarifying that the financial responsibility requirements apply only to third-party liabilities and not to damages to their own premises or to penalties or punitive damages, and supply that opinion to the electric cooperatives and their insurers.

3. As appropriate, either adopt regulatory changes through the emergency regulatory procedure or enter into an emergency compliance order with the affected utilities.

Thank you for your assistance and responsiveness in attempting to resolve this matter.

Sincerely,

A handwritten signature in cursive script that reads "Mike".

Rep. Mike Davis, Chairman  
House Special Committee on Oil and Gas