UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BEFORE THE ADMINISTRATOR

In the Matter of	)	
The Pittston Company	)	Initial Decision
NPDES Permit Application No. ME0022420	)	

This is a proceeding under Section 402 of the Clean Water Act (33 U.S.C. 1342 (1976 Ed., Supp. I, 1977)). The proceeding was initiated by Pittston's request, dated January 26, 1979, for an adjudicatory hearing pursuant to 40 CFR 125.36 following the Regional Administrator's denial, issued January 17, 1979, of Pittston's application, filed September 26, 1975, for a wastewater discharge permit required in connection with Pittston's proposal to construct a 250,000 barrel a day refinery, marine terminal and related facilities on Moose Island, Eastport, Maine. By letter, dated February 7, 1979, the Regional Administrator informed Pittston that its request for an adjudicatory hearing had been granted.

Because the proposed refinery was a new source within the meaning of Sec. 306 of the CWA, all environmental impacts of the project were required to be considered and an environmental impact statement prepared in accordance with the National Environmental Policy Act (NEPA), 42 U.S.C. 4321 et seq. (See 40 CFR 6.900). The Final Environmental Impact Statement (EIS), the comment period for which closed on July 18, 1978, contained EPA's tentative determination to issue the permit subject to certain conditions which were to be met before construction could commence. Although endangered species issues had not been raised during the comment period, by letter, dated August 16, 1978, the National Marine Fisheries

Service (NMFS)of the National Oceanic and Atmospheric Administration (NOAA) requested that EPA initiate consultation under Sec. 7 of the Endangered Species Act (16 U.S.C. 1536), expressing primary concern for marine mammals such as the right whale (Pittston Exh. 105). On September 1, 1978, the Fish and Wildlife Service (FWS) of the Department of Interior made a similar request with respect to the bald eagle which had been placed on the endangered species list in February 1978 (43 FR No. 31 at 6230 et seq.). EPA formally requested consultation under the Endangered Species Act with NMFS on September 1, 1978 (Pittston Exh. 107) and with FWS on September 15, 1978.

Under date of November 15, 1978, the Assistant Administrator for Fisheries of NOAA informed the Regional Administrator that the proposed refinery was not likely to jeopardize endangered shortnose sturgeon or sea turtles, but that insufficient information existed to determine whether the project would or would not jeopardize the existence of endangered whales, specifically the humpback and the right whale (Pittston Exh. 108). By letter, dated December 21, 1978, FWS informed the Regional Administrator of its determination that the Pittston project was likely to endanger the continued existence of the bald eagle. Although the Regional Administrator's decision denying Pittston's application purported to be based in part on NEPA grounds[1/] it is clear that the primary basis of the

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1/ The January 15, 1978 (actually 1979), letter informing Pittston that its application was denied provided in part at page 3: "* * it remains our opinion that the fisheries resources, though substantial, would not in themselves dictate denial of the permit to protect special resources from the risk of an oil spill, * * *. However, the findings of the NMFS report taken together with the findings concerning endangered species in the area affected by the project, contribute to a determination that the quality and scarcity of the resources is such that they should not be placed at risk from the proposed project." The NMFS report referred to is apparently the NOAA Position Statement on the Siting of an Oil Refinery by the Pittston Company at Eastport, Maine, dated November 16, 1978, transmitted to the Regional Administrator by letter from NMFS dated November 18, 1978 (Item VIII-48).

denial was the FWS opinion that the project would jeopardize the bald eagle and that the permit would have been issued absent the FWS opinion on jeopardy.[2/] On January 26, 1979, the same date that Pittston filed its request for an adjudicatory hearing under 40 CFR 125.36, it filed with the Secretary of the Interior an application for an exemption from the FWS determination in accordance with Sec. 7(g) of the Endangered Species Act. This led to the reopening of consultation with FWS to consider new information and mitigation proposals developed by Pittston. By letter to the Regional Administrator, dated June 4, 1979, the FWS reaffirmed its conclusion that the proposed Pittston refinery and marine terminal would likely jeopardize the continued existence of the bald eagle.

With respect to endangered whales, the Regional Administrator's decision denying the permit application informed Pittston that EPA would not be in a position to make an affirmative decision to issue a permit until the conclusion of the consultation process. In a letter to the Regional Administrator, dated March 8, 1979 (Pittston Exh. 112), NMFS outlined a research program considered to be necessary in order for a decision to be made as to whether the proposed refinery and marine terminal would jeopardize the existence of endangered whales. The program outlined was estimated to cost as much as $1,000,000 and to require as long as five years to complete.

2/ The Public Notice of Grant of An Adjudicatory Hearing, dated February 7, 1979, provides on page 4 "Under the Endangered Species Act, as amended on November 11, 1978, the finding of jeopardy to the eagles precludes issuance of an NPDES permit for the project." A letter from the Regional Administrator to Mr. Arnold F. Kaulakis, Pittston Vice President, dated April 17, 1979, confirms that the basis of the denial was the FWS opinion that the project would jeopardize the bald eagle.

Pittston was unwilling to undertake the research program recommended by NMFS and requested that consultation be terminated, insisting that sufficient information was available for a decision to be made. Accordingly, EPA terminated consultations with NMFS on endangered whales and by letter, dated April 17, 1979 (note 2, supra) advised Pittston that its application for a wastewater discharge permit was denied for the reason that there was insufficient information concerning the impact of the project on endangered whales to enable EPA to assure that granting the permit would not result in jeopardy to their existence. Pittston filed for an exemption from this determination with the Secretary of Commerce in accordance with the Endangered Species Act on May 4, 1979 and on May 30, 1979, NMFS informed the Regional Administrator of its belief that the Pittston project may jeopardize the continued existence of right and humpback whales. EPA informed Pittston on May 30, 1970, of the NMFS opinion and affirmed its decision denying the permit application in a letter dated June 29, 1979.

Pittston's exemption applications resulted in the convening of a Review Board pursuant to Sec. 7(g)(3) of the Endangered Species Act in order to consider the preliminary findings in the exemption process required by Sec. 7(g)(5). See 44 FR No. 114, June 12, 1979 at 33721 et seq. Controversy over whether the exemption applications were ripe for decision in the absence of final administrative decisions denying Pittston's NPDES permit application primarily on endangered species grounds resulted in litigation in the United States District Court for the District of Columbia and the disbanding of the Review Board.[3/] In a decision filed March 21, 1980 (The Pittston Company v. Endangered Species Committee, et al, & National Wildlife Federation, et al. v. Endangered Species Committee, et al. and The Pittston Company, Intervenor, Civil Nos. 79-1851 and 79-1779), the court concluded that a final administrative decision was a prerequisite to jurisdiction of the Endangered Species Committee.

Public notice of the grant of an adjudicatory hearing (40 CFR 125.36(c)(4)) was published on February 14 and 26, 1979. Timely requests to be admitted as parties were filed by the New England Legal Foundation, Roosevelt Campobello International Park Commission, Conservation Law Foundation of New England, Inc., Natural Resources Council of Maine, National Wildlife Federation, Friends of Eastport, Fish and Wildlife Service, National Oceanic and Atmospheric Administration and the New England Fishery Management Council. These applications were determined to be in conformance with the regulation (40 CFR 125.36(d)) and the applications for party status were granted. The Natural Resources Defense Council filed a motion for leave to intervene, which motion was granted on May 16, 1979.

At a prehearing conference held in Boston, Massachusetts on June 28, 1979, it was agreed that the rules in 40 CFR 125.36[4/] were applicable to this proceeding rather than the recently published revised NPDES regulations

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3/ The Review Board was apparently dissolved by the Endangered Species Committee after Civil Action No. 79-1779, cited infra, was filed.

4/ These rules provide for the Regional Administrator or his designee to issue the initial decision. However, the undated letter from the Regional Administrator forwarding this matter for assignment of an Administrative Law Judge requests that the assigned ALJ prepare the initial decision and the letter of designation from the Chief Administrative Law Judge, dated February 22, 1979, specifies that the undersigned is to issue the initial decision.

(44 FR No. 111, June 7, 1979, at 32854 et seq.). It was also agreed that the issues of the effect on this proceeding of the exemption applications under the Endangered Species Act and of EPA's endangered species obligations under NEPA would be referred to the General Counsel pursuant to 40 CFR 125.36(m). These issues, based on the assumption that the Review Board established under the Endangered Species Act would shortly be issuing a decison on the question of whether an irresolvable conflict between the Pittston project and endangered species existed, were referred to the General Counsel on July 20, 1979. The parties apparently agreed that action on the referral would be suspended pending a decsion by the District Court for the District of Columbia in the litigation previously mentioned.[5/] The presiding officer ruled that the evidentiary hearing would not be deferred pending a decision on legal issues.

The factual issues in this proceeding, which may overlap some what, may be broadly expressed as follows: (1) whether the project will, in fact, jeopardize the existence of endangered species, specifically, the bald eagle and the right and humpback whale; (2) whether safe navigation of Head Harbour Passage by tankers of the size contemplated is feasible and practical; (3) the risks of oil spills, including catastrophic spills, and the effects of such spills on birds, marine and aquatic life; (4) whether other environmental impacts of the project such as air emissions, solid waste disposal and aesthetics are such that the permit application should be denied; and (5) what are alternatives to the project including sites and a monomooring or monobuoy system.

5/ The disbanding of the Review Board, the fact that extensive evidence concerning the project's impact on endangered whales and the bald eagle was received at the hearing, and the District Court's decision apparently moot the issues referred to the General Counsel.

A hearing on this matter was held in Boston, Massachusetts during the period January 7 through February 9, 1980.

Summary Findings of Fact[6/]

Based on the entire record,[7/] including the proposed findings and conclusions submitted by the parties,[8/] I find that the following facts are established:

Endangered Species - Eagles

1. The June 4, 1979 biological opinion of the FWS reaffirming the conclusion that the proposed refinery and marine terminal would likely jeopardize the continued existence of the bald eagle was based on the expectation that adverse impacts on the eagle would result from air pollution, oil spills and development stimulated by refinery construction and operation.
2. With regard to air pollution, particular concern was expressed regarding emissions of lead and mercury from the refinery because of their toxicity. Mercury emissions from incinerations at the refinery were alleged to be 163 grams per day and boiler emissions of mercury were asserted to average approximately 200 grams a day. The FWS opinion letter stated that mercury was known to bio-accumulate as it passed up through the food

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6/ Detailed findings are contained in Appendix A. Summary and detail findings are to be read together.

7/ In addition to the transcript of testimony and exhibits received at the hearing, the record in this proceeding consists of the EIS of five volumes, the EPA record concerning the development of the EIS and correspondence subsequent to publication of the EIS, Pittston's application and studies submitted to the State of Maine and transcripts of testimony before the Maine Board of Environmental Protection. A specific listing is contained in the EPA Certified Index, dated November 7, 1979 and distributed on November 9, 1979.

8/ Findings not adopted are either rejected or considered unnecessary to the decision.

chain by a factor of up to 10,000 and that mercury emissions from the refinery would cause an increase in already high mercury concentrations in eagles.

3. Pittston has revised its plans so that sludge will not be incinerated and emissions from incineration may be eliminated from consideration. Pittston has sharply disputed the 200 grams a day average mercury emissions from boiler operations at the proposed refinery utilized by FWS and EPA, contending that the 200 grams a day figure is based upon outmoded data, crudes uniquely high in mercury, and was derived by techniques which have been discarded as inadequate and inaccurate. Currently accepted analytical techniques show that most residual fuel oils have a mercury content of four ppb or less. Assuming that the refinery would process light Aramco Crude (Saudia-Arabian) having a mercury content of four ppb and that 4,700,000 lbs. of No. 5 fuel oil would be burned in the refinery boilers per day and that 50% of the mercury would be retained or removed in the refining process, mercury emissions from the refinery would be .0194 lbs. per day or 8.8 grams.

4. Mercury content of crude oils is very low ranging from less than one ppb up to 50 ppb except for certain atypical crudes associated with mercury mineral deposits. Current methodologies allow detection of mercury to the level of one ppb or less. Mercury content of Mid-Eastern crudes ranges from less than four ppb to seven ppb. Heavy metals in crude oils when

refined tend to concentrate in the residual oils, No. 5 in particular, and mercury concentrations in residual oils resulting from refining such crudes would range from less than four ppb to 5.8 ppb.

5. The 200 grams per day average mercury emissions figure calculated by EPA was based on a 1978 EPA report to the effect that an average mercury concentration which may be applied to fuel oil is 0.1 ppm. This figure in turn is derived from a 1973 EPA report "Emission Factors for Trace Substances" showing an average mercury content for six imported residual oils, none of which were from the Mid-East, of 0.13 ppm which rounded to the nearest tenth equals 0.1 ppm.

6. Catalytic Hydrodesulfurization (HDS) is a process for removing sulfur and heavy metals from crude oils, so called sour crudes. The PSD permit requires that fuel oil with a sulfur content not to exceed 0.18% by weight be used in the operation of the refinery. The HDS process will remove from 50 to 90% of any metals and sulfur in the oil and mercury emissions stated in finding 3 assume a 50% HDS mercury removal.

7. While there is no test or performance data to substantiate a 50% mercury removal on the HDS catalyst, uncontradicted expert testimony supports this figure as a reasonable judgment based on approximately 80% removal of nickel and vanadium. Even on a worst-case basis, i.e., assuming no mercury removal on the HDS catalyst, mercury emissions from operation of the refinery utilizing Mid-Eastern crudes would equal approximately 17.6 grams per day. It is found that the 200 grams per day average mercury emission rate utilized by EPA/FWS from the combustion of fuel oil in the refinery boilers overstates actual emissions by a factor exceeding 11-fold on a worst-case

basis considering any crude oil likely to be processed in the refinery. Man-made mercury emissions in Maine constitute 30.1% of the total mercury, and assuming that all mercury emitted by the refinery remains within the state, 0.0775% on an annual basis would be added by the refinery to mercury present in the State of Maine.

8. Lead emissions from the refinery are based on the assumption of crude oil having a lead content of 50 ppb. Under this assumption and on the further assumption that 50% of the lead would be removed by the HDS catalyst, lead emissions from combustion of fuel oil in the refinery boilers would be 0.0969 lbs. per day or 43.95 grams per day. Assuming Middle Eastern crudes having an average lead content of less than 40 ppb and a worst-case basis (no lead removal on HDS catalyst), lead emissions per day would be .3864 lbs. or approximately 175 grams.

9. Average vanadium content for Middle Eastern crudes is 32.9 ppm. Vanadium concentrations in soils typically contain from 50 to 500 ppm and because the HDS catalyst would remove approximately 80% of the vanadium present in the crude being refined, emissions from the refinery will add a negligible amount of vanadium to the environment.

10. Although conceding that emissions from the proposed refinery, in and of themselves, were unlikely to cause sufficient acidification of lakes (even within a 25-mile radius where the impacts are expected to be greatest) to significantly reduce fish populations of value to the eagle as food, the FWS biological opinion asserted that acidification of rainfall would increase the availability of mercury and other metals in the food chain of eagles in Washington County.

11. The contention that acidification of rainfall would increase mercury and other metals in the food chain of eagles is a hypothesis that has not been established. Mercury residues in eagle eggs collected during the period 1968 to 1977 in Washington County range from 0.22 ppm to 0.40 ppm. These values are all substantially below the levels (excess of 0.50 ppm) which the FWS asserts is the level usually considered to have the potential for adversely effecting reproductive success. The Food and Drug Administration has established the action level for unavoidable mercury residues in the edible portion of fish and shellfish for human consumption at 1.0 ppm. Mercury and lead emissions from any crude oil likely to be processed in the refinery would not add significant or unacceptable levels of these metals to the environment.

12. Normal "clean rain" in eastern North American is slightly acidic and has a pH of about 5.6. The pH of precipitation in eastern Maine is about 4.3. Buffering capacity is dependent upon bicarbonate content which acts to neutralize or reduce acidity. Because large areas of eastern Canada and northeastern U.S. are underlain by or composed of granitic and siliceous rock or soils therefrom low in calcareous content, these areas are thought to be sensitive to acidification. There was 5.2 fold increase in acidity in Maine lakes during the period 1937 to 1974. Most of this change in pH occurred in the early 1950's (about 75% of the change occurred between 1950 and 1960) and the remainder more gradually since that time. No biological effects have yet been discerned.

13. Data on the pH of Washington County lakes indicate that a majority have a pH range of 6.3 to 6.7. The buffering capacity of the watersheds is not infinite and based upon projections of future increases in fossil

fuel consumption, it can be postulated that the pH of Washington County lakes will decline. However, the FWS concerns that emissions from the refinery will cause a decrease in productivity of eagles is speculative because none of the known causes of eagle mortality in Maine are linked with pollutants to be emitted by the refinery and the FWS position is based on substantial overstatements of SO_2 emissions from the refinery (4,860 tons per year) whereas actual SO_2 emissions will be 3,705 tons per year. Changes in pH as a result of refinery emissions will generally be less than 0.1 of a pH unit. Actual pH changes attributable to refinery emissions will be substantially less than 0.1 of a pH unit because, inter alia, these calculations assume a four-year flushing or turn-over time for the lakes whereas turn-over time is actually less than a year. There is no reasonable likelihood that pH changes will be sufficient to have any adverse effect on the bald eagle. Placing the refinery emissions in perspective, one year's exposure to the average deposition from the refinery over a grid (extending 100 km west of Eastport, 50 km south, and 50 km north) would be equivalent to the acidity that is attained by six hours of precipitation at present.

14. The biological opinion asserted that crude oil and refined products spills would impact eagles through three mechanisms: (1) mortality of embryos and nestlings resulting from oil brought back to the nest by contaminated adult eagles; (2) reduction of food fish populations both in Cobscook Bay and estuarine areas to the south of Eastport; and (3) localized reduction in numbers of waterfowl and other marine associated bird preyed upon by eagles.

15. If contact with oil by adult eagles during the nesting season be assumed, adverse effects on embryos and nestlings could occur.

Experiments in treating mallard eggs with oil indicates that embryos that are in earlier stages of development are more sensitive to oiling, but that the hatchability of eggs treated with oil increased as the age of the embryo at treatment increased. Eagle eggs require a 35-day incubation period. Egg laying dates for eagles in coastal Maine are approximately March 10 through April 14 and hatching dates are approximately April 14 through May 19. This indicates that the risk to egg embryos does not exceed 35 days and is probably much less because of reduced sensitivity to oil as the age of the embryo increases. Fledging (young in nest) requires a period of 10 to 13 weeks and occurs during the approximate period June 23 through August 19. While oil carried to the nest by adult eagles could have an adverse effect on nestlings, no instances of oiled eagles or eaglets have been reported.

16. Because of the feeding behavior of eagles (walking along beaches and grabbing objects off of the surface of the water) they are likely to get oil on their legs and feathers if oil is in the immediate area. It is also likely that because of their scavenging behavior eagles would select birds and marine animals killed or incapacitated by oil as prey. Whether eagles would ingest sufficient oil in this fashion to be harmed or reject such contaminated items as food is unknown. However, concern for the eagles ingesting oiled food was not listed as a reason for the FWS jeopardy determination. Eagles could become sufficiently coated with oil as to cause direct mortality through matting of plumage and lose of insulation.

17. A catastrophic oil spill could result in extensive mortality of seabirds thus reducing their population and consequently, a source of food for the

eagles on a temporary basis. The severity of the impact would depend upon the amount and extent of the spill and the presence or absence or the prey species in the area at the time. The effects of a catastrophic spill on fish that comprise the eagles food supply, i.e., alewives and eels, would be less extensive than on birds and would to a large extent depend on the timing of the spill.

18. The third reason advanced by FWS for the jeopardy to the bald eagle determination was the stimulation of economic development and human activity which would be caused directly and indirectly by the construction and operation of the refinery. Pointing to the number of jobs in the area created by construction and operation of the refinery and asserting that a significant amount of secondary development, including housing and commerce, would be stimulated by the influx of money and workers to Washington County, the FWS opinion asserted that adverse impacts of such development on eagles would be: nest desertion caused by human disturbance during early breeding season and permanent nest abandonment caused by human encroachment within nesting territories.

19. Eagles are more tolerant of human presence and resulting disturbance at some times of the year such as the winter months than at other times. Also they are more tolerant of human activity at favorite feeding, perching and roosting grounds than at other areas. Eagles are more sensitive to human disturbance and encroachment during nest building, egg laying and incubation periods. There is no data to show nest abandonment once fledgings have hatched. The incubation period of eagles in Maine is March through early to mid-May when the weather is normally inclement and not conducive to outdoor recreation.

20. The closest eagle nests are within three to six miles of the refinery site. Human activity near these sites (as close as one mile) includes roads, farmhouses, homes and at least six oil storage tanks. These activities have apparently had no effect on the productivity of the nests. Thus eagles in Cobscook Bay are living in an area which cannot be regarded as wilderness. The distance to the nearest nest is approximately 25 miles by road and most of the nests near water and accessible by water are in relatively inaccessible areas of Dennys and Whiting Bays. Considering the location of existing nests with respect to human activity and the probability of people being near nests or nest sites during the incubation period when weather was still inclement, the risks to the eagle from refinery construction and operation are small.

Mitigation Measures

21. As mitigation of risks to the eagle, Pittston has proposed disposal of sludge in a landfill rather than incineration to reduce or eliminate mercury emissions; undertaking an agrressive educational program with its employees and residents of the area as to the importance of the eagles and the consequences of improper human actions and encroachments, including making proper activity with respect to eagles a condition of employment; modifying its oil contingency plan to include explicit protection against accidental spills being carried into specific activity and feeding areas of the eagle in Cobscook Bay; provision for alternate food sources to lure eagles, and, if necessary, use of carbide cannon to frighten eagles away from oil contaminated areas; cooperation and

participation in the acquisition of prime nesting areas to prevent possible development and reduce the likelihood of human disturbance and finally participation with state and federal agencies in repopulation programs such as the importation of eagle eggs or eaglets to nests in the refinery site area and adjacent areas, such as Penobscot.

22. The FWS biological opinion adopted a negative attitude toward Pittston's mitigation proposals characterizing its educational program as unlikely to have much effect inasmuch as similar programs had already been instituted in Maine and had been relatively ineffective in reducing human disturbance to eagles. The FWS opinion appears to overlook the control Pittston would have over its employees and at least indirectly over employees of subcontractors. Although shooting bald eagles is a violation of federal law, shooting appears to be the predominant cause of known direct human related mortality in eagles.

23. Concerning the control of oil spills, FWS alluded to the extreme difficulties expected in attempting to control oil spills in Cobscook Bay by booming. The provision for alternate food sources in the event of an oil spill was characterized as problematic, the opinion stating that Region 5 of FWS has had little success in attracting eagles by this method. This position ignores evidence that eagles can be lured by fish and other prey items and that artificial feeding of eagles during the fall and winter months (October through March) has been successful in Sweden.

24. As to Pittston's proposal to cooperate and participate in the acquisition of prime eagle nesting areas in order to prevent their development, the FWS alluded to difficulties in acquiring the necessary

land and insisted that as much as one square mile around each eagle nest would have to be acquired. Evidence in the record does not support the FWS contention that one square mile would have to be acquired around each eagle nesting site in order to protect the eagles from human disturbance. The weight of the evidence establishes that educational programs can have some effect in reducing human disturbance to eagles, that the FWS position that as much as one square mile would have to be acquired around each nesting site in order to be effective in preserving eagles from human encroachment is without scientific basis, that provision for alternate food sources can be effective at certain times of the year, that eagle repopulation programs, that is introduction of eaglets into existing nests, can be successful and that the FWS rejection of these mitigation proposals was not warranted.

Status of the Eagle

25. The estimated population of bald eagles on the North American continent is approximately 100,000 and the year-round population of the lower 48 states is about 5,000. Data in the record suggests that the Maine population of bald eagles was 100 breeding pairs in 1900 and that this had declined to approximately 60 breeding pairs in the late 1940's. FWS eagle surveys place the number of breeding pairs of eagles in Maine at the time of the hearing at 56. There could be as many as 10% to 20% more breeding pairs of eagles than indicated by the surveys. This refutes the contention that the number of breeding pairs of eagles in Maine is at an all time low.

26. Available data indicates that in 1962 there were 27 active eagle sites or nests in Maine of which eight were successful (8 fledglings produced), equaling a success rate of approximately 30%. By 1979 there were 46

active sites of which 29 were successful with a total of 38 fledglings being produced. This indicates that approximately 63% of active sites were successful and that .83 young were produced per active site. Productivity has clearly substantially increased both in terms of numbers and in terms of the ratio of successful nests or sites to active nests.

27. In attempting to support the conclusion that the Pittston refinery would jeopardize the bald eagle, DOI contends the Cobscook Bay area is the focal point for the Maine eagle population. Occupied sites in the Cobscook Bay region for the years 1977, 1978 and 1979 were eight, eight, and six respectively, and production of young was seven, six, and eight respectively, amounting to 20%, 19% and 21% respectively, of Maine eagle production. Other data indicate that Cobscook Bay production was approximately 17% of the total state production in 1977, approximately 18% in 1978 and approximately 16% of total state production in 1979. There were 22 occupied breeding sites at other coastal bays in Maine in 1978, which produced a total of 13 fledglings. The contention that Cobscook Bay is the focal point for the Maine eagle population is unsupported.

28. The FWS biological opinion did not consider the eagle population in the Canadian Maritime Provinces. About 15 pairs of bald eagles nest in New Brunswick (mostly between the Maine boundary and the St. John River) and about 65 pairs nest in Nova Scotia, approximately one-third of which are on Cape Breton Island. There may be as many as 100 pairs of eagles in Nova Scotia which are within 200 to 300 statute miles from the principle eagle

coastal population of Maine and there may be dispersion of young eagles from that population into Maine. The FWS has conceded that there is some justification for considering the New Brunswick/Nova Scotia eagle population along with that of the northeastern U.S. The eagle population along the coast of Maine should be considered as continuous with that in New Brunswick, Nova Scotia, Cape Breton Island, and perhaps even further north.

29. It is generally accepted that the decline in the bald eagle population is attributable to reproductive failures caused by organochlorine pesticide residues, other contaminants such as PCB's, habitat destruction caused by man and nature and human-related direct causes of mortality such as shooting, electrocution and poisoning. An accepted criteria for eagle populations stability is that at least 50% of the breeding pairs of bald eagles must be productive and the population as a whole must produce at least 0.7 young per active nest. The evidence is that this standard or criteria has been reached or nearly reached in Maine.

Endangered Species - Whales

30. In an opinion, dated November 15, 1978, NMFS determined that insufficient information exists to conclude that construction and operation of the refinery and marine terminal is or is not likely to jeopardize the continued existence of endangered whales or result in the destruction or adverse modification of habitat that may be critical to the species. Important issues regarding marine mammals in the Eastport-Bay of Fundy area are the potential effects of oil spills and human activities

related to the refinery. NMFS stated that estimates of the northwest Atlantic population of the right whale did not exceed a few hundred, that right whales frequented the Bay of Fundy area in the spring and summer and occasionally into fall and that they were commonly sited in the Bay of Fundy and Eastport areas, often with calves, but in low numbers. It was further stated that because these animals are low in number, slow moving and surface feeders, the proposed activity may have an adverse impact on the population, but that the degree was unknown. Essentially the same conclusion was reached with respect to the humpback whale, the northwest Atlantic population of which was estimated to be approximately 1200 and which were asserted to be commonly observed in the Gulf of Maine during the spring and summer.

31. In a letter, dated March 8, 1979, NMFS outlined a research program allegedly necessary for it to make a scientifically based determination as to whether the Pittston refinery is or is not likely to jeopardize endangered whales. The program outlined stated that the first need was for a systematic study or assessment of the species and numbers of endangered whales in the Passamaquoddy-Bay of Fundy areas, but including the lower Bay of Fundy-Gulf of Maine areas. Without defining significantly, the outline asserted that if a significant number of whales occur in the area then a more complete assessment would be required. It also stated that studies should be conducted to describe and quantify normal behavior of endangered whales by age and sex so that behavioral modification from the refinery and related activities could be assessed. The outline further indicated

that there were no data on direct or indirect effects of oil on cetaceans and even whether cetaceans could or would avoid oil spills. Although stating that laboratory studies on large whales were impractical and that studies on small cetaceans such as dolphins were of questionable relevance, the NMFS outline stated that research considered to be feasible in a relatively short period of time (two to three years) that was directly applicable to enable NMFS to make a determination included: determination of the effect of oil on cetaceans, evaluation of the various frequencies and magnitude of sound emitted from the refinery and servicing ships to determine possible impacts on endangered whales, and the evaluation of the likelihood of short term impacts on food organisms. Studies asserted to be necessary to determine long term impacts of the refinery, oil and related activities on whales included evaluation of the long term impact on feeding, calving and migration, analysis of the potential for accumulation over time of petroleum hydrocarbons and metabolites in cetaceans, including where practical, determination of toxic threshold levels, evaluation of the likelihood of long term impacts on food organisms and determination of the ability of cetaceans to detect and avoid oil, and evaluation of the impact of ship traffic on endangered whales. These studies were estimated to cost up to a million dollars and require up to five years to complete.

32. EPA considered that the research program suggested by NMFS was Pittston's responsibility and Pittston was unwilling to undertake such a program. By letters, dated April 17, 1979, the Regional Administrator terminated consultation with NMFS regarding endangered whales and simultaneously

informed Pittston of the decision to deny issuance of a waste water discharge permit upon the ground that there was insufficient information as to the impacts of the project upon endangered whales to enable EPA to insure that granting the permit would not result in jeopardy to the species.

33. On May 30, 1979, NMFS issued its biological opinion concluding that granting of a permit for the Pittston refinery may jeopardize the continued existence of the right and humpback whales. The opinion incorporated by reference the initial determination of November 15, 1978, and the letter of March 8, 1979, outlining a suggested research program, and stated that the best scientific data on the risk of the operation of a major oil refinery at Eastport, Maine was largely inconclusive. The opinion stated that because right and humpback whales are believed to use coastal waters north of Cape Cod, Massachusetts as important feeding and nursery areas, a large oil spill in these waters could have serious impact on these species, either directly or by adversely affecting their habitat.

34. In a letter, dated June 29, 1979, the Regional Administrator informed Pittston that the January 17, 1979 determination to deny the permit application was expanded to include the following: "Based upon NMFS's letter of March 8, 1979 and biological opinion dated May 30, 1979, EPA believes that NMFS findings of jeopardy to endangered species of great whales precludes the issuance of a NPDES permit for the project."

35. The cited NMFS biological opinion on the right and humpback whales should be compared with its opinion issued to BLM on proposed OCS Lease Sale Nos. 51, 58 and 65 in the Gulf of Mexico. This latter

opinion recognized that several species of whales, including the humpback and black right whale, could be impacted by oil exploration and resulting activities, but concluded that: (i) no unfavorable impacts from seismic activities would result; (ii) that while it was conceivable that a large oil spill occurring in the immediate vicinity of whales could be harmful through intake of oil through the blowhole, fouling of the baleen plates and ingestion of oil contaminated food, there was no historical record of such an occurrence; and (iii) due to the migratory nature of whales, the small increase in boat traffic would have a minimal impact.

36. The right whale is definitely an endangered species, the most likely population being between 70 and 100 plus. The greatest number of sightings of right whales occurs in the Cape Cod region during late April and early May when the whales are distributed on Stellwagen Bank, Jeffreys Ledge and nearby areas. Right whales have been observed in the mouth of the Bay of Fundy and in the Passamaquoddy Bay area during August and September. Right whales feed on zooplankton and crustaceans, especially euphausids and copepods. Right whales do most of their feeding below the surface of the water and spend a relatively small part of time near the surface, except when food is there.

37. The most recent estimates of the population of the humpback whale in the North Atlantic are in the range of 2,000 or more. Humpback whales are frequently sited in the area from Cape Cod northward from spring to late fall. The Gulf of Maine appears to be an important feeding area and they congregate at productive locations including Jeffreys Ledge--Stellwagen Bank, Mount Desert Rock, Grand Manan Banks and Briar Island--St. Mary, Nova Scotia. Humpbacks feed only in the northern grounds on euphausids and small fish, such as capelin, herring and cod.

38. The number of right whales sighted in the Quoddy-Grand Manan area* at any one time does not exceed five. The maximum number of humpback whales sighted in this area at any one time is ten. Even if it be assumed that the number of humpback whales in the area exceed sightings by a factor of two or three, the population of humpback whales is such that loss of all the whales in the Grand Manan area would not place the survival of the humpback in jeopardy. While it is possible that the population of right whales has already been reduced below the critical number necessary for its survival, in which case it will become extinct, right whales do not occur in the Quoddy-Grand Manan area except during the period late July through October.

39. It is not known whether whales will be harmed by contact with oil or whether they would take action to avoid the presence of oil in the water. If whales encountered oil, some adverse impacts could occur through the ingestion of oiled plankton or through the fouling of the baleen (horny plates on each side of the jaw used to filter food from the water). The baleen of a right whale is finer than the baleen of the humpback. Fouling could interfere with feeding, but the effects of oil on the baleen are unknown. Despite numerous oil spills, no reports of deaths or adverse impacts on cetaceans attributable to oil have been reported.

40. As to other possible impacts on whales (ship collisions, noise, blasting, etc.), there is no information to indicate that ship collisions or sound effects are of any significance in the mortality

* This term is used because the Quoddy Region as defined herein does not include the Grand Manan channel and the area surrounding Grand Manan Island where the majority of whales in the area are sighted.

or the decline of whales. As to blasting, this concern seems unrealistic because of the protection against shock waves provided by the large size and thick body walls of mammals such as whales. It would seem a simple matter to schedule blasting activities at times when whales or other cetaceans were not in the vicinity or to detonate small charges in order to scare them away from the immediate vicinity.

41. Although there have been virtually no studies and few observations of the effects of oil on cetaceans, serious speculation as to the effects of exposure to oil on whales and porpoises includes: (i) cetacean skin is unique among mammals in that it is composed of all living cells and is a metabolically active organ which probably serves as more than a simple barrier against the water environment and exposure of cetaceans to petroleum could result in disruption of metabolic activities, perhaps affecting vital ionic regulation and water balance; (ii) cetaceans inhabit surface waters to breath and to feed thereby exposing them to vapors from petroleum, if present, which have been shown to be harmful to vital mammalian respiratory systems; and (iii) the possibility that heavier fractions of oil may foul or clog the baleen, while lighter fractions, being destructive of tissue, might damage the structural integrity of the baleen, in either case interfering with feeding eficiency. This threat would diminish with the passage of time as oil disperses and is weathered.

42. It is hypothesized that mass stranding of cetaceans may be due to, inter alia, acoustical confusion. However, it appears that most

animals become habituated to low level background noise such as that associated with ship traffic and onshore and offshore petroleum activities. Humpback and gray whales, harbor and elephant seals, bottle-noised dolphins, walruses and sealions seemingly coexist well with human activities.

43. While there is evidence in the record that two stranded, immature minky whales may have been hit by ships or boats, there is no evidence that such collision are a significant factor in death or injury to whales.

44. Critical assessment of past oil spills, such as the Santa Barbara Channel blowout of January 1969, did not conclusively link marine mammal deaths with the presence of oil. The number of gray whale strandings in 1969 following the Santa Barbara blowout did not differ significantly from prior years.

45. Only mammals which rely on hair or fur for thermal regulation would likely be effected by surface fouling of oil, the smooth body surface of cetaceans substantially reducing the likelihood of physical fouling.

46. Experiments with ringed seals which were immersed for 24 hours in oil covered water suggest that effects of surface contact with oil are irritation and inflammation of eyes, skin and sensitive mucous membranes. Experiments wherein seals were fed crude oil have shown no clinical, biochemical, or morphological evidence of tissue damage. These experiments have also shown that the seals rapidly absorbed crude oil hydrocarbons into body tissues and fluids, ultimately excreting the compounds. These findings tend to dampen

the fear that oil ingestion associated with feeding would necessarily be harmful to fish eating marine mammals. These experiments do not, of course, address the long term effects associated with hydrocarbon fractions persistent in the food chain, such as benzopyrene which is a potent carcinogen.

47. Fish have an enzyme capable of metabolizing 98% of accumulated hydrocarbon loads within two months of exposure. There is evidence that whales have the capability to metabolize oil, but they do not have a gall bladder and it is not known whether they can excrete oil without difficulty or harm.

48. Experiments wherein ring seals were immersed in oil covered water and subjected to a more concentrated exposure of volatile hydrocarbon fractions than would be normally encountered in an oceanic spill, led to the conclusion that short term inhalation of such vapors by marine mammals was not necessarily harmful either in terms of structural damage or gas exchange. The ability of marine mammals such as harbor porpoises and seals to withstand exposure to oil is dependent in part on the pre-existing health of the animals.

49. Zooplankton, upon which baleen whales are known to feed, are pelagic animals that are carried about by ocean currents and their abundance is frequently very spotty or patchy. Plankton live in an area where oil has a very short residence time, many species of zooplankton have very high reproductive rates and any reduction in population size caused by an oil spill would be made up very rapidly at least during the period April though October. This period encompasses the period when whales are present in the Quoddy-Grand Manan area. Most of the

zooplankton in the Bay of Fundy is brought in principally from the Gulf of Maine and plankton is most abundant at the entrance to the Bay.

50. Studies have shown that plankton has the ability to cleanse themselves of oil once placed in clean water, losing up to 50% of hydrocarbons within one day and up to 90% within one week. No deleterious effects on zooplankton have been observed from the ingestion of oil. There is no substantial evidence of major damage to plankton communities as a result of an oil spill.

51.. While it is generally accepted that larvae and juvenile stages of fish and other marine animals are most susceptible to damage from oil, there has no documented instance of a material impact on pelagic fish stocks, which includes herring, as a result of a oil spill.

52. A cold water mass called the "fundy front" extends from below Grand Manan Island, across the Bay of Fundy and past the tip of Nova Scotia. The cold water mass is caused by the intense tidal activity of the area which keeps the water column constantly mixed. The mixing activity brings nutrients to the surface which together with sunlight are essential for the growth of phytoplankton. The highly turbulent water results in low productivity for phytoplankton and the constant mixing can set up currents which carry light dependent plankton below the euphotic zone resulting in retarded growth. This apparently does not happen along the Fundy front where nutrients levels are near maximum, phytoplankton are plentiful throughout the euphotic zone and productivity is optimized. Intense phytoplankton

concentrations (100,000 cells per liter or more) surround Grand Manan Island, extend eastward toward the Oigby-St. Mary's Bay area of Nova Scotia and westward toward Campobello Island and West Quoddy Head. The area of intense concentrations does not include Head Harbor Passage, Passamaquoddy or Cobscook Bays and does not extend into the upper Bay of Fundy.

53. Copepods are filter feeders and have enormous capabilities for removing oil from surface layers which they inhabit. While they can ingest and excrete large quantities of oil without apparent harm to themselves, the resulting deposits, so-called "fecal rain," can be ingested by fish larvae in the water column and filter feeding shellfish and other benthos in addition to being incorporated into bottom sediments where the residence time can be prolonged to months or even years dpending on hydrographical conditions. Laboratory and field observations have shown that ground fish and other marine organisms readily take up petroleum hydrocarbons from oiled sediments and that such exposures can lead to abnormal development of eggs and larvae and to pathology in adults. For this reason, the cleansing process or depuration by copepods and other zooplankton ingesting oil may be harmful or potentially harmful to other marine organisms. While PCB's and toxic metals are readily passed through marine food webs, petroleum hydrocarbons are not transferred extensively because enzyme systems in marine organisms convert them to oxygenated products. Laboratory studies have shown that accumulated hydrocarbons are extensively converted into a variety of other products (metabolites) in marine organisms and that some of these metabolites are potential mutagens and carcinogens.

54. Petroleum is a naturally occurring mixture of organic compounds formed from the partial decomposition of animal and plant matter over geologic time. Crude petroleum contains tens or thousands of different chemical compounds and a precise definition is not possible because no two samples are exactly alike. Crude oils consist primarily of hydrocarbons, but may contain as much as 50% polar organic compounds. These compounds because of their relatively low volatility, their thermal instability, or both, are not quantifiable by gaschromatography or most state of the art techniques and consequently, are virtually undetected in routine tests. Although these polar organic compounds can be analyzed by high performance liquid chromatography, this is not applied in the routine analysis of marine samples and there are many toxic chemicals in the marine environment which may be undetected.

55. The real issue in terms of environmental pollution is to distinguish or separate highly complex polar compounds associated with petroleum from those compounds which are not part of petroleum but biogenic or coming from some other source. While it is erroneous to assume that the limited number of hydrocarbons separable by gaschromatography is an absolute index of petroleum pollution, the most that can be said is that the undetectable or inseparable petroleum hydrocarbon fractions are potentially harmful.

56. The biological effects of oil can generally be viewed as being of two types: (1) the smothering effect of oil on flora and fauna and (2) the less visible but destructive effects of oil being released into the environment. The light fuels, consisting primarily of the low boiling point molecules which dissolve more readily in water,

are generally considered to be the more toxic. Although these lighter fuels are more volatile and evaporate more rapidly, they also mix readily in the water column.

57. Oil begins weathering or undergoing physical and chemical changes as soon as it is released into the water. While there are concerns that the less volatile hydrogen compounds have potential carcinogenic properties, no actual field observations of mutagenic or carcinogenic pressure on biota as a result of petroleum have been reported.

58. The effects of an oil spill depend at least in part on its trajectory once a spill occurs. Single and multiple trajectory analysis for a hypothetical 13 million gallon crude oil spill released over a five-day period at a site 2.5 miles off of the coast of Campobello Island show that high probability impact areas include Grand Manan Island, Campobello Island, internal bays and passages of the Quoddy region, the northern coast of Washington County, Maine, and the coast of Charlotte County, New Brunswick. Lesser probability impact areas include the southwestern coast of Nova Scotia and the mid-to-soutern coast of Washington County, Maine. During the winter, the probability of impacts to Canadian coastlines is less due to prevailing winds. Less oil is likely to be deposited on shorelines from a winter spill than from a summer spill.

59. A typical large spill will deposit a considerable amount of oil in the water column. Subsurface oil from a typical hypothetical 13 million gallon spill at the site mentioned above will cover an area of 500 sq. km, assuming a depth of 10 m, within 10 days from the start of a spill. Although all of these senarios shows the area around Grand Manan (an area of high zooplankton concentrations at certain times of the year) to be within the zone of high probability

of impact, certain caveats are in order. Conditions that can vary the most are the velocity, duration and direction of the wind and spill simulations for at least single event models are specific to the wind record employed, no attempt having been made to make wind data used in the model correspond to seasonal or monthly averages. Model predictions do not address detailed residual and tidal patterns in Passamaquoddy Bay and Head Harbor Passage. Because of these facts, hypothetical spills showing disposition of oil at specific points, i.e., Grand Manan, New Brunswick, Campobello, should be viewed with caution, although the general trend in terms of area impact may be considered reasonable.

Risk of An Oil Spill

60. Because there was no data base for Eastport save the knowledge that a large vessel has occasionally safety navigated those waters (Head Harbor Passage) and because worldwide accident statistics did not account for variables attributable to different ports, ships, traffic and weather conditions, etc., the FEIS concluded that probabilities derived from such statistics could not be applied to a particular port. The FEIS also concluded that even if it was possible to calculate a probability or frequency figure of a major catastrophic spill occurring, e.g., once every 60 years, there was no way to determine if the spill would occur during the first or 60th years or at some point in between. For these reasons, the FEIS made no attempt to calculate the probability of a major oil spill but concluded; "However, the possibility and probability of

severe spills always exist near oil refineries that receive crude oil from tankers. The proposed Eastport refinery ultimately will experience its share of severe spills as have other comparable refineries."

61. Undaunted by the difficulties perceived by the authors of the FEIS, Engineering Computer Opteconomics, Inc. (ECO) use worldwide and domestic oil tanker accident data and tank barge accident data from 44 major U.S. ports to estimate the statistical risk of petroleum spills presented by the operation of the proposed refinery. ECO concluded that excluding catastrophic spills (defined as those where there is a total vessel loss or an outflow of 365,000 barrels (50,000 long tons) or greater), there would be an oil spill of an average size of 6,470 barrels on an average of once every 5.3 years and that there was a significant risk (0.48) of a catastrophic oil spill in the project area over an assumed 25 year life of the refinery. These calculations were based on New England accident rates rather than worldwide data and if the worldwide data is applied to Eastport, the mean time between spills would be 7.1 rather than 5.3 years. This rate is specific to Eastport only in the sense that it is based on the anticipated annual number of calls by barges, product and crude carriers. Calculating an accident probability rate for a particular port would not be meaningful because the data base is so small. This, of course, is especially true for Eastport which has no prior history of extensive large vessel traffic.

62. Using the port call method of computing accident rates results in large tankers having a higher accident rate than smaller tankers. The port call method has been severely criticized because most spillage occurs at sea rather than in port and because larger tankers with lower unit transportation costs make longer voyages and have fewer port calls. Larger tankers have no more spills per arrival than smaller tankers. A better measure of exposure would be per ton of oil carried or delivered. Using this criterion, larger tankers clearly have a lower ratio of accidents to total tonnage as well as a lower ratio of PCI's (pollution causing incidents) to total tonnage than smaller tankers.

63. Contrary to popular belief, very large tankers (80,000 DWT and upward) can transfer a given quantity of oil over a given distance safer than their smaller counterparts. In addition, historical data clearly show that tanker accidents and associated pollution incidents are a function of traffic density and water depth and not tanker size.

64. In computing the probability of a catastrophic spill for Eastport, world-wide data over a six-year period was used, indicating a catastrophic spill occurred once in every 16,000 to 20,000 port calls. ECO calculated that there was a probability of a catastrophic spill at Eastport once every 27 years or presented in terms of an assumed refinery life of 25 years, the risk of a catastrophic spill was 0.48. ECO did a similar study of the probability of oil spills in connection with the proposed Hampton Roads Energy Company refinery at Portsmouth, Virginia. Because most of the port calls at Portsmouth are made by barge and only self-propelled tankers are considered in determining catastrophic spills,

the expected number of tanker annual port calls was less than at Eastport (223 as compared with 387)* and it was determined that a catastrophic spill would occur once in approximately 50 years.**

65. World-wide statistics and averaging techniques cannot be applied in any meaningful way to determine the probability and size of expected spills at particular ports. Any comprehensive and meaningful oil spill study for the development of spill probability and expected spill size must be concerned with site specific factors such as tanker fleet composition, density, navigation systems, route characteristics, operational conditions, regimes, and etc. Moreover, the criteria for reporting incidences of pollution or shipping accidents vary widely from country to country, and even the U.S. system, which is as good or better than most, produces data that leaves much to be desired.

Safety of Navigation of Head Harbor Passage

66. The FEIS relied on the opinion of the Coast Guard that the channel through Head Harbor Passage was adequate for safe navigation of 250,000 DWT tankers. The Coast Guard opinion was expressed in

* Simple arithmetic demonstrates that if 387, the expected number of annual tanker port calls at Eastport is divided into 16,000, the lower end of the range of the number of port calls per catastrophic spill, the result is over 41 years. ECO has apparently calculated the 27 year figure by combining annual barge and tanker port calls at Eastport (597) even though world-wide catastrophic spill data excludes barges and even though the probability of a PCI per port call is lower with barges than with tankers (Table I-5, NOAA Exh 33).

** The Office of the Secretary of the Army included barge statistics in estimating costs and catastrophic spill probabilities for the HRECO refinery at Portsmouth, Virginia (Tables 14-17, Attachment 3, Pittston Exh 57). Expectations of a catastrophic tanker spill in Hampton Roads and the entrance to Chesapeake Bay were determined to be once in 51 years with the refinery and once in 71 years without the refinery (Id., Table 20).

letters dated March 28, 1977 and August 23, 1976, which concluded that the channel was adequate for nagivation of tankers of 250,000 DWT and those of lesser size, provided certain provisions were made to assure safe passage. The provisions were: (1) that the channel passage area depths, configurations and current data shown on articles, charts and surveys be confirmed by hydrographic survey, (2) provision for a navigation system wherein the existence and movement of all traffic in the area could be monitored, communicated with and scheduled, (3) provision for means to control movement of tankers in the event of steering and/or propulsion failure during transit, and (4) development and strict adherence to an operating procedure for tanker passage. Considering objections to the project expressed by the Canadian Coast Guard, the U.S. Coast Guard stated that if provision cited above were carried out, there would be no technical basis for further objection by the Canadian Coast Guard. The Coast Guard subsequently clarified its position on provision (2) above stating that whatever the theoretical capability of any installed precise navigational system, there would indeed be meteorological conditions which would preclude safe transit--in other words, Head Harbor Passage could not be safety transited under all visibility conditions. The Coast Guard's opinion that Head Harbor Passage could be safety navigated by tankers of up to 250,000 DWT and those of lesser size was not arrived at in a cursory or casual manner.

67. The Canadian Coast Guard examined the proposed Pittston project and reluctantly concluded that "With highly sophisticated aids to navigation and generous tug assistance, Head Harbor Passage could probably be negotiated by a well-equipped, well-manned and carefully navigated VLCC of the 250,000 DWT class during daylight hours and

good visibility." However, the report further concluded that the degree of navigational risks associated with continuous year-round supply of crude oil and product distribution from the refinery poses a serious threat to the ecology of the region. The Canadian Coast Guard stated flatly that the risk of pollution remains high and is environmentally unacceptable. The Canadian Coast Guard evaluation was submitted in November 1976 which was after the Canadian Government had expressed opposition to the Pittston project on environmental grounds.

68. Computer simulation studies carried out by Dr. Haruzo Eda of Stephens Institute of Technology, Hoboken, New Jersey have confirmed that 250,000 DWT and smaller tankers can safety navigate Head Harbor Passage. Computer simulation involves the utilization of a series of comprehensive and complex mathematical equations, including hydro-dynamic coeficients to define and account for the effects of wind, wave, current, rudder and throttle activity, etc., on ship behavior. The initial studies, conducted in 1976, concluded that 250,000 and 80,000 DWT tankers can maintain a trajectory close to the desired track in the channel (Head Harbor Passage) in currents up to at least 2.7 knots without tug assistance and without anticipatory control input to account for the effects of wind and tide. A trajectory close to the desired track means that the vessel at no time deviated enough from the center of channel to approach at all close to the edge of the designated channel. The studies further show that winds up to at least 20 knots from the most adverse directions introduced no serious problem in ship control during transit under fully loaded conditions and that with anticipatory control in ports such as provided by a pilot, the deviations observed in these studies would be even less.

69. The validity of Dr. Eda's mathematical models has been verified by comparing computer predicted responses to a full-scale sea-trial results. Supplemental computer simulation runs have indicated that a fully loaded 250,000 DWT tanker inbound in Head Harbor Passage could maintain its trajectory close to the desired track without difficulty and without tug assistance in 60 knots of wind (wind in a southeast or northeast direction). During the outbound transit, the 250,000 DWT tanker under ballast conditions maintained its trajectory close to the desired track under beam wind conditions of up to 35 knots. This was without tug assistance and with assistance until the tanker's speed was built up, the limiting wind conditions should be higher. Similar conclusions were reached with respect to the 80,000 and 150,000 DWT tankers in currents up to 2.7 knots and 20 knots winds.

70. The validity of the computer simulation studies referred to in the preceding findings have been attacked upon the ground, inter alia, that they do not properly account for the human factor and upon the ground that they show only the technical feasibility of transiting Head Harbor Passage, but not the actual risk of doing so. The mathematical simulation model included control commands equivalent to those expected from an average pilot and anticipatory control in negotiating turns in the waterway but did not include anticipatory control to counteract the effects of wind and currents. Anticipatory control to counteract the effects of wind and currents would make the deviations from the desired track shown in the computer simulation studies even smaller.

71. It is true that under mathematical simulation, the precise location of the ship relative to the channel is always known and that accurate and precise information on the vessel's heading and rate of change of the heading is always available. In actual conditions this may not always be true and a deficiency of computer simulation of studies is the failure to include or account for a threshold of perception on the part of the pilot. The model of a human pilot utilized in the studies has no statistical variation in its character or responses. While there is evidence that direct computer calculations are not recommended to represent ship handler reactions in port entry situations, an encouraging correlation between computer simulations and the results of actual sea-trials including a harbor or port entry situation has been demonstrated. Analysis of the technical feasibility of navigating Head Harbor Passage gives an excellent indication of the actual risk involved.

72. The Maine Board of Environmental Protection in its Order, dated March 12, 1975, required real time simulation studies to confirm navigational feasibility of vessel traffic in Head Harbor Passage prior to the commencement of operations. This Order remains in effect and Pittston fully intends to and will be required to comply therewith prior to sending loaded tankers into Head Harbor Passage and commencing refinery operations. Oponents of the project contend that Pittston should be required to conduct real time simulation studies before being licensed to proceed with construction. Real time simulation studies also utilize mathematical models such as

those used in the computer simulation studies referred to above. The difference between real time simulation and computer simulation is that the former measures and records the response of the human pilot under simulated conditions of weather, traffic, visibility, etc. Real time simulation is a useful tool in training pilots for specific ports and for research work on specific problem encountered in specific ports. However, for obtaining an overall perspective of the suitability of a particular channel for ship traffic of specific sizes under particular conditions, off-line computer studies are adequate. It is noted that real time simulation studies were conducted in the Netherlands for the Port of Valdez, Alaska, prior to the opening of the Trans-Alaska Pipeline, not for the purpose of determining whether VLCC traffic to that port was feasible, but for the purpose of determining limiting conditions of wind, tug assistance, etc.

73. Pittston employed Frederic R. Harris, Inc. as engineering and marine consultants to determine the feasibility of the project. Frederic R. Harris concluded that the approach from the sea through Head Harbor Passage and Friar Roads to Estes Head and Deep Cove was satisfactory for the type and size of vessel specified, providing navigational aids were installed and providing recommended operational procedures were followed. Tug assistance was to be provided from the time a VLCC enters or leaves the channel and during berthing and deberthing operations. Lighted buoys and radar reflectors were to be installed to mark the limits of the navigatable channel. An electronic guidance system consisting of land based radar and

electronic range finders was to be installed and operated to provide further navigational guidance.

74. Operating procedures recommended by Frederic R. Harris until experience justified a relaxation included the following: (i) berthing and deberthing of tankers would be carried out during slack tide, (ii) vessel transit between Head Harbor Passage and the piers would take place only during daylight or clear moonlighted hours, (iii) tankers would not enter or leave Head Harbor Passage when visibility of less than one mile, and (iv) tankers waived for a berth would not be allowed to anchor in Eastport waters.

75. Current measurements have been taken at four points in Head Harbor Passage very close to the proposed ship track. Two of the stations (F-57 and L-2) where current measurements were taken are at the northern end of the proposed ship track between Casco Bay Island and Campobello Island where the channel has a minimum width of about 700 meters, while two other stations (F-54 and L-4) are along the segment of the proposed track opposite Western Passage. These measurements show that the component of the current perpendicular to the ship track would have a maximum velocity of about one knot. This is at station F-54 opposite Western Passage.

76. At station F-57, residual current is in the flood direction with a magnitude of less than 0.1 knots and the directions of the flood and ebb are very nearly parallel to the proposed ship track, i.e., the cross-current component nearly vanishes.

77. Residual currents are those which are not caused by tidal flow. Average residual currents in Head Harbor Passage are on the order of 10% of the speed of the peak ebb or flood currents. The sum

of the average residual current and the tidal component forms the entire predictable or deterministic portion of current observations. The nondeterministic or unpredictable component of the currents at a particular site represent the third and final component of observed current velocities, which constitutes the variation in the measured current from the predicted current. The magnitude of change between successive measurements obtained at five-minute intervals shows that from 69.4% to 89% of all current speed changes were 0.19 knots or less, most of the larger variations (above 0.2 knots) were in the range of 0.2 to 0.39 knots (approximately 10% of measured peak ebb and flood currents) and the largest percentage of variations exceeding 0.6 knots was 2.1% at station L-2 in the transverse component. Data available from two key stations (L-2 and L-4) along the proposed ship track, obtained by measurements at five minute intervals, are adequate to determine current conditions including current fluctuations, and it is unlikely that additional current meter stations along the proposed ship track would provide substantially different measures of unpredictable fluctuations.

78. Maximum currents within Head Harbor Passage are on the order of four knots while minimum currents are approximately 1.2 knots. Maximum currents opposite Broad Cove, the crude pier terminal area, are five knots* and minimum current speed at that point is 1.8 knots. The Maine BEP Order of June 1975 requires that the outboard side of the crude pier be within the one knot line.

79. Pittston's plan is that VLCC's will not be transiting Head Harbor Passage when currents on the average exceed three knots and

* The March 1973 record of current measurements appears to show a single excursion to a maximum of six knots at 26 feet below mean low water.

that such movements will normally be made with currents ranging between zero and two knots. A Pittston study reflects that a VLCC, presumably fully loaded, can cover the 6.3 nautical miles between East Quoddy Light and Shackford Head, being brought to a dead stop opposite the crude pier, in 132 minutes, having at no time exceeded a ground speed of six knots or encountered tides in excess of two knots. This does not include time, estimated at 20 minutes, to turn the VLCC so that its bow is to the seaward, or the time, estimated at 15 to 20 minutes, to push the vessel onto the breasting dolphins at the pier.

80. It is anticipated that pushing the VLCC onto the breasting dolphins will be undertaken when currents are 0.5 knots or less in order to minimize forces broadside to the vessel when it is being turned. Data obtained by EG&G, Inc. off of Estes Head shows that minimum time with a current at plus or minus 0.5 knots is 20 minutes and the maximum is 70 minutes and that with the current at plus or minus one knot, minimum time is 50 minutes and maximum time is 120 minutes. This establishes that with proper scheduling there is adequate time to make the described berthing maneuvers in currents of plus or minus one knot or less.

81. Vessels of the U.S. Navy up to 624 feet in length and freighters up to 400 feet in length have successfully navigated Head Harbor Passage. Moreover, oil barges towed by tug on a line of approximately 1200 feet in length come down Head Harbor Passage, make the turn at Western Passage and proceed up the St. Croix River or to St. Andrews, New Brunswick on a regular basis with no apparent difficulties. Head Harbor Passage may be safety navigated by VLCC's with tug

assistance as proposed by Pittston and the evidence does not establish that the waters in the Eastport area are so turbulent and unpredictable that transit by such vessels would be unduly hazardous.

Fog

82. The Eastport area has the highest number of fog days along the east coast of the United States. The most severe fog conditions occur in the summer months of June, July and August. Fog results from light, southerly winds bringing warm, moist air over the cold water in the Eastport area. As much as 94.75% of all fog approaches Head Harbor Passage from the south having formed or moved into the area from Grand Manan Channel. Fog typically moves through Lubec Narrows and simultaneously through a valley on Campobello Island, converging in Friar Roads and then diverging, moving up Head Harbor Passage and into Cobscook Bay on either side of Eastport.

83. Records from the Weather Bureau Station in Eastport over a 66 year period (1885-1951) show that the average number of days at Eastport with visibility less than 1/4 of a mile is 58 and that these conditions pervail on 30 days in the summer (33% of the time) and on five days in the winter (5% of the time). It further appears that 75% of fog occurrences begin during hours of darkness, that more than half of the poor visibility hours occur at night and that in practically every case where fog occurrence developed during the day, the winds were light (5-10 knots) with a southerly component. Data in the FEIS indicates that visibility in the Eastport area is likely to be

two miles or greater 80% of the time and two miles or greater 90% of the time during daylight hours.

84. Uncontradicted testimony is to the effect that the kind of fog prevalent in the Eastport area (radiation advective) is so well known and observed that routine meteorological forecasting procedures could just about eliminate the possibility of a tanker moving down Head Harbor Passage when the fog was moving in. Reliability of weather bureau forecasts for one or two hour periods in advance is nearly a hundred percent.

Wind

85. Prevailing winds in the Eastport area are westerly. During the period November to March, winds blow from the west to north direction and from April to October, southwesterly winds predominate. There is nothing unusual about the winds in the Eastport area as compared to other areas along the East, Gulf, Pacific and Alaskan Coasts. Speed of wind is not a special risk in Eastport nor peculiar to that area.

Duration of Effects of Oil Spills

86. The magnitude and permanency of damage resulting from an oil spill is a function of: (i) the chemical composition and physical properties of the spilled petroleum, (ii) the quantity of the petroleum and duration and the spill, (iii) seasonal oceanographic, and meteorological conditions, (iv) nature of the exposed ecosystem, (v) habitat type and substrate, (vi) geographic location, and (vii) type of spill cleanup employed. While opponents of the Pittston project have stressed the possibility of irreversible jeopardy and permanent alteration of the ecosystem as a result of oil spills, there is no scientific data to establish that any species has been completely and permanently eliminated from any area as a result of even the most massive oil spill. Recovery from the effects of an oil spill starts immediately after a spill as the oil immediately undergoes weathering processes such as spreading to form slicks, evaporation of volatile components, dissolution of soluble compounds into the seawater beneath the slick, emulsification of fine particles of petroleum into the water column, absorption of petroleum with water borne particles, compaction of the oil into tar balls, modification of petroleum mixtures by ingestion and excretion of bacteria and large life forms and photochemical modification. Microbial degradation of oil is undoubtedly the most important process involved in weathering and the eventual disappearance of petroleum from the marine environment and some microorganisms capable of oxidizing chemicals in petroleum have been found in virtually all parts of the marine environment examined.

87. There's no doubt that a large oil spill in the Eastport area would cause harm to the environment. However, even in the event of a large oil spill, not all of the area within the impact zone would be uniformly oiled, some areas would be heavily oiled, others less so, and other areas within the impact zone would likely not be oiled at all. Moreover, because of varying degrees of weathering the oil that comes ashore would have different chemical compositions and the different habitat types in the Eastport area would have their own characteristic rate of recovery which depend to a large extent on the physical and chemical environments of these habitats. The rate of recovery of an environment is proportional to the rate of removal of oil. Oil can be physically removed by wave action or by the efforts of clean-up forces or it can be removed through the processes of solution and evaporation. Once the cleanup process has been carried out the most important route by which oil is removed from the environment is bacterial action and in order for bacterial degradation to proceed at a high rate, a source of oxygen and nutrients, such as nitrogen and phosphorus is required.

88. High energy shores, that is, rocky shores exposed to wind and wave self-clean fairly rapidly. An exposed rocky shore in France was essentially cleaned within a year after the Amoco Cadiz spill. Unconsolidated sediments with plenty of water perculation or a large degree of oxygen availability will be cleaned up fairly rapidly by bacterial action and oil will persist for long periods of time only in low energy areas where there is little or no water

perculation in the sediments. Applying these criteria to an oil spill in the Eastport area, rocky shores can be expected to be largely clean in a year or so, with substantial recovery occurring within one year and complete recovery within four years. Beaches will cleanup at widely varying rates depending on grain size and wave exposure. Following the Tamano oil spill in Portland, Maine in 1972, two heavily oiled exposed beaches were cleaned in three to six weeks and Tamano oil could not be identified past four years. A conservative prediction of recovery time for beaches in Cobscook Bay would be from less than a year to a maximum of four years.

89. It is generally agreed that marshes, especially salt marshes, require the longest time to recover from the effects of an oil spill and are, at the same time, the most vunerable to oil. Oil in muddy environments can be expected to persist for some three to eight years, while ten or more years may be required for recovery of a severely oiled marsh.

90. In nearly every environment all or nearly all of preexisting plants and animals may be killed, by a major oil spill, but as oil levels decrease, species of animals or plants which are very resistant to physical stress will begin to repopulate the area. Animals which are very resistant to environmental stress and have very high reproductive rates are commonly referred to as "opportunistic animals." Opportunistic animals, while resistant changes in the physical environment, are not very good at resisting competition by other species of animals.

91. A physically controlled environment is one in which the number and species of animals found therein is determined by its physical

characteristics. A biologically controlled environment is one in which the number and kind of animals and plants found therein are determined primarily by the interaction or competition between these species of animals and plants. As oil degrades or as otherwise removed from an oiled area, the area progresses from being a physically controlled environment, in which there are characteristically low numbers of species in large numbers, through an intermediate period where there are both opportunistic species which originally colonized the area and species which are characteristic of the area. As more and more of the species characteristic of an environment return following an oiling, these species overcome the opportunistic species and the community of animals and plants found in the environment returns to its original state. When each of the originally occurring species reappears in an environment which has been oiled depends upon the tolerance of that species to oil.

92. Highly hydrated sediments are resistant to oil penetration. Soft intertidal sediments generally exhibit the highest degree of microbial activity and degrade oil more rapidly than clay-gravel type beach sediments. One of the reasons for the rapid degradation of petroleum in such sediments is that the sediments offer a habitat for polychaete worms which are able to tolerate relatively high residues of petroleum concentrations and perform the crucial function of turning over and burrowing into the sediments to enable microbial action to oxidize petroleum residues.

93. Rough estimates of the amount of oil degraded by microbial actions following the Amoco Cadiz spill in France were on the order of 10,000 tons in two weeks.

94. In studies following the Arrow spill which ran aground in Chedabucto Bay, Nova Scotia in February of 1970 spilling two-thirds of a cargo of 108,000 barrels of Bunker C fuel oil, it was concluded that most of the hydrocarbons degradable by microorganisms had largely disappeared 18 months after the spill and that Chedabucto Bay was then (1977) relatively oil free. Although Eastport and Chedabucto Bay are similar in some respects, there is no doubt that the climate is more harsh and the growing season shorter in Chedabucto Bay. Proof of this conclusion is found in the fact that soft-shell clams which may reach a length of two inches in five to eight years in Cobscook Bay, require 17 to 22 years to reach the same length in Chedabucto Bay.

95. Studies undertaken in the Port of Milford Haven, Wales, 15 years after it commenced operation as a substantial oil port, reached the conclusion that there were no overall ecological changes which could be attributed to the oil industry. This was attributed at least in part to an efficient harbor administration, cooperation of the oil companies and a well organized clean-up system. In addition to the human factors listed above, the minimal damage inflicted on Milford Haven by the oil industries could be attributable to extensive tidal flushings, a relatively small number of mudy shores--the shores of Milford Haven being predominantly rocky--and the presence of a small number of oil susceptible birds.

96. Salt marshes are considered the most biologically productive areas on the east coast of the United States. Data from the Maine Department of Fisheries and Wildlife are to the effect that there are 278 acres of marshland in the Cobscook Bay area. This data is only on

areas of five acres or more and it is possible that inclusion of marshes below five acres in size would substantially increase the total.

97. There are 9,300 acres of mud and sand flats in the Eastport area, of which slightly over 6,000 acres are mud flats in Cobscook Bay. Mud flats are defined as a nonvegetated intertidal flat exposed at each low tide.

98. Estimates of the spread of spilled oil from hypothetical spills of 50,000 tons each occurring in the northern part of Head Harbor Passage at low water and off of Estes Head one hour before high water are in the record. The conclusion was that dispersion of spilled oil would be rapid and extensive in Head Harbor Passage and that the risk of contamination seemed to be general rather than being concentrated in a few collector-sites. All the waters and shores of Head Harbor Passage would be vulnerable within twelve hours of a spill and the waters and shores of Passamaquoddy Bay, Campobello and Grand Manan Island would be vulnerable to contamination within a week. Waters and shores of the Bay of Fundy and the Gulf of Maine would be vulnerable to contamination in longer periods of time. These conclusions assume that no clean-up efforts were effected and that there were no restraints on the spread of oil other than land bodies. The period of time in which the oil would be released in these hypothetical spills is not clear. Moreover, these studies of hypothetical spills make no allowance for evaporation, no estimate of the amount of oil trapped in estuaries or shoreline areas, and no allowance for the effects of wind.

Alleged Uniqueness of Quoddy Region

99. Opponents of the Pittston project have emphasized the uniqueness of the Quoddy region, arguing that such an area should not be exposed to the risk of oil spills which will be engendered by the project. The FEIS concluded that if uniqueness is to be considered as the presence of species or habitats which are found absolutely nowhere else, then the Cobscook Bay area could not be considered unique. The FEIS further concluded that all species found in the Cobscook Bay area are thought to occur in other habitat along the coast of Maine and that no evidence has been found to indicate that species are present which would be eliminated as a result of an oil spill.

100. While NOAA contends that eastern Maine and the Quoddy region, especially Head Harbor Passage and the Cobscook Bay area, are unique in terms of benthic invertebrates, data presented by their own witness show that other areas of Maine have a greater number of invertebrate species as well as a greater number of unique species. Data in the record establish that the Sheepscot River Estuary and Casco Bay rather than Cobscook Bay are the most productive in terms of mean numbers or density of species. Productivity of Cobscook Bay in relation to other Maine Estuaries and other tempered estuaries in the world can properly be termed "relatively high."

101. All of the animals found in the Eastport area are in fact found elsewhere and the reason for the diversity in the Eastport area is because the environment is more predictable than in other areas of Maine.

102. It is also argued that the Quoddy region is unique because species found intertidally there are found only subtidally elsewhere and

because of what is termed "giantism," the large sizes obtained by some benthic invertebrate species. While species found intertidally can be more readily observed and studied, there are species found intertidally in some areas of Maine and not in Cobscook Bay. Giantism has been observed and recorded in other areas of the world.

103. Migrating shore birds which congregate on the large intertidal flats of the Quoddy region to feed at certain seasons include semipalmated sandpipers and semipalmated plovers. These birds feed on intertidal invertebrates such as amphipods which reportedly occur only in the northern Gulf of Maine and Bay of Fundy on this side of the Atlantic.

104. Water and shore bird species in the vicinity of the proposed project and in adjacent coastal waters through which tankers would pass may be grouped into six categories: (1) gulls, terns and cormorants, (2) shore birds, including phalaropes, (3) waterfowl, including loons and grebes, (4) alcids, stormpetrels and associated seabirds, (5) wading birds, and (6) hawks and eagles. Birds that spend most of their time feeding on the water or diving for their food would be most vulnerable to oil spills and these include loons, grebes, diving ducks, such as scoters and eiders, and possibly birds in large concentrations such as alcids (seabirds) which consist of groups including auks, puffins, kies, razorbill and murres.

105. Because some of the birds are migratory and others move in and out the area at specific times of the year for breeding, nesting and other reasons, not all birds common to the area would be present

at any particular time and thus at risk from an oil spill. There are no reports of permanent or lasting damage to bird populations as a result of oil spills and no contention has been made that the survival of any species, other than the bald eagle, would be jeopardized by the refinery.

106. Oil causes death in birds by disrupting the feather structure and causing feathers to mat together, thus destroying the insulation and buoyancy qualities of the feathers so that birds may die of exposure or drowning. Attempts to clean and rehabilitate oiled birds have faired poorly in the past, but are improving and the success rate for a well-run rehabilitation center should be about 60%.

107. Birds may also ingest oil directly by preening, drinking, or eating food covered with oil or indirectly when consuming food that contains oil or fractions of oil. Necropsies of birds killed in oil spills have revealed some general pathological effects of direct ingestion of oil which includes lipid pneumonia, gastrointestinal irritation, fatty livers, enlarged adrenal gland and kidney, and pancreas damage which can lead to other complications such as dehydration, starvation, shock and reduced disease resistance. In general, short term ingestion of small amounts of oil may cause detectable changes in avian physiology and behavior. However, the magnitude or consequencies of oil ingestion of prey items in the wild are unknown.

108. Studies using artificially or naturally incubated eggs of ducks, gulls, herons, etc., have shown that a single application of 1-20 microliters (5 microliters equals a small drop) of several crude

and refined oils will significantly reduce hatchability of eggs. Bird embryos are most sensitive to petroleum during the first ten days of incubation. Weathered oils are less toxic to bird embryos than unweathered samples of such oils. Oil can be transferred to eggs from the plumage and feet of birds.

109. The largest bird mortality from oiling in the Eastport area would most likely occur during the period August through April, as except for offshore islands, the area is less important for reproduction than it is for migration and wintering. Migrating species that use the area heavily during late summer, fall or spring include black ducks, American brant (geese), scoter ducks, northern phalaropes, sandpipers, semipalmated plovers, black-bellied plover and Bonaparte's gulls. Wintering species include black ducks, scoter ducks, common eiders, goldeneye, buffle head and old-sqaw ducks, great cormorants, horned grebes, several alcids, herring gulls, black-legged kittiwakes and northern fulmar. Seaducks, alcids, cormorants and loons would be most severely effected by an oil spill followed by diving ducks, horned grebes and geese. More migrating northern phalaropes visit Eastport and vicinity than any other area in North America and because of their habit of feeding and resting on open water, they would be seriously threatened by a large spill. Migrating shore birds that roost on intertidal flats would be vulnerable to a night oil spill or a night movement of previously spilled oil.

110. Based on spreading, solubility and toxic characteristics, No. 2 fuel oil, a product of the refinery, poses the greatest oiling threat followed by incoming Saudia Arabian Crude and No. 5 fuel oil.

Value of Resources at Risk

111. The FEIS recognizes that invertebrate species found in the Quoddy region have substantial commercial value. Species of commercial interest in Washington County, Maine and Charlotte County, New Brunswick are listed and these include lobster, soft-shell clam, shrimp, scallop, periwinkle, blue mussel and worms. Invertebrate landings for Washington County in 1975 totaled 5,345,000 lbs. valued at $6,711,000. Invertebrate landings for Charlotte County, New Brunswick for 1975,which doesn't include mussel and worms, totaled 1,509,000 lbs. valued at $1,603,000. Data in the record show that total Washington County invertebrate landings for 1978 were 5,789,633 lbs. valued at $8,302,357 and that comparable data for Charlotte County for 1978 totaled 1,677,900 lbs. valued at $2,365,000.

112. The FEIS shows 1975 ground fish landings in Washington County totaling 257,000 lbs. valued at $40,000. Ground fish include cod, haddock, cusk, eel, dab (plaice), hake, pollack, halibut, winter flounder and witch flounder (gray sole). Ground fish landings for Charlotte County, New Brunswick in 1975 totaled 2,492,000 lbs. valued at $302,000. Washington County ground fish landings (including only cod, haddock and pollack) for 1978 totaled 1,088,780 lbs. valued at $169,530, while Charlotte County's ground fish landings for 1978 are reported at 770,000 kilograms valued at $360,000.

113. The FEIS states that herring are the single most important fishery in the Passamaquoddy region. Herring landings for Washington County in 1975 totaled 6,596,870 lbs. valued at $293,717. Herring

landings for Charlotte County, New Brunswick in 1975 were 131,965,000 lbs. valued at $3,383,000. Washington County herring landings in 1978 totaled 14,726,874 lbs. valued at $822,400 while Charlotte County, New Brunswick herring landings in 1978 totaled 131,744,000 lbs. valued at $8,777,000. Finfish and shellfish landings for Washington and and Charlotte Counties in 1978 totaled 156,600,000 lbs. valued at $20,807,000.

114. Landings and landed values reported in the preceding finding are estimates because the data includes only commercial landings collected at major ports. The data does not include recreational landings and not all dealers handling fish and shellfish are contacted by government personnel collecting the data. Moreover, fish caught in one area may be landed in another. Although as a generalization, the figures on landed quantities of marine products show a general upward trend during the period 1969 through 1978, it is clear that the dramatic increases in landed values are due primarily to price increases in an inflationary economy.

115. Values added by handling, processing, etc., are not included in the landed values stated in the preceding findings. Applying the multiplier 2.96 to expressed or landed value of commercially reported landings, it is estimated that the aggregate economic impact from commercial fisheries in "Washington County, Maine and Charlotte County, New Brunswick is approximately $60,000,000."

Oil Discharges and Pittston's Oil Spill Containment and Recovery Plan

116. The FEIS indicates that 550 lbs. or 92 gallons of oil and grease per day will be discharged in the immediate vicinity of the refinery. The FEIS further indicates that dispersion through the diffuser outfall would minimize the visual impact of this quantity of oil and grease and that concentrations in the vicinity of the diffuser should be near or below the threshold at which animals and plants may be affected. While it is stated that sediments in the immediate area of the diffuser will lose the potential for supporting benthic life, it is expected that the loss of organisms in the immediate vicinity of the discharges will have insignificant effects on the ecosystem. Because petroleum compounds are readily metabolized by bacteria, there will be no year-round accumulation of oil in the vicinity of the discharges.

117. The FEIS estimated oil spills during routine transfer operations at the crude and product years at 20 to 86 barrels per year. This estimate was essentially based on Milford Haven, United Kingdom, which is considered similar to Eastport in many respects, but handles 3,500 vessels per year as compared to Eastport's anticipated 500 to 750. Tankers will be surrounded by booms during transfer operations and substantially all of this oil should be contained and removed.

118. The FEIS defined a severe incident as one where the oil spill exceeds 700 barrels. The Pittston Oil Spill Contingency Manual for the Proposed Refinery envisages that should an oil spill occur in transit, the source of the oil would be removed, the spilled oil

would be contained and diverted, protective equipment would be deployed in sensitive areas and clean-up activities would follow. Specifically, the Manual states that should a spill occur in transit from a loaded tanker compartment, the tanker would be stopped in the channel with tug assistance, spill emergency signals would be sounded, and the tanker crew would take immediate action to transfer oil to the ship's slop tank, other cargo tanks where space exists or water ballast tanks if feasible. In addition, the cargo would be pumped to barges or tankers if available at the terminal. Tugs, motor boats, and a vacuum barge would form the nucleus of equipment for containing and recovering oil in the channel from any source. The Oil Spill Contingency Manual envisaged that permanent folding booms would be installed to protect lobster pounds on Deer Island. The Manual also envisaged the installation of permanent booms in a folded position, the booms to be deployed in the event of an oil spill, in Passamaquoddy Bay at Western Passage and in Cobscook Bay. The evidence is that because of currents it would be very difficult to deploy booms in this manner and that it is unlikely that booms so deployed would be very useful.

119. Booms are usually ineffective in containing oil at current speeds in excess of 1.5 to 2 knots. The Oil Spill Contingency Manual states that boom containment is effective without skimmers in currents of two knots parallel to the boom surface and one knot perpendicular to the boom surface. Additional difficulties with diversionary booms are that diverted oil must be promptly removed or it will escape either through entrainment or current direction changes, booms which are not continuously tended will generally

fail because of one or more tidal changes and irregularities at the shore end of booms leave gaps which allow oil to escape and contaminate the shores. Other impediments to deploying and effectively utilizing booms in the Eastport area are wind, tides, extremes in temperature and poor visibility.

120. Uncontradicted expert testimony for NOAA was to the effect that lobster pounds could only be protected by extensive, permanently constructed facilities and that ad hoc booming to prevent clamming flats was doomed to failure because of inadequate time to deploy the booms before impact, most areas being impacted within one tidal cycle.

121. Oil removal equipment to be employed by Pittston includes 24-foot motor boats with gasoline powered fire pumps, positive displacement rotary pumps, portable diesel generators, portable vacuum skimmers, portable hose and oil skimming tugs. Absorbent booms, pillows and sweeps may be used to cleanup oil outside of the booms. For oil reaching the shoreline, vacuum trucks would be employed if accessible by road and natural and man-made absorbents would be used.

122. Although disposal of oil soaked absorbents and debris has been a serious problem, there is evidence that facilities being developed by the State of Maine will resolve this problem by the time the refinery is operational. Absorbents, foam and other supplies will be stockpiled at the refinery and a listing of additional equipment and supplies and procedures for obtaining the same will be included in the final contingency plans.

123. The Pittston Oil Spill Contingency Manual is preliminary and there is no doubt that under Maine law and regulations Pittstion may be required to submit a revised oil spill contingency plan, and that the State of Maine may impose additional construction, pre-operational and operational conditions on the project and require Pittston to maintain specified equipment and supplies at the refinery for use in cleaning up oil spills.

124. In instances of significant or major oil spills (defined as anywhere from 250,000 to millions of gallons) clean-up efforts seldom result in a recovery rate of over 20%. While there is evidence that a spill of 250,000 gallons or more offshore could not be contained in the Eastport area, this is not peculiar to Eastport, but would be true anywhere along the coast of Maine and probably anywhere in the world.

Need for the Refinery

125. The FEIS justified the need for the refinery in part by citing Federal policy to encourage the construction of refining capacity within the U.S. to meet domestic needs for reasons of national security. It was stated that by 1973 product imports totaled 3,000,000 barrels per day or 17% of total requirements. Product imports exceeded 2.5 million barrels a day during the first four months of 1977 and more domestic refinery capacity was assertedly needed to back out imported products and take care of anticipated future growth and demand. The FEIS cited the serious problems

created by U.S. dependence on foreign crude and asserted that overdependence on foreign refineries would be equally dangerous. Petroleum products were estimated to supply approximately 42% of U.S. energy requirements by 1985 and to require 20,731,000 barrels per day as compared to 16,291,000 barrels per day in 1975. Similar increases in petroleum consumption were projected for the East Coast of the U.S. and for the New England States.

126. The most serious deficit of domestic refining capacity is on the East Coast (having approximately 30% of requirements) and there is no refining capacity in New England.

127. Because U.S. refining capacity exceeds domestic oil production and there is surplus refining capacity not only in the Caribbean, but also in Europe, opponents of the Pittston project contend that need for the refinery has not been demonstrated. Opponents of the project also cite the President's policy that imports of foreign oil into the United States not exceed 1977 levels (8.6 million barrels a day) and therefor assert that in the absence of an unlikely substantial increase in domestic oil production, the increase of the petroleum consumption projected by the FEIS cannot take place.

128. Because of increasing use of unleaded gasoline, demand for unleaded gasoline is very close to the U.S. refinery capacity to produce such gasoline. Refineries in the Carribean and in Europe do not have the capability to supply significant amounts of unleaded gasoline to the U.S. Moreover, U.S. refinery capability to process sour crudes (defined as crudes having more than 0.5% sulfur content by weight) is 46% of capacity and because of the declining availability of sweet crudes, 65% of domestic refining capacity should be devoted to sour crudes.

129. It is U.S. policy to encourage construction of domestic refining capacity to meet domestic needs and not to rely on product imports. If the refinery were built, it would be more likely to be able to obtain crude oil in the event of an embargo or other shortage.

Economic Benefits of the Refinery

130. Economic benefits of the refinery as related to product prices are due primarily to lower costs associated with crude oil deliveries in VLCC's. The FEIS estimated that these benefits may amount to as much as \$.37 a barrel compared with a similar refinery delivering the same product to the same market from the Gulf Coast and as much as \$.58 per barrel from the Middle Atlantic States. Although dependent on tanker rates, other evidence places the cost advantage of crude delivery in VLCC's and product deliveries in medium size tankers at \$1.00 a barrel.

131. Balance of payments benefits from the refinery are the cost of refining which is estimated at \$3.00 a barrel. This might have to be reduced somewhat to account for possible closings of older, less efficient refineries.

132. Construction of the refinery is expected to create 1,000 jobs during the first year, 2,500 jobs during the second year and 1,000 jobs during the third and final year of construction. Permanent jobs at the refinery will be 300 with another 200 jobs created by firms or individuals performing services on a contract basis. Application of a conservative multiplier of 1.25 for retail, service

and other support activities would result in 700 jobs in the Eastport area in addition to those created by the refinery.

133. There is a shortage of year-round jobs in Washington County, Maine and much of existing employment is seasonal in nature. The unemployment rate in Washington County in 1975 was 13.6 percent and Washington County is the poorest county in Maine. Per capita income for Eastport in 1972 was 14 percent below the county level, 30 percent below the State level and 45 percent below the national average.

Alternatives to Pittston Project

134. The FEIS stated that EPA action on the Pittston permit application was limited to granting, denying or granting the application with conditions. It was pointed out that action on the permit application must relate to the project as conditionally approved by the Maine BEP. Consideration of alternative sites for a refinery and marine terminal were limited to those in the State of Maine. Other sites considered were Machias, Penobscot/Blue Hill and Portland. EPA concluded that none of these sites was preferable or superior from an environmental standpoint to Eastport. The FEIS also analyzed the alternative of a monobuoy (single point mooring or SPM) system in the Grand Manan Channel off of Lubec, Maine. It was concluded that because of locational constraints in the Eastport area such a system would not significantly reduce overall environmental impacts associated with the project.

135. Although opponents of the Pittston project have attacked the FEIS consideration of alternatives as inadequate and based on an

erroneous interpretation of EPA's NEPA obligations, they have presented no probative evidence to contradict EPA's conclusion that other sites in the State of Maine are not environmentally preferable to Eastport.

136. Opponents of the project do rely on a study conducted by an intra-agency task force chaired by the Corps of Engineers in connection with the final supplement to the EIS concerning the Hampton Roads Energy Company's (HRECO) proposal to build a refinery in Portsmouth, Virginia. The study evaluated alternative locations to the Portsmouth, Virginia site including Eastport and Portland/Sanford, Maine as well as other sites in other states and gave Eastport unacceptable ratings as to risks or impacts on endangered or threatened species, terrestrial species and waterfowl, aquatic species and commercial and sport fisheries. The study, however, recognizes that the amount of information available on each site varied widely and that comparisons were valid only in relation to HRECO's Portsmouth, Virginia site. Moreover, in preparing the EIS for the Pittston project, EPA used "worst-case analyses," a factor not applied to other sites with the exception of the Portsmouth site. The matrix developed to graphically present evaluation of key descriptors for alternative sites in the HRECO EIS does not allow comparing the relative significance of one descriptor with another and states that attempting to rank sites using the matrix is not a valid procedure. In taking final action on the HRECO permit application and accompanying

EIS, the Office of the Secretary of the Army determined that there were gross inconsistencies in the way information was translated into the matrix and that the matrix was invalid as a decisional guide.

137. Pittston considered Eastport a preferred location because; (1) it had a very deep, naturally sheltered harbor, with excellent channel approaches as regards depth, straightness and length; (2) it was a logistically excellent location in relation to water distances to foreign crude supply points as well as to product markets, and the size of tankers that could be accomodated; (3) it is a location on the U.S. mainland with attendant stability and production geared to supply U.S. markets; (4) it has a receptive local community; and (5) it is an adequate site which has been acquired or is under binding options. EPA concluded that only sites in Maine met the requirement for deep water ports close to shore, capable of accomodating VLCC's and that a discussion of alternatives to Eastport should include sites meeting some of the basic business criteria necessary for Pittston to proceed with the project.

138. Pittston determined that Portland was not an acceptable site because water depth was limited to tankers of 90,000 DWT, there was not enough land near the waterfront for a refinery or marine terminal, the refinery would have to be located approximately 30 miles from the waterfront and it was difficult or impractical to pipe crude and fuel oil for those distances, and it would be difficult to obtain the necessary right of way.

139. Pittston's marine engineering consultant, Frederic R. Harris, Inc., determined that it was technically feasible to construct a monobuoy in the Grand Manan Channel offshore or from Lubec, Maine. The site selected by Frederic R. Harris was 1.5 miles off of the U.S. mainland. This location is not far enough from the shore to make it unlikely that spilled oil would impact the shore. With regard to a monobuoy system in Machias Bay, the FEIS concluded that it would be merely transferring the hazard to an equally ecologically senstive area.

140. A monobuoy system is impractical for product which would still have to be shipped from the refinery in tankers.

141. There is evidence in the record from which it could be concluded that it would be economically feasible to construct an SPM 50 miles off of the coast of New Jersey. The facility would consist of three SPM's connected to a pumping platform 50 miles off of Atlantic City, New Jersey in 130 feet of water. The capacity of the system would be 1.041 million barrels per day of existing capacity plus 250,000 BPD of additional capacity, the latter equivalent to the capacity of the proposed Pittston refinery at Eastport.
The study omits land use regulations and environmental attitudes as selection criteria based on the expectation these constraints may be lifted or modified in the near future. Who the owners of the project would be or how it would be financed were not explored, although there is a vague reference to studies and possible ownership by the State of New Jersey. Detailed engineering work on the project has not been done and there is nothing in the study comparing the proposed system with Pittston's project from an economic standpoint. The proposed pipeline would

go ashore approximately at Atlantic City, New Jersey and cross the southern portion of the state. Studies as to the availability or the ability to acquire rights of way have not been performed. Moreover, the study made no allowance for the fact that New Jersey is in in a nonattainment area under the Clean Air Act.

Maine BEP Conditions as Part of Section 401 Certification

142. On September 2, 1977, the Acting Commissioner of The Maine Department of Natural Resources, Henry E. Warren, issued a certfication pursuant to Section 401(a)(1) of the CWA that the discharge proposed in the NPDES permit to be issued to the Pittston would comply with the applicable provisions of Sections 301, 302, 306 and 307 of the CWA. The certification made no mention of the conditions under which the Maine BEP had approved the Pittston project and in fact, was completely silent as to existence of the BEP Order and conditions. Nevertheless, the proposed permit states that as part of its certification for this permit, the Maine Board of Environmental Protection has required compliance with the conditions set forth in this Order No. 29-1466-29210 of March 12, 1975, as amended on June 4, 1975, and that in accordance with Section 401(d) of the Act, those conditions set forth in the Board's Order, as amended, which are now required to assure compliance with Sections 301, 302, 306, and 307 are hereby made part of this permit. Pittston has contested the finding that the conditions of the Maine BEP order were a part of the Section 401 certification.

143. The State of Maine issued a license authorizing Pittston to discharge treated waste waters from a refinery complex in Eastport on June 8, 1977. The license was specifically made subject to general and special conditions attached. These conditions made no reference to the BEP Order referred to in the preceding finding.

144. Mr. Henry E. Warren, Commissioner of the Maine BEP, submitted testimony which incorporated by reference a letter to EPA, dated June 21, 1979, signed by Mr. Warren. The letter refers to four draft NPDES permits, copies attached, the last three of which recite in substantially identical language that: "* The Maine BEP has required compliance with the conditions set forth in its Order No. 29-1466-29210 of March 12, 1975 and amended June 4, 1975." The draft permits are undated except the final one (Attachment I) which states "Final Draft Permit for State Certification Date 8/19/77." Mr. Warren's testimony was admitted over Pittston's objection and Pittston has renewed its objections on brief and filed a motion to strike.

Conclusions

1. In denying Pittston's application for a wastewater discharge permit under the CWA upon the ground that it would jeopardize the existence of the bald eagle and of the right and humpback whale, the Regional Administrator relied on findings and determinations of FWS and NMFS.
2. In denying Pittston's permit application, the Regional Administrator specifically determined that the value of the fisheries resources at risk, though substantial, would not justify denial of the permit.
3. There is no reasonable likelihood that emissions from the proposed refinery will significantly increase hazards to which bald eagles are exposed.
4. While there is a possibility that a significant oil spill would expose eagles, their eggs and young to contamination by oil, considering the navigational safeguards and restrictions, the limited time of high vulnerability of eggs to oil exposure and all the other circumstances, this possibility is unlikely.
5. The influx of people and increased commercial activity engendered by construction and operation of the refinery could result in increased disturbance of eagles resulting in nest abandonment, reduced productivity and increased mortality. However, the closest eagle nest is approximately 25 miles by road from Eastport, the period of maximum eagle sensitivity to human disturbance is the nesting season, prior to the hatching of eaglets, and a period when the weather in the Eastport/Cobscook Bay area is normally inclement and not conducive to outdoor recreation. These factors tend to

minimize the likely effects of the Pittston project on eagles.

6. Mitigation measures proposed by Pittston, which include educational programs, alternate food sites to lure eagles, and carbide cannon to frighten eagles away from oil contaminated areas, cooperation in acquisition of land around nest sites in order to minimize human encroachment and repopulation programs such as the introduction of eaglets into existing nests can, with the cooperation of FWS, significantly reduce hazards to eagles from human disturbance of nests and oil spills and mitigate the effects of such hazards.

7. Eagles at risk from the refinery are limited to Cobscook Bay eagles (six breeding pair in 1979).

8. The bald eagle population in eastern Maine is continuous with that of New Brunswick and Nova Scotia, including Cape Breton Island, so as to constitute one eagle population.

9. Considering the bald eagle population in eastern Maine with that of New Brunswick and Nova Scotia, including Cape Breton Island, as the appropriate population segment, the hypothetical loss of all eagles in the Cobscook Bay area would not jeopardize the continued existence of that bald eagle population segment.

10. There is no reasonable likelihood that construction and operation of the refinery will jeopardize the continued existence of the bald eagle as that phrase is defined by regulation (50 CFR 402.02).

11. Risks to the whale caused by construction and operation of the refinery would result primarily, if not solely, from a massive oil spill.

12. While the effects of oil on whales are unknown, there is no reported instance of whale mortality or injury which has been attributed to the presence of oil.

13. There is no reasonable likelihood that noise from construction activities, such as blasting, and refinery and ship operation will result in jeopardy to the continued existence of whales.

14. Although increased ship traffic as a result of operation of the refinery could result in collisions with whales, there is no evidence of significant whale mortality attributable to such collisions and no reasonable likelihood that ship traffic associated with construction and operation of the refinery will jeopardize the continued existence of whales.

15. The population of the humpback whale in the Northwest Atlantic is such that the hypothetical loss of all whales in the Quoddy/Grand Manan area at any one time (not more than 30 and probably far less) would not jeopardize the continued existence of the humpback.

16. The maximum number of right whales in the Quoddy/Grand Manan area at one time is five and the period the right whales stay in the area does not exceed the period July through October.

17. Because zooplankton, food for the whale, are pelagic, live in an area where oil has a very short residence time and have very high reproduction rates, even the most massive oil spill would not destroy the whales' source of food.

18. Considering the navigational safeguards and restrictions and the limited time whales are in the Quoddy/Grand Manan area and thus exposed to the risks of an oil spill, there is no reasonable

likelihod that construction and operation of the refinery will jeopardize the continued existence of the right and humpback whale as that phrase is defined (50 CFR 402.02).

19. Head Harbor Passage can be safely navigated by tankers of up to 250,000 OWT and, considering depth of the water, navigational safeguards and restrictions together with the low traffic density, risks of such navigation such as currents, wind and fog cited by opponents of the project, are exaggerated.

20. Navigational risks are primarily a function of water depth and traffic density rather than tanker size, both of which are in Eastport's favor.

21. Although a massive oil spill is a possibility, it is unlikely and the risks of such a spill can only be characterized as very small or minute. An oil spill in excess of 250,000 gallons in the Eastport area probably could not be successfully-contained with existing techniques. This, however, is not limited to Eastport, but would be true anywhere along the Maine coast and probably in the world.

22. No other site for a marine terminal and refinery in the State of Maine is superior from an environmental standpoint to Eastport.

23. Need for the refinery is established by the lack of sufficient refinery capacity on the East Coast of the United States to equal consumption, by the fact there is no refining capacity in New England, by the need for refinery capacity to process sour crude oil and to produce unleaded gasoline and by the U.S. policy to encourage construction of domestic refining capacity to meet U.S. requirements, rather than rely on product imports.

24. Although the value of the fisheries in the Quoddy Region is substantial, it is erroneous to regard the entire value of these fisheries as being at risk from construction and operation of the refinery because there is no evidence of the loss of an entire year class of pelagic or other fish stocks from even the most massive oil spill and because fisheries and the oil industry have coexisted in the Gulf of Mexico and other areas for many years.

25. Benefits of the project include increased likelihood of obtaining crude oil in times of shortage, cost savings resulting from transport of crude oil in VLCC's, balance of payments benefits approximately equal to the cost of refining, jobs in an area in need of year-round employment opportunities and outweigh the risks.

26. The FEIS adequately considered alternatives to the Pittston project.

27. The alleged alternative of an SPM off of the coast of New Jersey is an altogether different project than proposed by The Pittston Company and is not a reasonable alternative thereto.

28. No legal or factual reason for denying Pittston's permit application having been shown, the decision denying the permit application is reversed and the permit will be issued.

29. Irrespective of the intentions of the BEP, the conditions of the Maine BEP Order of March 12, 1975, as amended June 4, 1975, are not legally a part of the State's 401(a)(1) certification under the CWA. However, these or similar provisions may be imposed as conditions of the NPDES permit in accordance with NEPA, as previously decided by EPA's General Counsel and incorporated into applicable regulations concerning preparation of environmental impact statements (40 CFR 6.918).

Discussion

The parties have argued extensively over the burden of proof in this proceeding. Before discussing this question, the precise basis upon which the Regional Administrator denied Pittston's application should be determined. As indicated (footnote 1) the January 15, 1979, letter informing Pittston that its application was denied contained the opinion that the fisheries' resources, though substantial, would not in themselves dictate denial of the permit to protect special resources from the risk of an oil spill. The letter went on to state that the findings of the NMFS report taken together with the findings concerning endangered species in the area affected by the project, contribute to a determination that the quality and scarcity of the resources is such that they should not be placed at risk from the proposed project. This language is sufficiently ambiguous that it may plausably be argued that the Regional Administrator determined that the value of the resources at risk from the proposed project was a principal or substantial reason for the denial. However, as noted previously (footnote 2 and accompanying text) the notice of grant of an adjudicatory hearing stated that the finding of jeopardy to the eagles precludes issuance of an NPDES permit for the project and a letter to Pittston, dated April 17, 1979, confirms that the basis of the denial was the FWS opinion that the project would jeopardize the bald eagle. It is clear that absent the FWS and NMFS findings of jeopardy, the permit would have been issued.

No party was apparently aware of the Administrator's decision, 170 Alaska Placier Mines, More or Less, NPDES Appeal No. 79-1 (March 10, 1980), which holds that even under the former rules of practice applicable to NPDES proceedings (40 CFR 125.36) and notwithstanding Sec. 125.36(i)(1) to the effect that the burden of proof and of going forward with the evidence shall be on the requestor, the burden of proof is always on the permit applicant. The decision appears to be based upon a prior decision under Sec. 316(a) of the CWA concerning thermal pollution. Under that section, placing the burden of proof upon the applicant would seem to be eminently proper, because the applicant is in effect asking for an exception from effluent limitations controlling the thermal component of discharges. Be that as it may, the Administrator's decision is controlling in this proceeding. Pittston, however, has carried its burden and no part of this decision is dependent upon allocation of the burden of proof.

Two months after the conclusion of the hearing and simultaneous with the submission of proposed findings and conclusions, counsel for EPA submitted a motion for referral of issues of law to the General Counsel pursuant to 40 CFR 125.36(m)(1).[9/] Issues proposed to be referred included whether EPA adequately considered alternatives to the Pittston project as required by NEPA; whether in acting on the permit application EPA could appropriately formulate and apply the following criteria under NEPA: whether the environmental risk at the site (Eastport) is appreciably greater than at other reasonably available alternate sites or whether the quality and scarcity of the resources at risk is such that no significant threat to the impairment should be incurred; and whether EPA properly deferred to the expertise of NOAA and FWS in denying the permit application upon the ground of jeopardy to endangered species.

9/ Motion for Referral of Issues of Law, dated April 14, 1980.

Although the parties stress the apparent mandatory nature of the regulation requiring referral of legal issues to the General Counsel, they do not agree on which issues should be so referred. For example, while supporting referral of the first issue suggested by EPA, NOAA and the New England Fishery Management Council (NEFMC) opposed referral of the NEPA risk criteria upon the ground the General Counsel has previously ruled that EPA has the authority to impose such criteria and upon the further ground that no party has objected thereto.[10/] Referral of the last issue suggested by EPA was objected to for the reason that the extent to which EPA relied on the expertise of FWS and NMFS was a matter within its discretion and was totally factual in nature.

Roosevelt Campobello International Park Commission (Commission) and the Conservation Law Foundation (CLF) asserted that the first issue framed by EPA was a mixed question of law and fact and should not be referred, that no party appeared to be challenging the NEPA risk criteria advanced by EPA,[11/] but that an issue as to whether EPA properly adopted a lesser standard in considering alternatives under NEPA because the project was privately funded should be referred.[12/] The Commission and

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10/ Memorandum of National Oceanic and Atmospheric Administration and New England Fishery Management Council In Response to The Motion of the Environmental Protection Agency For Referral of Issues of Law, dated May 12, 1980.

11/ Memorandum of the Roosevelt Campobello International Park and The Conservation Law Foundation Regarding Region I's Request For Referral of Issues of Law to General Counsel, dated May 5, 1980.

12/ Motion of the Commission and CLF For Referral of Issues of Law to the General Counsel, dated May 5, 1980.

CLF contend that an issue as to the level of deference acting agencies were to accord opinions of the wildlife agencies under the Endangered Species Act should be referred. DOI concurred with the Commission and CLF that the issues framed by EPA should not be referred, and that the issue proposed by the Commission and CLF as to whether EPA properly adopted a lesser standard in considering alternatives under NEPA in view of the fact the project was privately funded should be referred.[13/] DOI asserted that the law on the level of deference to be accorded the opinions of FWS and NMFS was clear and that there was no need to refer this issue.

CLF, Natural Resources Council of Maine (NRCM) and the National Wildlife Federation (NWF) moved for the submission of three issues to the General Counsel: whether NEPA and the Fishery Conservation and Management Act of 1976 (FCMA) require consideration and study in an EIS of a project's impacts upon management of marine fisheries, whether the FCMA required EPA to condition issuance of a permitted activity on rebuilding, restoration or maintenance under the FCMA of a fishery to be effected by that activity and whether NEPA required EPA to study, develop and prescribe in an EIS prepared for a project, the reasonable alternative of management of marine areas that will be affected by the project as a marine sanctuary.[14/]

13/ Response of the Department of Interior on the Question of Referral of Legal Issues to EPA's General Counsel, dated May 9, 1980.

14/ Motion For Referral of Issues of Law to EPA General Counsel, dated May 5, 1980.

Pittston[15/] and NELF[16/] oppose the referral of any legal issues contending, inter alia, that such motions at this stage of the proceeding can only serve the purpose of delay. Pittston also disputes the contention that it has acquiesced in the NEPA risk criteria formulated by EPA.[17/]

Although in responding to the opposition to the motion for referral counsel for EPA asserted their disagreement with the contention that Issue No. 1 as framed by them was a mixed question of law and fact,[18/] they have presented no persuasive reasons as to how this question can properly be answered without considering the evidence. It is concluded that Issue No. 1 as phrased by counsel for EPA is a mixed question of law and fact not appropriate for referral to the General Counsel.[19/]

In its response to the opposition to the motions for referral (note 18, supra), counsel for EPA withdrew its request for the referral of the NEPA risk criteria issues to the General Counsel upon the ground these criteria were no longer contested.

In its request for an adjudicatory hearing, dated January 26, 1979, Pittston specifically raised as legal issues the Administrator's authority

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15/ Opposition of the Pittston Company to the Referral of Issues of Law, dated May 5, 1980; Answer of the Pittston Company to Various Motions For Referral of Certain Legal Issues, dated May 9, 1980.

16/ Opposition of New England Legal Foundation to Motions For Referral, dated May 16, 1980.

17/ Supplemental Memorandum of The Pittston Company Regarding Referral of Legal Issues, dated May 20, 1980.

18/ Memorandum In Response to the Motions of The Pittston Company, The Roosevelt Campobello International Park Commission, The Conservation Law Foundation and the Department of the Interior Concerning Referral of Issues of Law, dated May 15, 1980.

19/ See e.g., <u>Boston Edison Company</u>, G.C. Decision No. 69 (May 3, 1978) (questions involving application of facts to law not appropriate for referral).

to condition an NPDES permit for reasons other than ensuring demonstrated compliance with water quality standards under the CWA and the authority of the Administrator to enter into a stipulation with an applicant which imposes conditions for the issuance of a license that are unrelated to demonstrated compliance with water quality standards under the CWA. Because these questions or their equivalent had been previously decided (OGC opinion, dated September 23, 1976) and incorporated into regulations governing the preparation of environmental impact statements for new sources (40 CFR 6.918), the presiding officer ruled at an early stage in these proceedings that referral of these issues to the General Counsel was neither required nor appropriate.[20/] In view of this ruling, Pittston properly elected not to address the question of EPA's authority to condition or deny an NPDES permit on non-water quality related grounds at this stage of the proceeding (Brief of April 15, 1980, at 18, 19). Pittston is, of course, not bound by the General Counsel's opinion and remains free to contest that ruling on appeal to the Administrator and in court.

Assuming the authority to impose or apply it, Pittston supports the risk criteria applied by EPA in considering alternatives, i.e., whether the risk of environmental harm at the site (Eastport) is appreciably greater than the risk presented at other reasonably available alternative sites.[21/] As to the second NEPA criterion formulated by EPA, that is,

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20/ ALJ's letter to the parties, dated February 28, 1979.

21/ Supplemental Memorandum of The Pittston Company (note 17, supra, at 1).

whether the quality and scarcity of the resources at risk is such that no significant threat to the impairment should be incurred, Pittston points out that it raised in its request for an adjudicatory hearing the issue of whether the finding of highly unusual and scarce resources justified as a matter of law denial of the permit application and points to pages in its initial and reply briefs where this issue was assertedly discussed.[22/] In addition to the discussion on pages 18 and 19 of its initial brief wherein Pittston specifically stated that it was not addressing the question of EPA's authority to condition or deny an NPDES permit on non-water quality related grounds, Pittston re-iterated its non-acquiescence in EPA's view that it had such authority (Brief at 303, footnote 116). In view thereof and in view of the applicable rules of practice, Pittston cannot be deemed to have acquiesced in the NEPA risk criteria applied by EPA nor to have waived its right to contest the same on appeal.[23/]

The ruling that the NEPA risk criteria are within the scope of issues previously decided by the General Counsel and thus not appropriate for referral is affirmed.

. The last question framed by EPA, i.e., whether EPA properly deferred to the expertise of FWS and NMFS in denying the permit application upon

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22/ Pittston's Supplemental Memorandum (note 17, supra at 2).

23/ At the first prehearing conference held on June 28, 1979, the presiding officer informed the parties that his decision not to refer legal issues raised by Pittston and those suggested by other parties to the General Counsel was without prejudice to their right to brief and argue such issues in this proceeding [logically on appeal to the Administrator] and should not affect the review of such issues on appeal (Memorandum of Prehearing Conference forwarded to the parties under dates of July 2 and July 28, 1979).

the ground of jeopardy to endangered species also involves weighing of evidence and as such is not appropriate for referral under 40 CFR 125.36(m).

Concerning the legal issues proposed for referral by the Commission and CLF, a similar standard for alternative sites under NEPA has been upheld 24/ and referral of this issue is unnecessary. Similarly, although I resolve the issue differently than argued by DOI, I agree that the law on the level of deference acting agencies must accord opinions of FWS and NMFS under the Endangered Species Act is clear and that this issue need not and should not be referred. 25/

Regarding issues involving the Fishery Conservation and Management Act suggested for referral by CLF, NRCM and NWF, the presiding officer ruled at the first prehearing conference that he had no present intention of referring such issues pursuant to 40 CFR 125.36(m). It is noted that the agencies most directly concerned, NOAA and NEFMC, have not joined in this motion and no showing has been made that these issues are in anyway determinative of the decision herein. The ruling declining to refer issues involving the FCMA to the General Counsel is affirmed.

24/ Seacoast Anti-Pollution League v. Nuclear Regulatory Commission, 598 F.2d 1221 (1st Cir., 1979).

25/ It is, of course, clear that issues previously decided by the General Counsel need not be referred (G.C. Decision No. 69, note 19, supra). This was extended to issues previously resolved by a Federal Court decision in proposed revisions to the rules of practice set forth at 40 CFR 125.36 (Memorandum from counsel for Adjudicatory Hearings forwarding copy of draft regulations, dated August 3, 1977) and, of course, the referral procedure has been eliminated at the hearing stage in superceding rules of practice (40 CFR Sec. 124.89-90, 44 FR No. 111 at 32943 (June 7, 1979)) and eliminated altogether in the current rules of practice (40 CFR Sec. 124.90-91, 45 FR No. 98 at 33416, 35503-04 (May 19, 1980).

For the foregoing reasons, all motions for referral of legal issues to the General Counsel are denied.26/

Under date of August 25, 1980, the Commission filed a motion to reopen the record and submit newly discovered evidence. The alleged newly discovered evidence consisted of a draft DOE "Refinery Policy Study--Summary of Analysis," dated June 10, 1980. The draft casts doubt upon the primary justification of the need for the refinery advanced by Dr. Reed of DOE at the hearing, i.e., the need for additional refinery capacity or capability to produce unleaded gasoline and to process high-sulphur, so-called sour crudes, thus in the Commission's view buttressing its contention that there is no need for the refinery. The Commission's motion indicates that the date for finalization of the draft has been postponed perhaps indefinitely (copies of the final statement have not been distributed as promised by the Commission) and granting the motion would not alter the decision herein. This is because it is a fact that refinery capacity on the East Coast of the United States equals approximately 30% of consumption of petroleum products in that area and because Federal policy not to rely on product imports is an established fact. While the draft might provide a basis for changing that policy, this is not the

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26/ The question of referral of legal issues to the General Counsel pursuant to 40 CFR 125.36(m) is clearly for the presiding officer to determine in the first instance (Decision of Administrator, National Steel Corporation, NPDES Appeal No. 75-15 (January 7, 1976) and if there is error in this ruling, it is readily correctable by the Administrator on appeal. Moreover, although the parties have agreed that the former rules of practice apply here, it is well settled that laws or regulations or revisions thereto which become effective during the course of administrative proceedings are or may be for application in the absence of a showing of prejudice. See court decisions and the discussion on this point (44 FR No. 111 at 32886-87 (June 7, 1979)).

forum in which to do so nor to attack the wisdom of the existing policy. The motion to reopen the record is denied.27/

DOI moved to reopen the record in order to introduce data on the productivity of bald eagles in Maine in 1980 (Motion filed under date of October 6, 1980). However, the memorandum containing the data contains self-serving declarations obviously supportive of the FWS position herein.28/ Admission of the memorandum would not change the decision herein and the DOI motion is denied.

Not to be outdone NOAA and NEFMC filed a motion to reopen the record and introduce newly discovered evidence, dated December 4, 1980. The alleged newly discovered evidence consisted of a Preliminary Report (Summer 1980) by the New England Aquarium, Marine Mammal Research, of ten aerial surveys of the Bay of Fundy conducted during the period June 17 to October 31, 1980. These surveys were apparently conducted under contract with NOAA and purport to show three right whales in the Gannet Rock area (southeast of Grand Manan) on July 10, 1980 and as many as eight right whales to the east of Grand Manan Island on August 29 and 30, 1980. Other data, apparently garnered separately, purport to show as many as 12 right whales east of Grand Manan and five two miles north of South Wolf Island on August 13, 1980, for a total of 17. The latter data also report the

27/ The refinery and marine terminal, being privately financed and currently estimated to cost 750 million dollars, is seemingly unlikely to be an economically viable project if the statements and projections in the draft are accepted as accurate.

28/ The author of the memorandum, Mr. Frank Gramlich, acknowledged at the hearing that he was violently opposed to the refinery.

observation on several occasions of possible nursing behavior by young and mating behavior by adults, thus in NOAA's view enhancing the importance of the Quoddy-Grand Manan area to the right whale.

The reports do, of course, show right whales in the Quoddy-Grand Manan area as early as July 10 and as late as October 30, 1980. In other respects, the reports merely confirm what has long been known, that is, the right whale frequents the area in the summer and early fall. In this regard, "east of Grand Manan" could include the Bay of Fundy east to Digby Neck, Nova Scotia and it would be helpful to have the sighting areas separated as in the aerial survey areas on Figure 1, that is, A, B and C for the areas from Grand Manan to Digby Neck, Nova Scotia and A', B' and C' for the areas immediately surrounding Grand Manan Island, and westward toward Passamaquoddy Bay, Campobello Island, West Quoddy Head, and other areas of Maine. The rapid dilution and mixing of oil in an open sea situation makes it unlikely that oil in each of these areas would be equally as deleterious to whales. Moreover, the apparent sighting of over three times the number of right whales as had been observed in the area previously raises an obvious question: was 25% of the western Atlantic population of the right whale in the Quoddy-Grand Manan area on August 13 or are there substantially more right whales than had heretofore been thought? Because of this and other questions that could be raised as to the accuracy and method of gathering the NOAA "newly discovered evidence," it would not be proper to allow these reports into the record without giving Pittston an opportunity to test the credibility of the authors and to introduce rebuttal evidence. Moreover, the conclusion that the Pittston refinery and marine terminal is not likely to jeopardize the continued existence of the right whale is based on the unlikelihood of massive oil spills, the fact that whales are present in the area for only approximately three months of the year, the short residence time of oil in the Grand Manan area where most whales are sighted when in the area and the absence of reports of death or injury to whales from even the most massive oil spills. Accordingly, the proferred reports would not change the result and the motion to reopen the record is denied.

Pittston's motion, dated May 9, 1980, to strike the proposed findings and conclusions of the Commission upon the ground they were filed with its reply brief rather than its initial brief is denied, no prejudice having been shown. A similar motion by DOI, NOAA, NEFMC, CLF, and the Commission to strike a portion of NELF's opposition to referral of issues to the General Counsel upon the ground it contained matters which should have been argued in its reply brief is denied for the same reason.[29/]

Endangered Species

Operative language of the Endangered Species Act (16 U.S.C. 1531 et seq.) is contained in Sec. 7(a)(2) (16 U.S.C. 1533)[30/] and provides in

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29/ Curiously, the Commission showed no reluctance in submitting a letter, dated September 5, 1980, citing a recent decision of the First Circuit (Grazing Fields Farm v. Goldschmidt, ____ F.2d _____, 14 ERC 1785 (June 25, 1980)), which allegedly supports its position regarding the necessity of a supplemental EIS.

30/ The full text of Sec. 7(a)(2) as amended (Public Law 96-159, 93 Stat. 1227 (December 28, 1979) is as follows:

> "(2) Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an 'agency action') is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available."

pertinent part: "Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency * * is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species, which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, * * * *."

The phrase "is not likely" was added by the 1979 amendments (note 30, supra). Although the addition of this phrase would seem to imply a lesser standard of certainty as to whether a proposed action would in fact jeopardize endangered or threatened species, the Committee Report (House Conference Report No. 96-697, December 11, 1979) states at 12 that the change was to bring the language of the statute into conformity with existing agency practice and judicial decision.

In this connection, joint FWS-NMFS regulations (50 CFR 402.02) promulgated prior to the 1979 amendments to the ESA (43 FR No. 2 at 874, January 4, 1978) define "jeopardize the continued existence of" as follows:

> "Jeopardize the continued existence of" means to engage in an activity or program which reasonably would be expected to reduce the reproduction, numbers, or distribution of a listed species to such an extent as to appreciably reduce the likelihood of the survival and recovery of that species in the wild. The level of reduction necessary to constitute "jeopardy" would be expected to vary among listed species."

The cited regulation (50 CFR 402.04(g)) as well as court decisions interpreting the ESA (e.g., National Wildlife Federation v. Coleman, 529 F.2d 359 (5th Cir. 1976) and Hill v. TVA, 549 F.2d 1064 (6th Cir. 1977), affirmed TVA v. Hill, 437 U.S. 153, 98 S. Ct 2279 (1978)) make it clear that the ESA did not give the Secretaries of the Interior or of Commerce, as the case may be, veto power over the actions of other departments and agencies and that the final decision as to whether to proceed with the proposed activity in the light of its Sec. 7 obligations rested with the acting department or agency. The 1979 amendment to Sec. 7 (note 30, supra) made it clear that this determination was to be based on the best scientific and commercial data available.

The parties disagree as to whether the Regional Administrator reviewed and independently adopted the findings of the FWS and NMFS in denying the permit application or whether he mistakenly considered himself bound by those determinations as a matter of law. Citing statements in the decisional document, in the notice of grant of an adjudicatory hearing, in the letter to the Chief ALJ forwarding the matter for assignment of an ALJ and in letters to Pittston to the effect that the FWS and NMFS opinions precluded issuance of the permit and that factual matters relating to the FWS findings should be deferred pending the outcome of Pittston's application for an exemption under the ESA, NELF argues that the Regional Administrator misinterpreted the ESA, considering himself bound by the opinions of FWS and NMFS and thus, powerless to issue the permit (Brief at 3-8). According to NELF, the consequence of this error is that there is no proper decision on endangered species issues which is subject to challenge herein and thus no party can have the burden of proof on such issues. NOAA and NEFMC, on the other hand, assert that because the ultimate decision under Sec. 7(a)(2) of the ESA is for EPA to make, the extent of its deference to the opinions of the Services was within EPA's discretion (Response to Motion of EPA For Referral of Issues of Law (note 10, supra, at 6,7). NOAA and NEFMC also contend that the question of the deference actually accorded the opinions of FWS and NMFS by the Regional Administrator is now irrelevant, because the issue of jeopardy to endangered species can be decided on all the evidence in this proceeding (Id.; Reply Brief at 14, 15).

The NOAA and NEFMC analysis accords with the scheme of the ESA that the acting agency makes the final administrative decision as to whether to proceed, has been and is being followed herein and would be accepted without further discussion save for the likelihood that the NEPA balancing involved in the decision to deny the permit application was affected by an erroneous interpretation of the ESA. 31/

31/ The letter to Pittston, dated January 15, 1979, informing the company of the decision to deny the permit application states in part at 2: "However, EPA is barred from issuing a permit if it would cause the making of any irreversible or irretrievable commitments of resources potentially foreclosing measures to avoid jeopardy to the species." The quoted statement is based on Sec. 7(d) of the ESA (16 U.S.C. 1533) as amended (Public Law 95-632, 92 Stat. 3753, Nov. 10, 1978) to the effect that:

> "(d) Limitation on Commitment of Resources.--After initiation of consultation required under subsection (a), the Federal agency and the permit or license applicant shall not make any irreversible or irretrievable commitment of resources with respect to the agency action which has the effect of foreclosing the formulation or implemention of any reasonable and prudent alternative measures which would avoid jeopardizing the continued existence of any endangered or threatened species or adversely modifying or destroying the critical habitat of any such species."

Legislative history (House Report No. 95-1625, September 25, 1978) indicates that the purpose of this section was to strengthen the consultation process. While this appears to support the contention of NOAA (Reply Brief at 84) and DOI (Reply Brief at 29) that after termination of consultion this section is irrelevant, it has been held that the duty to consult continues until a biological opinion based on adequate information has been rendered. North Slope Borough v. Andrus, (Notes 34 and 43, infra).

Relying on legislative history, e.g. (House Report No. 95-1625 (September 25, 1978)) at 12 to the effect that biological opinions of the FWS will ordinarily be given great weight by the courts, NOAA and DOI assert that the standard of proof normally applicable in administrative hearings and in judicial proceedings at the trial level, i.e., preponderance of the evidence, is not applicable to endangered species issues. NOAA argues that the FWS and NMFS opinions carry with them a presumption of validity which must be overcome by any party contending for a contrary conclusion (Reply Brief at 16). DOI goes even further, contending that the FWS biological opinion must be accepted unless it is without a rational basis (Reply Brief at 24, 25).

No issue need be taken with NOAA's contention that biological opinions of the Services on jeopardy to endangered species enjoy a presumption of validity, because it is well settled that once a presumption has been overcome by probative evidence the presumption disappears and has no further affect on the decision.[32/] DOI apparently regards rational basis and substantial evidence as synonymous. Be that as it may, substantial evidence is the standard applied on judicial review of administrative decisions and has no place at the hearing or trial stange.[33/]

Judicial decisions interpreting the ESA do not support the contention that issues of jeopardy to endangered species are to be decided by other

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32/ 31 A C.J.S. Evidence, Sec. 119.

33/ Charlton v. FTC, 543 F.2d 903 (D.C. Cir., 1976) (preponderance of the evidence is "rock bottom" at fact finding level of litigation).

than a preponderance of evidence at the hearing and fact finding level. In Sierra Club v. Froehlke, 534 F.2d 1303 (8th Cir. 1976), the Court reviewed the District Court's findings to the effect that jeopardy or adverse effects to an endangered species of bat by the project under consideration had not been shown under the usual (clearly erroneous standard) and affirmed, holding that no clear error had been shown. In National Wildlife Federation v. Coleman, 529 F.2d 359 (5th Cir. 1976), the case usually cited for the proposition that the courts give great weight to the opinions of the Services on endangered species questions, the Court reversed the District Court, holding that it had misinterpreted Sec. 7 of the ESA, and deferred to the expertise of the Secretary of Interior as to what modifications were necessary in a highway project in order to insure that it would no longer jeopardize the continued existence of the sandhill crane or destroy or modify critical habitat of the crane. Because the lower court had found no violation of the ESA, it had not addressed the modification question and there were no findings on that issue to be reviewed. More importantly, the Circuit Court was not reviewing an administrative decision made after an Administrative Procedure Act hearing. Accordingly, the applicable evidentiary standard on all disputed issues in this initial decision is the normal preponderance of the evidence.[34/]

In view of the findings and conclusions above finding no reasonable likelihood that the Pittston project is likely to jeopardize the continued existence of the bald eagle, extended discussion of the arguments raised by DOI would unnecessarily lengthen this opinion. Because one issue, i.e., the population segment of the bald eagles to be considered, is controlling, this issue merits discussion. In its proposed findings at 132, DOI states the issue thusly: "The test to be applied in determining whether authorization of the Pittston refinery would be violative of the Endangered Species Act is whether the refinery reasonably would be expected to reduce the reproduction, numbers or distribution of the northeastern United States bald eagle population to such an extent as to appreciably reduce the likelihood of the survival and recovery of that

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34/ CLF correctly states that the decision herein is _de novo_ (Reply Brief at 10) and the Commission recognizes that even as to endangered species issues the appropriate standard is preponderance of the evidence (Reply Brief at ii). Reliance is also placed on _North Slope Borough_ v. _Andrus_, ________ F. Supp. _____, 13 ERC 2169 (D.C. D.C. January 22, 1980) (biological opinion provides courts with substantial evidence of an agency's compliance or noncompliance with Sec. 7(a)(2) of ESA). The order issued by the District Court enjoing the Secretary from leasing tracts in the Beaufort Sea has been vacated, sub. nom., _National Wildlife Federation_ v. _Andrus_, _____ F.2d _____, 14 ERC 1846 (D.C. Cir., July 8, 1980).

population in the wild." DOI goes onto state that in determining whether the northeastern U.S. bald eagle population would be jeopardized, the contribution of the Canadian Maritime population should be considered (Id.). At another point (Proposed Findings at 17) DOI states that the northeastern United States eagle population may be considered biologically part of a population which extends from Maine into the Canadian Maritime provinces. This acknowledgment is consistent with the findings in this decision and with the weight of the evidence.

DOI contends that the eagle population segment for consideration is the northeastern bald eagle population consisting of nine states from New Jersey to Maine (Proposed Findings at 16). NELF suggests that this segmentizing of the population is an FWS ploy in order to make the Cobscook Bay eagle population seem a significant percentage of eagles in a vast territory and in order to avoid including the considerable population of eagles in the Chesapeake Bay area.[35/] Because it has been found and DOI concedes that eagles in Maine are continuous with those in New Brunswick and Nova Scotia, including Cape Breton Island, and form one

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35/ NELF Brief at 13-15. NELF points out that the FWS' own data show that there were no active nests in Vermont, New Hampshire, Massachusetts, Connecticut or Rhode Island in 1977, one each in New York and New Jersey and three in Pennsylvania. FWS Region 5 includes in addition to Maine and the states previously listed, Delaware, Maryland, Virginia and West Virginia. Data in the record (Eagle Biology, DOI Exh. 34) indicate that in 1977 Maryland had 44 active nests and produced 47 young and that Virginia had 33 active nests, which produced 23 young (Memorandum from Regional Director FWS to Director FWS, dated September 2, 1977).

eagle population, it is unnecessary to decide whether the appropriate population segment should have included eagles in the Chesapeak Bay area. It should be noted, however, that the NELF argument is far from frivolous.36/

Nothwithstanding its concession that the Maine eagles and those in New Brunswick and Nova Scotia, including Cape Breton Island, should be considered biologically as one eagle population, DOI argues that the status of Canadian eagles is irrelevant because they are not protected by the Endangered Species Act.37/ This argument conflicts with the Act's definition of species as "including any distinct population segment, of any species of vertebrate fish or wildlife which interbreeds when mature"38/ and ignores the fact that one of the reasons the bald eagle was listed as threatened rather than endangered in the States of Minnesota, Wisconsin and Michigan is that "the population was continuous with

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36/ In the light of the facts recited above (footnote 35), it is instructional to read from the preamble to the final rulemaking extending endangered species status to the northern bald eagle, which provides in part, 43 FR No. 31, (February 14, 1978) at 6231: "Moreover, there is considerable movement of eagles of both subspecies [southern and northern eagles] into each other's breeding range during nonbreeding periods. Southern bald eagles may wander northward as far as Canada during the late summer. Northern bald eagles migrate southward in large numbers for the winter. With respect to the species as a whole, the bald eagle probably has a larger regularly inhabited range than any other species now listed or being considered for listing."

37/ Proposed Conclusions of Law at 17 et seq.; Reply Brief at 10, 11 and 18. DOI states that the Act may be applied, to foreign jurisdiction, but asserts that in this case the protection of the Act has not been extended to Canadian eagles (Reply Brief at 11, footnote 2).

38/ Sec. 3 of the Endangered Species Act (16 U.S.C. 1532(16) defines species: "(16) The term 'species' includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." Obviously, this definition does not allow political boundaries to determine a population segment.

others in Canada" (43 FR No. 31, February 14, 1978, at 6231). Viewed in this light, FWS' failure or refusal to consider Canadian eagles in making its determination that the Pittston project is likely to jeopardize the continued existence of the bald eagle is nothing more than an arbitrary attempt to define the appropriate population segment in such a manner as to bolster its case[39/] against the refinery.

DOI points to the Act's definition of endangered species as meaning "any species which is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. 1532(4)) and to the regulatory definition of "listed species" as "any species of fish, wildlife, or plant which is designated as endangered or threatened under the Act" (50 CFR 402.02) and argues that exclusion of Canadian eagles from the Act's protection was permissible (Proposed Conclusions of Law at 19, 20). Accordingly, DOI argues that the issue of jeopardy is to be determined solely by the impact of the project on protected eagles. The protection of the ESA was extended to the northern bald eagle effective March 16, 1978 (43 FR 6230), prior to the amendment of the statute (92 Stat. 3751, November 10, 1978) to include the definition of species quoted supra (Note 38).

39/ The FWS opinion of June 4, 1979 admitted that there was some justification for including Nova Scotia and New Brunswick eagles along with Maine eagles, but excused the failure to do so by the assertion New Brunswick eagles were considered endangered by that Province (Id. at 4). This merely raises a host of questions as to the population segment to be considered in New Brunswick (Are they ignoring Nova Scotian and Maine eagles?) and cannot justify the position taken.

While this amendment of the Act probably does not effect the validity of the prior listing of the bald eagle as endangered or the failure to extend the Act's protection to Canadian eagles, it certainly precludes FWS in the instant case from defining the appropriate population segment by reference to political boundaries so as to exclude eagles in New Brunswick and Nova Scotia, including Cape Breton Island, which DOI admits to be one population with Maine eagles. DOI concedes that it is inappropriate to ignore Canadian eagles, stating that "if it were established that eagles in New Brunswick had a very high reproduction rate and would disperse into Maine in the event that the number of eagles in Maine were reduced because of the refinery, it might be possible to conclude that the northeastern U.S. population would not be jeopardized" (Proposed Conclusions at 18). This restricted view of the effects of the Canadian eagle population on the jeopardy determination at issue here is justified only if it was proper to limit the population segment under consideration to northeastern United States eagles. As we have seen, this is not the case. In any event, it has been found above that eagles at risk from the refinery are Cobscook Bay eagles (six breeding pair in 1979), which constitute slightly over three percent of the appropriate population segment, an estimated 180 breeding pair in Maine, New Brunswick and Nova Scotia, including Cape Breton Island. Credible expert testimony (Dr.'s White and Dunston) has established that the hypothetical loss of all Cobscook Bay eagles would not appreciably reduce the likelihood of the survival and recovery in the wild of that population segment of the bald eagle. 40/ This is, of course, worst case analysis and the findings above establish that there is no reasonable likelihood of the loss of all Cobscook Bay eagles from construction and operation of the refinery. 41/

The foregoing conclusions require reversal of the decision denying Pittston's permit application insofar as based on jeopardy to the bald eagle. 42/ However, because it might become an issue on appeal, the

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40/ The findings herein include recovery which is defined by the regulation as meaning improvement in the status of listed species to the point at which listing is no longer required (50 CFR 402.02). DOI argues that recovery should be equated with the proposed objectives of the Northern Bald Eagle Recovery Plan, i.e., restoration of eagles to all formerly occupied suitable habitat (Proposed Findings at 158-59). However, the Northern Bald Eagle Recovery Plan is not in the record, the word "proposed" implies that the plan or its objectives have not been finalized or implemented and there is no evidence from which it can be concluded that restoration of eagles to all formerly occupied suitable habitat is necessary in order for eagles to no longer require the Act's protection.

41/ That there is a limit to the judicial deference to opinions of FWS even where endangered species are concerned is established by the case of Conner v. Andrus, 453 F. Supp. 1037 (W.D. Texas, 1978), wherein the enforcement of regulations banning hunting of the Mexican duck, an endangered species, in designated areas of Texas, New Mexico and Arizona was enjoined principally upon the ground the duck in question was abundant in Mexico.

42/ The findings herein establish that EPA can issue the permit, consistent with fulfilling its statutory responsibility to insure that the Pittston project is not likely to jeopardize the continued existence of the bald eagle.

extent to which critical habitat entered into the FWS determination warrants mention. It will be recalled that the FWS opinion of June 4, 1979, stated in part: "* * it is clear that this project will have a significant adverse impact on habitat considered essential to the conservation of the bald eagle and thus is likely to jeopardize the continued existence of this species." NELF contends that the FWS determination was based upon its view of Cobscook Bay as "critical habitat" for the eagle and points out that the Act (16 U.S.C. 1533(b)(4) and 1533(f)) requires publication of notice of the proposed designation of an area as critical habitat, public meetings or hearings and consideration of economic and other impacts of the designation (NELF Brief at 10, 11, & 23). Answering this contention, DOI asserts that the absence of designated critical habitat does not mean that impacts of the proposed refinery upon eagle habitat can or should be ignored in determining whether the proposed refinery is likely to jeopardize the contended existence of the bald eagle (Reply Brief at 20). DOI further argues that the question of the impact of the refinery on endangered species cannot be considered separately from the impact upon, and the importance of, that habitat. While this is probably true, it would seem to be a compelling reason to implement the prediction in the biological opinion that Cobscook Bay is almost certain to be designated as critical habitat in the future (Opinion at 4). The record contains no indication that DOI has taken any action in this regard and, if it has not done so, the statutory requirements for designation of critical habitat are readily circumvented. Although unnecessary to be resolved here, it is at least a serious question as to whether DOI can continue to rely on impacts to allegedly critical habitat for the eagle (Cobscook Bay) without taking the statutory steps to designate it as such.

Regarding the NMFS determination on endangered whales, NOAA's own expert witness (Dr. Katona) agreed with Pittston's expert (Dr. Winn) that the population of the humpback whale in the western North Atlantic was in the range of 2,000 animals, far more than the approximately 1200 considered by NMFS, and concurred with the NMFS determination that the Pittston project would jeopardize the continued existence of the humpback whale only if it be limited to that portion of the humpback population which regularly feeds in the New England area. Because NOAA has not argued and the evidence would not support a determination that any such segmentizing of the humpback population is appropriate and because credible expert testimony establishes that the hypothetical loss of all humpbacks in the area effected by the refinery at any one time would not appreciably reduce the likelihood of the survival and recovery of the humpback in the wild, the only question warranting discussion is the possible impact of the refinery on the right whale.

As we have seen, the right whale is definitely an endangered species, the best estimates of its population (U.S. side of the Atlantic Ocean) ranging from 70 to the low one hundreds. It is however, inaccurate to regard the Quoddy-Grand Manan area as a major feeding, or nursery ground for right whales. According to NOAA's expert, Dr. Katona, the place to look for right or humpback whales in abundance is the Stellwagen Bank--Jeffreys Ledge areas (north of Cape Cod) and in the Cashes Ledge area which is toward the central Gulf of Maine. The NMFS biological opinion does not dispute this view stating "Because right and humpback whales are believed to use waters north of Cape Cod, Massachusetts as important feeding and nursery areas, a large oil spill in these waters could have a serious impact on these species either directly or by adversely effecting their habitat" (Opinion at 3). This highlights the thinness of the NMFS opinion as "north of Cape Cod" could include all or a substantial portion of the Gulf of Maine, a spill in the Gulf of Maine would be an open sea situation where as a result of mixing and dilution oil concentrations would likely be reduced to background levels within a few days, witness the Argo Merchant, and there would be no reason for crude carriers to be in the Stellwagen Bank or Jeffreys and Cashes Ledge areas where most of the whales are found. While a spill from a product carrier could impact those areas, evidence at the hearing and the posthearing arguments centered on the risks of navigating Head Harbor Passage in VLCC's.

In this respect, NMFS' suggestion that alternative sites such as Portland or Blue Hill Bay are environmentally superior (Brief at 195-97, Reply Brief at 74) is curious because there are more whales near or adjacent to those areas than there are in the Quoddy-Grand Manan area.

It is true that multiple trajectory analyses show oil from a hypothetical 13 million gallon spill of off the coast of Campobello Island extending into the Gulf of Maine (Figures 40 & 41, NOAA Exh 84). However, the one percent probability impact line extends as far south as Cape Cod only for winter spills (November-April) when whales are not normally in the Gulf of Maine, except for possibly a few in early November and late April. Although multiple trajectory analyses were stopped after 50 days, it is not clear what time frame is involved in these probability impact lines and thus no assessment of weathering, evaporation, etc. can be made.

The principal, if not the sole, risk to the whale from construction and operation of the refinery results from the possibility of a massive oil spill when whales are in the Quoddy/Grand Manan area. The effects of oil on whales--whether it will foul the baleen and interfere with feeding activity, whether ingested oil is harmful to whales and indeed whether whales can and will avoid oil spills--are unknown. The difficulties of gathering useful information in this regard are formidable as experiments with live whales are impractical or impossible and NMFS has questioned the relevance of studies on small cetaceans. With this state of knowledge, it would seem that the appropriate response for NMFS would have been to maintain its earlier position (letter of November 15, 1978) that insufficient information exists to conclude that construction and operation of the refinery is or is not likely to jeopardize the continued existence of the right and humpback whale or result in the destruction or adverse modification of habitat that may be critical.

Indeed, the biological opinion supports this view stating that "The best scientific data currently available on the risk to endangered whale species presented by the operation of a major oil refinery at Eastport, Maine is largely inconclusive." Such an opinion would not have been as likely to prevent the project from going forward as EPA could have issued the permit and it would appear that Pittston could have proceeded with construction of the refinery as long as a good faith effort to develop additional information was made and no reasonable likelihood of a violation of Sec. 7(a)(2) of the ESA was shown. 43/

Although the effects of oil on whales are unknown, there is no reported instance of whale mortality or injury which has been attributed to oil. 44/ Moreover, the time when right whales are in the Quoddy-Grand Manan area and thus presumably at risk from a massive oil spill in the

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43/ The NOAA-NMFS argument that neither EPA nor Pittston could have proceeded as long as there was information sufficient to show some risk to the species (Brief at 207) is inaccurate and is rejected. In North Slope Borough v. Andrus, note 34 supra, the Court cited legislative history (House Conference Report No. 96-697, December 11, 1979, at 12) for the proposition that if a Federal agency proceeds with the action in the face of inadequate knowledge or information, it does so with the risk that it has not satisfied the standard of Sec. 7(a)(2), but ruled that inadequate information cannot provide the basis for a halt to all agency action (13 ERC at 2183-84). In this context construction of the refinery could have proceeded as it would only be operation of the refinery, including the transport of crude oil and refinery products that might possibly jeopardize endangered whales. It is this type of analysis and the fact that leasing, exploration and production, if oil is found, are separate stages that has enabled the OCS leasing program, e.g., Georges Bank, to proceed in the face of inadequate information. As noted, the order issued by the District Court enjoining the leasing of tracts in the Beaufort Sea has been vacated, sub. nom. National Wildlife Federation v. Andrus, Note 34, supra.

44/ It is noted that right and humpback whales were placed on the endangered species list in 1970 and that the Environmental Assessment Report, dated March 8, 1976, submitted by Pittston, reflected the presence of right and humpback whales in the Head Harbor Passage area (Item III-17 at V-17-18). Despite these facts,the fact that NMFS was represented at committee meetings of Federal agencies coordinating preparation of the EIS (Item IV-115), that NOAA-NMFS commented on the draft EIS without referring to whales (Pittston Exh 94; Item IV-115) and vigorously opposed the project without mentioning endangered whales as a reason for doing so (Pittston Exhs 97 and 100), even contemplating going over the head of the Regional Administrator to the Deputy Administrator of EPA or the Council on Environmental Quality (Pittston Exhs 102 and 103), NOAA-NMFS did not request consultation under the Endangered Species Act until August 16, 1978. This was almost two months after issuance of the FEIS and publication of EPA's tentative decision to issue the permit and almost 30 days after the close of the public comment period. Under these circumstances, Pittston's suspicions as to the bona fides of the NMFS biological opinion (Brief at 261-66) are understandable.

area does not exceed the period July through October and the findings herein establish that considering the navigational safeguards and restrictions and the low traffic density, the likelihood of such an oil spill is very small. It should also be emphasized that the great mobility of whales significantly reduces the period and the likelihood of exposure to concentrations of oil sufficient to be harmful. Pittston argues that this small or minimal risk is acceptable as the ESA does not require zero or no risk (Brief at 317 et seq.). Project opponents, on the other hand, cite legislative history to the effect that the benefit of any doubt must be given to the species. 45/ The "benefit of any doubt" language is contained in House Conference Report No. 96-697 at 12 (Note 43, supra) and refers to an agency proceeding in the face of inadequate information. There is, however, no reason to reach the issue of doubt unless there is a reasonable likelihood that the standard of jeopardy set by the statute has been or is likely to be breached. As we have seen, the definition of "jeopardize the continued existence of" requires a reasonable expectation that the activity would reduce the reproduction, numbers or distribution of a listed species so as to appreciably [perceptibly] reduce the likelihood of the survival and recovery of that species in the wild (50 CFR 402.02). For the reasons heretofore stated, it has been concluded that there is no reasonable likelihood that construction and operation of the refinery will jeopardize the continued existence of

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45/ CLF Reply Brief at 25, DOI Reply Brief at 31, NOAA Reply Brief at 17, Commission Reply Brief at 38.

right and humpback whales as that phrase is defined. As in the case of eagles, this conclusion is considered to enable EPA to issue the permit consistent with its statutory responsibility to insure that the project is not likely to jeopardize the continued existence of the right and humpback whale. If right whales be presumed to come into contact with oil and if oil is assumed to be harmful, a different result would be required.[46/]

National Environmental Policy Act Issues

Opponents of the project assert that the effects of the project on endangered species of whales and eagles must be considered under NEPA even if it is determined that construction and operation of the refinery would not violate the Endangered Species Act (DOI Conclusion of Law at 7-13). No issue is taken with this contention nor with the contention that a worst case analysis is appropriate, even if not required.[47/] A worst case analysis insofar as eagles are concerned would assume the

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46/ The Commission in affect argues for a "worst case analysis" contending that because the effect of oil on whales is unknown, the benefit of any doubt being given to the species requires that oil be presumed to be harmful (Reply Brief at 39-40). This, of course, requires the further assumption that whales come into contact with oil and although this possibility cannot be completely excluded, the definition of jeopardy obviously contemplates some degree of risk. Although the court in North Slope Borough v. Andrus (Note 34, supra) considered that a "worst case analysis" was appropriate in the face of inadequate information, it did so under NEPA rather than the Endangered Species Act.

47/ As in North Slope Borough v. Andrus (Note 34, supra), Council on Environmental Quality Regulations (40 CFR 1502.22) requiring worst case analysis, in the face of gaps in relevant information or scientific uncertainty became effective July 30, 1979, after the issuance of the EIS.

presence of oil and as result the possible elimination of all eagles at risk from the refinery, that is, Cobscook Bay Eagles--six breeding pair in 1979. NELF's contention that under NEPA the six pair of Cobscook Bay eagles must be considered in relation to the 100,000 eagles on the North American Continent (Reply Brief at 13) need not be accepted in order to conclude that the hypothetical loss of all Cobscook Bay eagles, while highly undesirable, does not require denial of the permit as NEPA does not require environmental concerns to be elevated over other considerations such as benefits of the proposed project.[48/] It bears repeating that the loss of all Cobscook Bay Eagles is unlikely and that it has been found above that mitigation measures proposed by Pittston can, with the cooperation of FWS, substantially alleviate risks to the eagle from the project.

The population of the humpback whale in the western North Atlantic is such that a worst case analysis for this species, i.e., the hypothetical loss of all humpbacks in the Quoddy-Grand Manan area at any one time (a maximum of 30 and probably much less) does not tip the scales in favor of permit denial. The situation with respect to the right whale is more "iffy" because the population of this whale on the U.S. side of the Atlantic may already have been reduced below the point where recovery is possible in which case it will become extinct. If that is so, the most that can be said is that the loss of all right whales present in the Quoddy-Grand Manan area at any one time will hasten the process. This, of course, would not mean the elimination of the right whale from the

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48/ Strycker's Bay Neighborhood Council v. Karlen, _______ U.S. _______, 13 ERC 2157 (1980).

Earth as there are right whales along the coasts of South America and Africa (Tr. 254). Although the small stock off the coast of South Africa is reported to have shown a significant increase (Report of the Scientific Committee, NOAA Exh 3), there are no data on the size of that population in the record. Once again, NEPA requires only that environmental concerns be considered, not that such concerns be given priority over other legitimate considerations such as a projects benefits. It should be emphasized that the loss of all right and humpback whales in the Quoddy-Grand Manan area at any one time as a result of an oil spill regardless of size is exceedingly unlikely.

As indicated at the inception of this discussion, a source of controversy in this proceeding has been the exact basis of the decision denying the permit application. Although the evidence clearly supports and it has been concluded that the permit would have been granted, but for the FWS and NMFS determinations of jeopardy to endangered species, the letter denying the application went on to state that the "findings of the NMFS report taking together with findings concerning endangered species [eagles] * * contribute to a determination that the quality and scarcity of the resources is such that they should not be placed at risk from the proposed project." Project opponents have seized on this language to argue that the Regional Administrator found the value of the resources including endangered species too valuable to be placed at risk (the first NEPA criterion) and, given that for the purposes of this proceeding the authority to establish such criteria under NEPA has been presumed because of a General Counsel decision, they further argue the Regional Administrator's decision must stand unless Pittston overcomes by a preponderance of the evidence the Regional Administrator's finding that the quality and scarcity of the resources at risk is such that no significant threat to their impairment should be incurred (NOAA Reply Brief at 2, 11; Commission Reply Brief at 3). The Commission goes even further asserting that the only way Pittston can satisfy its burden under this criterion, as properly construed, is to demonstrate that there is no risk of a catastrophic or other major oil spill during the life of this project (Commission Reply Brief at 5, 6).

These arguments ignore the language in the letter of January 15, 1979, to Pittston that "it remains our opinion that the fisheries, though substantial, would not in themselves dictate denial of the permit to protect special resources from the risk of an oil spill, especially considering the level of their commercial and recreational use in comparison to other areas along the Maine coast" (Id. at 3). On the basis of this language, language in the notice of adjudicatory hearing and in other letters to Pittston (footnotes 1 and 2 and accompanying text), it has been concluded that but for the FWS determination of jeopardy to the bald eagle and the later NMFS determination of jeopardy to the right and humpback whale the permit clearly would have been issued. Moreover, the NMFS report, dated November 16, 1978 (footnote 1), exaggerates the value of the resources at risk by citing landings and value data for the Bay of Fundy rather than the more limited area more likely to be impacted by an oil spill,[49/] contains other assertions that are questionable,[50/] or exaggerated[51/] and relies on the Supplement to the Final Environmental Impact Statement prepared by the Corps of Engineers for the Hampton Roads Energy Company's proposed refinery in Portsmouth, Virginia (Appendix, Item 25) for the proposition that there are 17 environmentally superior sites for an oil refinery and marine

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49/ The NMFS report (Item VIII-48) states that commercial landings by Canadian and U.S. fishermen from the Bay of Fundy during 1977 were 118,000 tons with a dockside value of $50 million and approximate retail value of $150-$200 million (Id. at 5). The evidence, viewed most favorably to project opponents, can only be regarded as supporting in the most tentative fashion the view that oil from a spill in the Quoddy Region will extend to the entire Bay of Fundy (Figures 40 & 41, NOAA Exh 84). By contrast, NOAA's principal witness on the value of the resources of risk, Dr. Anthony,concentrated his efforts on landings in Washington County, Maine and Charlotte County, New Brunswick, the areas most likely to be effected by an oil spill according to the testimony of Virgil Keith. It should be emphasized that whatever may be the size of the fishery at risk, there is no evidence of the loss of an entire year class of fish stocks from an oil spill irrespective of how massive the spill.

50/ The report states that recreational use of the area is heavy and that about two million people (60 percent U.S. citizens) annually visit recreation areas in southwest Charlotte County, New Brunswick on the north shore of Passamaquoddy Bay (Id. at 5). This figure is questionable because Technical Report No. 428 (Canada 1974) states that precise data on the number of resident and nonresident visitors to the coastal regions of Charlotte County are not available and other data show that during the period May 15 - October 31, 1977, a total of 1,253,000 overnight visitors entered the province (New Brunswick, not just Charlotte County) and, of these, 128,600 persons stayed overnight in Charlotte County (NOAA Exh 58 at 98).

51/ The report states that the Passamaquoddy and Bay of Fundy area supports a major recreational fishery for Atlantic salmon (Id. at 5). In contrast, Dr. Anthony testified that Charlotte County produced a modest sport catch of salmon averaging 41 fish annually since 1970 and that the Washington County catch (90% of Maine's annual total) averaged 274 annually during the years 1948-1979 (NOAA Exh 47 at 47 and Table 28).

terminal on the east coast of the United States.[52/] In view of the foregoing, and the further fact that the FWS and NMFS jeopardy determinations concerning endangered species have not withstood the test of the preponderance of the evidence in this proceeding, the decision the Regional Administrator would have made had he been aware of these facts is clear, that is, the permit would have been issued.

The Commission argues that without a quantification of the level of risk it is not possible to compare risks and benefits and points out that world-wide accident statistics have been used in other environmental impact statements assessing risks of oil spills, i.e., by the Corps of Engineers concerning the proposed HRECO refinery in Portsmouth, Virginia and by the Coast Guard concerning the proposed Louisiana Offshore Oil Port (Brief at 98 et seq.). CLF makes similar arguments concerning the necessity for a detailed risk analysis (Brief at 14 et seq.). These arguments reflect a passion for placing numbers on what in the final analysis are matters of judgment. In taking final action on the EIS for the proposed HRECO refinery, costs and damages from a catastrophic tanker spill were estimated in a broad range of $5.00 to $10.00 a gallon and it was estimated that once in 83 years the costs of a catastrophic

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52/ The deficiencies of this study as a decisional tool in comparing other possible refinery and marine terminal sites have been highlighted in the detailed findings and will not be repeated here. It is of interest that NOAA referred to the availability of "other less damaging sites" in opposing the HRECO refinery at Portsmouth, Virginia (NOAA letter to the Secretary of the Army, dated October 23, 1979, Pittston Exh 113).

spill would equal or exceed net estimated national economic development benefits of the refinery of $56.2 million.[53/] Nevertheless, after citing the 83 year figure, the Secretary of the Army concluded "And this assumes a catastrophic occurrence in port despite historic data indicating otherwise, and ignores the excellent port characteristics of Hampton Roads and lack of pollution causing incidents which mitigate against such an infrequent occurrence. I do not believe that oil refinery operations would have a lasting adverse effect * * *" (Letter to the Secretary of the Interior, dated October 3, 1979, Note 53, supra, at 3).

Although the Commission and CLF are correct that historical spill data were used by the Coast Guard in the LOOP EIS, it should be noted that because of the special nature of the traffic and obstructions in the Gulf of Mexico world-wide historical data were not used to estimate spill rates for collisions, rammings or groundings (Appendix, Item 20A, Vol. 3 at B-32). This obviously reflects a judgment that such data were not applicable to the facility under consideration there. It seems anomalous to contend that, although judgment must be used in determining the extent to which world-wide accident data can be applied to a specific port, it is nevertheless mandatory that such data be used to calculate probabilities in terms of numbers even though the numbers can be no better than the judgment used in determining their applicability.

53/ Table 20, Attachment 3, Pittston Exh 57. These calculations were made by the Office of the Secretary of the Army, the Chief of Engineers having concluded that a catastrophic spill was avoidable (Id. at 32).

In the instant case, Mr. Keith of ECO purportedly screened the world-wide accident data to remove accidents other than those attributable to collisions, rammings and groundings in calculating the probability of a catastrophic spill (0.48) over the assumed 25-year life of the refinery. Because ECO determined that a catastrophic spill would be expected to occur once every 27 years, project opponents assert that a catastrophic spill during the life of the refinery is nearly a statistical certainty (CLF Brief at 22). However, as we have seen (finding 65) the 27-year figure is not valid because it is based on combining expected tanker and barge traffic at Eastport even though world-wide catastrophic spill data excluded barges and even though ECO's own data shows that barges have a lower probability of a PCI per port call than tankers. Another problem with the world-wide spill statistics is that they are based on assumptions and averages concerning tanker usage rather than actual port calls (Tr. 2360-64).

The Commission argues that the ECO data and analysis is merely the first step and that Eastport must then be examined for attributes--winds, currents, water depths, etc.--which make it more or less hazardous than the average port.54/ Apparently it is permissible to apply judgment

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54/ The term "average or typical port" is misleading because there is no indication that world-wide accident data is in any way dependent upon such a concept or that the data can be refined to determine a typical port, other than hypothetically. In any event, Mr. Kieth acknowledged that comparing Eastport with other ports involved subjective judgments (Tr. 2433).

in the second step, but impermissible to conclude that world-wide accident data cannot be applied in any meaningful way to Eastport. Although project opponents emphasize swift and allegedly unpredictable currents, fog, etc. which in their view make Eastport more hazardous than the mythical "typical port," the wide and relatively straight channel, deep water[55/] and low traffic density are definitely in Eastport's favor. The reasons for rejecting the contention that Eastport is unduly hazardous have been set forth in the findings and will not be repeated here.[56/]

Project opponents also contend that the EIS should not have relied on comparisons with Milford Haven because the differences are significant and reliance on only one port for comparison introduces the problem of statistical bias (CLF Brief at 20 et seq.; Commission Brief at 108 et seq.). Among differences emphasized are the extensive fog at Eastport while Milford Haven is relatively fog free and the channel bottom and boundaries at Eastport are largely rock while the channel boundaries at Milford Haven are approximately one-half rock and one-half sand or softer material. The problem of fog at Eastport has been taken into

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55/ CLF alludes to a 54-foot shoal or shallow spot in the middle of the channel at Friar Roads allegedly shown on Canadian charts (Brief at 21). Subsequent surveys have failed to disclose this alleged shallow spot (Item V-20A at 2; Item VIII-71 at 16).

56/ Although Captain Crook appeared to be very familiar with the code of recommended standards for the prevention of pollution in marine terminal systems issued by the Canadian Coast Guard (TERMPOL CODE (February 1977), Pittston Exh. 32), the only standard that he considered Eastport did not meet was the recommended turning radius (Tr. 2570-71).

account by the operating requirement of a minimum of one mile visibility for a vessel to enter Head Harbor Passage or depart its berth and by the "state-of-the-art" navigational aids to be employed by Pittston. It should also be noted that these operating conditions contemplate one vessel in the channel at any one time thus reducing the likelihood of collisions and that more specific operating procedures will be established by the Coast Guard after real time simulation and whatever other studies are considered necessary. The fact that it will not be possible to operate tankers in or out of Head Harbor Passage at all times (Frederic R. Harris concluded that the terminal would be operational 85% of the time) must be and is a recognized cost of terminal and refinery operation. The findings herein establish that for short periods of time (two hours or the approximate time for a tanker to transit Head Harbor Passage) the fog at Eastport is predictable making it unlikely that a tanker would meet the minimum visibility requirement of one mile, enter the Passage and suddenly become enveloped in a dense fog.

Regarding Eastport's rocky or rock bound channel, this is of significance only in the event of a vessel's contact therewith and in this respect Eastport's wide channel and deep water tend to reduce that possibility. In attempting to make Eastport appear far more hazardous than Milford Haven, project opponents neglect to mention the narrow channel at Milford Haven (850 feet), the fact that entry of deep draft vessels has to be coordinated with the tides and the fact that Milford Haven handles approximately 3,500 vessels a year while traffic at Eastport is unlikely to equal 20% of that figure.

The problem of statistical bias was raised by Dr. Stewart, an expert witness for NOAA. While he stated that the data base at Milford Haven was too small to reliably estimate the probability of casually related spills, he nevertheless maintained that the Milford Haven experience was consistent with world-wide spill data in the ECO study. Some problems with the ECO study have been identified above and in the final analysis, it comes down to a question of judgment as to the extent to which Eastport can properly be compared with Milford Haven. Dr. Stewart asserted that experts can differ in this regard and acknowledged that he did not have the expertise to make that judgment. The only witness to testify in this proceeding who had intimate knowledge of Milford Haven was Captain Guilford Dudley, Harbormaster, who, in addition to the areas previously mentioned (depth of water, width of channel) where Eastport is obviously superior to Milford Haven, identified other areas (making the turn to the berthing piers, the area and time in which tugs can be made fast and the time scale in which a vessel has to proceed down the channel), which in his opinion made Eastport a significantly easier operation. This list is obviously not exhaustive of actual or potential problem areas and, of course, Captain Dudley, while an expert on Milford Haven, acknowledged that he was not such as to Eastport. Nevertheless, his testimony together with the problems with the ECO data and its application mentioned previously serve to refute the contention that comparing Eastport and Milford Haven was arbitrary.

Project opponents also contend that because real time simulation studies or trials will be required prior to the time the refinery becomes operational, the real decision as to whether Head Harbor Passage can safely be navigated by VLCC's is being improperly postponed and that it is arbitrary not to require such studies prior to a final decision on whether the permit is issued (Commission Brief at 111 et seq.; CLF Brief at 62). This argument reflects a misunderstanding of the purpose of real time simulation and in any event, requires acceptance of the contention that a decision as to whether Head Harbor Passage can be safely navigated by VLCC's cannot be properly made on all the evidence in this proceeding. Real time simulation involves use of mathematical formulas or models similar or identical to those used by Dr. Eda in conducting computer simulation studies and is a useful tool for training ship pilots and masters, determining ship operating procedures under various conditions, etc. The Coast Guard was of the opinion that it could be premised that the channel at Eastport can be safety navigated and that further delay for the purpose of studying channel adequacy was not justified (Letter of August 8, 1979, Item IV-21). This letter was in response to a CEQ request for Coast Guard assistance in conducting real time simulation studies. It is of significance that the Maine BEP required real time simulation at the pre-operational stage and not prior to construction. This, of course, merely reflects the judgment, amply sustained by the evidence in this proceeding, that Head Harbor Passage can be safely[57/] navigated by VLCC's.[58/] Project opponents, as are other members of the public, are entitled to the articulation of a judgment as to the risk of environmental damage from this project and a comparison of expected benefits with those risks. They are not entitled to insist that those risks be determined in any particular way nor may they insist on calculations, which while giving the appearance of certainty, add little of value to the determination.[59/] The contention that real time simulation must be required prior to a decision on issuance of the permit is rejected.

In comparing risks and benefits, the FEIS recognized the possibility, even the probability, of oil spills stating that Eastport would ultimately experience its share of such events. The great majority of these will be at the pier or berthing area. Because tankers will be boomed and the BEP Order requires that crude carriers be berthed inward of the one-knot line, such spills are expected to be readily contained and cleaned up.

57/ CLF's contention that safely means nothing without a quantification of "safe" is rejected. The Coast Guard is the Agency with presumed expertise in this area, its opinion is consistent with and supported by the overwhelming weight of the evidence in this proceeding and is accepted.

58/ The BEP limited its approval to tankers of 150,000 DWT and under, indicating some reservations about tankers of larger size.

59/ This was Mr. Stickney's conclusion after discussing the matter with Arthur D. Little, Inc. which had performed analyses and calculations for the LOOP EIS (Tr. 5066). Because it appears that considering only tanker port calls (an average of 16,000 port calls to one catastrophic spill), a catastrophic spill can be expected once every 41 years at Eastport rather than 27, ECO's calculated probability of a catastrophic spill (0.48) is equally open to question.

Considering the ECO data that a spill of 6,470 barrels, may be expected on an average of once every 7.1 years, it is noted that collisions (vessel-to-vessel contact) constitute a substantial proportion (approximately 43% of tanker PCI's and approximately 27% of barge PCI's) of the world-wide PCI's (Tables III-2 & IV-2, NOAA Exh 33), and in view of the fact Pittston's plan contemplates one tanker at a time in the channel, the chances of a collision are seemingly remote.[60/] Similarly, there is no data base for rammings in the world-wide catastrophic spill statistics and eliminating the "all other" category which ECO says it did, collisions were the cause of approximately 37% of world-wide catastrophic spills (Table IV-4, NOAA Exh 33).

The foregoing merely illustrates further the dubious propriety of attempting to draw meaningful conclusions from world-wide spill data. It may be taken as given that a spill in excess of 250,000 gallons (approximately 5,900 barrels) may not be completely contained or cleaned up should it occur in Head Harbor Passage or at other than the berthing areas. The evidence is that this is not peculiar to Eastport, but would be true at any location along the Maine Coast or in the world.[61/]

60/ This, of course, does not consider the possibility of a collision other than in Head Harbor Passage. However, this possibility exists without the Pittston project because of traffic up the St. Croix River and Passamaquoddy Bay and because of traffic to the 300,000 barrel-a-day refinery at St. John, New Brunswick, variously estimated to be from 40 to 60 miles from Eastport. Although Mr. Kieth testified that the most likely spot for an oil spill was at a point off of the coast of Campobello Island, his concern with the safety of the project centered on navigation of Head Harbor Passage in VLCC's. This apparent discrepancy has not been explained.

61/ Although project opponents have severely criticized the adequacy of Pittston's oil spill contingency plan, it is at least as detailed as that for the Port of Milford Haven (Appendix, Item 18B).

Going forward with the refinery and terminal thus involves accepting the risk that there will be spills which may not be completely contained prior to impacting shore areas. Depending on the area or areas impacted and the timing of the impact, it may also be accepted that complete clean-up of oil may not be possible despite the utmost diligence. There is also a risk, properly characterized as very small or minute,[62/] that there may be a catastrophic oil spill during the life of the project. The findings herein demonstrate, however, that even the most massive oil spill has not resulted in the loss of an entire year class of pelagic or other fish stocks and that use of terms such as permanent and irreversible to describe effects of oil spills is inaccurate and misleading.

As we have seen, the Regional Administrator's basic finding was that the value of the resources at risk, though substantial, was not such as to warrant denial of the permit. Otherwise stated the benefits of the project were considered to outweigh risks. The only question warranting discussion here is whether there is anything in the record as supplemented by this proceeding, which would require or justify altering that conclusion. Although NOAA-NMFS have produced data amplifying and updating valuations of fishery resources from those stated in the FEIS, it is erroneous to regard the entire value of these resources as being at risk from the refinery. The overwhelming weight of the evidence

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62/ Although the Commission has been critical of the subjective nature of judgments involved in so characterizing the risk of a significant oil spill, its own characterization, after citing the ECO 0.48 probability figure for a catastrophic spill, was that the risk of oil spillage is extremely large (Reply Brief at 22).

establishes that Head Harbor Passage can and will be safely navigated by VLCC's and that the risks of catastrophic oil spills are, if anything, even less than those postulated by the FEIS.

The FEIS estimated transportation benefits from delivery of crude in VLCC's and delivery of product in medium size tankers at $.58 per barrel as compared to a similar facility serving the same market in the Middle Atlantic States and at $.37 per barrel as compared to a similar facility serving the same market on the Gulf Coast. Although dependent in part on tanker charter rates, evidence at the hearing indicates that these savings may be as much as $1.00 a barrel. Long-term benefits to Eastport, which is badly in need of a stable, year-round source of employment, are obvious as the refinery together with related service and trade generated employment is expected to create approximately 1,200 permanent jobs. Balance of payment benefits are estimated at $3.00 a barrel, the approximate cost of refining, although this figure might have to be reduced somewhat to account for the possible closing of older and less efficient refineries in other parts of the U.S. The evidence supports the FEIS determination that benefits of the project outweigh risks.

Because of a reduced rate of consumption of petroleum products and because of the President's policy to limit imports of petroleum to 1977 levels (8.6 million barrels a day), the Commission argues that the projected increases in petroleum consumption stated in the FEIS to take place by 1985 cannot occur and that therefore, the primary justification for the refinery no longer exists (Brief at 70 et seq.). The Commission further argues that the justification for the refinery stated by Dr. Reed of DOE, i.e., the need to produce unleaded gasoline and the need for refining capacity to process high-sulphur, so-called sour, crudes, not having been stated in the FEIS, requires the preparation of a supplemental EIS if these reasons are to be relied upon to support the need for the refinery. As pointed out in connection with the Commission's motion to supplement the record, it is Federal policy to encourage the construction of refinery capacity to meet domestic requirements and not to rely on product imports. The FEIS recognized this policy and that refinery capacity on the East Coast of the U.S. equals approximately 30% of the consumption of petroleum products in that area. Although the Commission may consider the policy not to rely on product imports to be unwise, this is not the forum for attacking the wisdom of that policy nor for seeking its change. Accordingly, the primary justification for the refinery was correctly stated in the FEIS and the fact that other analyses also support the need for the refinery can hardly be justification for requiring the preparation of a supplemental EIS. It is worthy of note that even though the Secretary of the Army found no absolute need for the proposed HRECO refinery in Portsmouth, Virginia, he nevertheless issued the necessary permit--leaving the ultimate question of need to be determined by the market, that is, whether the project may be financed.

Cases (Brief at 140 et seq.) cited by the Commission to support its argument that information and evidence introduced at the adjudicatory hearing may not be used to augment the EIS without the preparation of a supplemental EIS are distinguishable as none of these cases appear to have involved an APA type hearing. The principal reason for the Court's holding in Grazing Fields Farm v. Goldschmidt (Note 29, supra) to the effect that material in the Administrative record, not expressly incorporated into the EIS,could not be used to validate an otherwise deficient EIS was the lack of opportunity to comment upon such material by other Federal agencies and the public. It should be emphasized that decision was not rendered upon review of an APA type hearing.[63/] In the instant case, all requests for party status or for leave to intervene were granted and no reason is apparent why the hundreds of pages of briefs and reply briefs cannot serve as comments within the spirit of NEPA upon the lengthy list of subjects they address. To require the preparation of a supplemental EIS would presumably mean that the lengthy hearing in this proceeding has been to no avail and that the process can begin anew once a supplemental EIS is prepared and circulated for comment. The adjudicatory hearing process is designed to bring an end to litigation. The contention that a supplemental EIS must be prepared is rejected.

The foregoing discussion is not to be taken as recognition that the FEIS is in any way inadequate. The Commission asserts that the EPA was wrong as a matter of law in adopting what it considers to be a lesser standard for the consideration of alternatives because this was a privately

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63/ The very court which decided Grazing Fields Farm, supra, appears in fact to have allowed such supplementation, provided the APA was complied with, in the lengthy litigation over the Seabrook Nuclear Power Plant. See New England Coalition on Nuclear Pollution v. NRC, 582 F.2d 87 (1978); Seacoast Anti-Pollution League v. Costle, 572 F.2d 872 (1st Cir., 1978) and the same case at 597 F.2d 307-08.

funded project (Brief at 25 et seq.). In considering this question, the FEIS stated in part "In making decisions subject to NEPA requirements for privately sponsored projects, EPA generally believes its role is to determine whether the proposed site is environmentally acceptable and not to undertake to locate what EPA would consider to be the optimum site for a new facility. * * * Thus, in our view, the purpose of the consideration of alternatives in reviewing the proposed facility was not to enable EPA to make affirmative findings that a particular alternative would be marginally preferable, but to facilitate comparisons that might reveal substantial environmental drawbacks in the proposed site. This different purpose affects the extent of the information on alternatives necessary to make a decision" (FEIS, Vol. II at I-10).

There are certainly ample practical reasons for the approach adopted in the FEIS, namely: the projected return on a privately funded project must compensate for the risk or the project is unlikely to be capable of being financed and with the possible exception of public utilities, the power of eminent domain is usually lacking for privately funded projects. Be that as it may, a substantially similar test was upheld in considering alternative locations for the Seabrook Nuclear Power Plant, Seacoast Anti-Pollution League v. NRC (Note 24, supra), the Court upholding a test phrased in terms of whether alternative sites were "obviously superior." Moreover, NEPA does not require the consideration of all possible sites, but only a sufficient number to permit a reasoned choice.[64/] In view thereof the Commission's contention that the FEIS is

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64/ Seacoast Anti-Pollution League v. NRC (Note 24, supra).

inadequate for failing to consider alternative sites outside of the State of Maine is rejected.

The Commission also argues that the consideration in the EIS of other sites in the State of Maine was, in any event, inadequate. The other sites considered in the FEIS were Machias, Penobscott/Blue Hill and Portland. With commendable candor, the Commission concedes that because of environmental considerations, including heavy recreational use, there is little purpose in further consideration of the Penobscott/Blue Hill alternative site (Brief at 41, 122). Although the Commission attacks as unsupported the statement in the FEIS that "facilities in the Machias area would be more exposed to wind and weather from the Bay of Fundy," it seemingly concurs in the view that Machias and Eastport are so similar that different environmental results from siting a refinery and marine terminal could not be expected.[65/] If this is true, the absence of a detailed comparison of tides, currents, etc., which the Commission argues should have been done, does not make the FEIS inadequate. It should be noted that Machiasport was eliminated from consideration by the Corps of Engineers Tank Force considering alternative sites for the HRECO refinery based on fisheries and weather considerations. While not determinative it supports the conclusion of the FEIS in the instant case that Machias and that area was not environmentally preferable to Eastport.

65/ Brief at 40 et seq. Any contention or implication that consideration of these sites was merely for the purpose of appearances and not in good faith is rejected.

The Commission concentrates its criticism on the FEIS consideration of a monobuoy or SPM system in Luske (Luckse Sound) Portland, Maine. Pittston determined that this was not an acceptable site because water depth limited the tanker size to 90,000 DWT, there was not enough land near the waterfront for a refinery or marine terminal, the refinery would have to be located approximately 30 miles from the waterfront resulting in difficulties and expense in piping crude and product for that distance and difficulty in acquiring the necessary right-of-way. The FEIS concluded that because of exposure to the open ocean such a system would be subject to a greater risk of an oil spill than a fixed pier at Eastport. Although the Commission attacks this conclusion, purporting to find data in the FEIS to the effect that the SPM would be relatively protected, the actual statement is that "While it is physically possible to locate a monomooring system in Luckse Sound (sic), the area is relatively open to the sea and is only protected from the east by Cliff Island" (FEIS, Vol. II at X-46). Moreover, the FEIS states that chronic spills associated with a monomooring system in the area would not only potentially interfere with the fishing industry of Casco Bay, but would pose a hazard to the recreation industry in the Portland area which is not found in Machiasport or Eastport (Id.).

It is not feasible to distribute product through an SPM system. The Secretary of the Army's decisional paper on the proposed HRECO refinery at Portsmouth, Virginia, alluded to the possibility of an SPM system in Luske Sound, Portland, Maine, but stated that "Because the nearby market is not good and since pipeline construction to heavy market areas would be extremely costly, we would expect that a great deal of product (more than HREC) would have to be moved by coastal tanker. We view the potential for oil spill in the harbor and along the coast greater than HREC because of port conditions, weather and greater tanker traffic in the harbor. * *" (Id. at 84). In concentrating on the alleged environmental advantages of delivering crude to an SPM system, project opponents seemingly ignore the fact that product will have to be moved by tanker in any event, even though the evidence is that refined petroleum is generally likely to be more harmful than crude.

Regarding the alleged alternative of an SPM system 50 miles off of the coast of New Jersey not much needs to be said. The proposal assumes, inter alia, that the project can somehow be financed,[66/] that environmental constraints will be lifted, that necessary rights-of-way will be available and that pipeline capacity to transport product to the Pittston market will be available (Tr. 4360). It is well settled that alternatives entitled to serious consideration under NEPA must be feasible and compatible with the time frame of the needs to be met by the proposal under consideration. Seacoast Anti-Pollution League v. NRC (Note 24, supra). The purported alternative of an SPM system off of the coast of New Jersey is an altogether different proposal than the Pittston project and is simply too remote and speculative to be regarded as a reasonable alternative thereto.

66/ The assertion that the project might be financed by the State of New Jersey is simply not credible.

It is concluded that the FEIS candidly discussed the environmental consequences of licensing the Pittston project and adequately considered a reasonable range of alternatives thereto. Under the case law, no more was required.[67/] The contention that the FEIS was inadequate is rejected.

Maine BEP Conditions a Part of Sec. 401 Certification

As indicated in the findings, the certification under Sec. 401(a)(1) of the CWA issued by the State of Maine on September 2, 1977, made no reference or mention to the conditions under which the Maine Board of Environmental Protection had approved the Pittston project and in fact was completely silent as to the existence of the BEP Order and conditions. Nevertheless, EPA has taken the position that the BEP Order was part of the certification and the testimony of Commissioner Warren of the Maine BEP, supported by reference to copies of drafts of the EPA permit in the Board's files at least one of which bears a date prior to the certification, and all of which recite that the Maine BEP has required compliance with the conditions set forth in its Order No. 29-1466-29210 of March 12, 1975 as amended June 4, 1975, is to the effect that the certification is impliedly dependent upon compliance with the BEP Order and conditions. This testimony was admitted over Pittston's objection and on brief, Pittston has renewed its objection and filed a motion to strike. The basis of the motion is the parol evidence rule which is to the effect

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67/ Strycker's Bay Neighborhood Council v. Karlen (Note 48, supra) and Vermont Yankee Nuclear Power Corp. v. NRC, 435 U.S. 519, 11 ERC 1439 (1978).

that evidence to contradict or vary the terms of an integrated written instrument is ordinarily inadmissible. A recognized exception to the parol evidence rule is that evidence concerning conditions precedent to the effectiveness of an instrument or writing is admissible. Under this view, the conditions of the Maine BEP Order are conditions precedent to the effectiveness of the Sec. 401 certification. Although a conditional State certification is of dubious validity,[68/] the motion to strike is denied upon the basis of this exception to the parol evidence rule.

This ruling does not end the matter for it is clearly not any or all requirements of State law that are automatically included into terms of EPA issued permits by virtue of a Sec. 401 certification by a state. Sec. 401(d) of the Act provides that any certification provided under this section shall set forth any effluent limitations and other limitations, and monitoring requirements necessary to assure that any applicant for a Federal license or permit will comply with any applicable effluent limitations and other limitations, under Section 301 or 302 of this Act, standard of performance under Section 306 of this Act, or prohibition, effluent standard, or pretreatment standard under Section 307 of this Act, and with any other appropriate requirement of State law set forth in such certification. Sec. 301(b)(C) refers to more stringent limitations including those necessary to meet water quality standards, treatment standards or schedules of compliance established pursuant to State law or regulations and Sec. 302 concerns water quality related effluent limitations. It seems to be clear that Sec. 401(d) contemplates that

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68/ See the discussion on State Certification, 44 FR No. 111, June 7, 1979, at 32880.

certification will include requirements of state law relating to water quality standards, effluent limitations or schedules of compliance and not matters unrelated thereto. This is the gist of OGC decisions interpreting the state certification requirement of Sec. 401(d)[69/] and the conditions of the Maine BEP relating to test runs with tankers prior to delivering oil, limiting the size of tankers to those of 149,999 DWT or less, requiring real time simulation studies, stating times and conditions of navigation of Head Harbor Passage, and other matters unrelated to water quality may not legally be regarded as part of the State of Maine's Sec. 401 certification, irrespective of the intention of the issuer of the certification.

This ruling also does not end the matter for in accordance with the General Counsel opinion of September 23, 1976, which has been incorporated into the regulation (40 CFR 6.918), EPA may impose appropriate conditions upon the issuance of the permit in accordance with NEPA. While Pittston is free to contest this ruling on appeal, it is considered binding for purposes of this initial decision. In this regard, the proposed stipulation with Pittston (Item VIII-75) would require Pittston to conduct the real time simulation studies six months prior to the commencement of on-site construction rather than preoperational as specified in the Maine BEP Order. The evidence in this proceeding supports the conclusion that conducting real time simulation studies prior to the commencement of refinery

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69/ See, e.g., Texaco, Inc., G.C. Decision No. 44 (June 22, 1976), Bethlehem Steel Corporation, G.C. Decision No. 58 (March 29, 1977), and New York City Department of Water Resources, G.C. Decision No. 59 (April 7, 1977).

operations would adequately serve the usual purposes of real time simulation studies. Be that as it may, the conditions of the stipulation are left to negotiation by the parties in the light of this decision and in the light of the ruling that the conditions of the BEP Order are not legally a part of Maine's Sec. 401 certification.

Conclusion 70/

The decision denying Pittston's application for a wasteater discharge permit under the CWA is reversed and it is directed that the permit be issued. The conditions of the Maine BEP Order of March 12, 1975, as amended June 4, 1975, are not legally a part of its Sec. 401(d) certification and are not automatically incorporated into the permit. The parties are left to negotiate the conditions of the Maine BEP Order, if any, which should be included in the permit. 71/

Dated this 8th day of January 1981.

Spencer T. Nissen
Administrative Law Judge

70/ No attempt has been made to deal with every argument or proposed finding. Arguments considered to merit discussion have been discussed.

71/ Unless appealed in accordance with 40 CFR 125.36(n) or unless the Administrator elects to review the same on his own motion, this initial decision shall become the final decision of the Administrator and of the Agency.

Appendix A

Endangered Species - Eagles

1. The June 4, 1979, biological opinion of the FWS reaffirming the conclusion that the proposed refinery and marine terminal would likely jeopardize the continued existence of the bald eagle was based on the expectation that adverse impacts on the eagle would result from air pollution, oil spills and development stimulated by refinery construction and operation. It is arguable that the air pollution reason has been abandoned (letter, dated November 9, 1979, from FWS Regional Director Howard Larsen to EPA Regional Administrator William Adams, DOI Exh. 34, which states (numbered Paragraph 8) at 2: "The construction of an oil refinery in the Eastport area is likely to jeopardize the continued existence of the bald eagle. This is due to the probability that eagles, their eggs and young could be contaminated by an oil spill and also due to increased human activity." However, evidence concerning air emissions from the proposed refinery was introduced at the hearing and counsel for DOI continues to argue that such emissions will adversely impact the eagle.

2. With regard to air pollution particular concern was expressed regarding emissions of lead and mercury from the refinery because of their toxicity. Based on correspondence from EPA (letter, dated May 11, 1979, Item VIII-106A),* mercury emissions from incineration at the refinery were alleged to be 163 grams per day and boiler emissions of mercury were asserted to average approximately 200 grams a day. The FWS opinion letter stated that mercury was known to bio-accumulate as it passed up through the food chain by a factor of up to 10,000 and that the mercury emissions from the refinery would cause an increase in already high mercury concentrations in eagles.

3. Regarding incineration, Pittston has revised its plans and stated that sludge will not be incinerated so that such emissions may be eliminated from consideration (Testimony of Mr. Kaulakis, Pittston Exh. 57, at 8; letter, dated August 7, 1979, from Pittston attorney Bruce W. Chandler to the Maine DEP). Pittston has sharply disputed the 200 grams a day average mercury emissions from boiler operations at the proposed refinery utilized by FWS and EPA, contending that the 200 grams a day figure is based upon data obtained prior to 1972 showing mercury content of fuel oil as 0.1 part per million (ppm), that this figure was based on California crudes uniquely high in mercury and was derived by techniques which have been discarded as inadequate and inaccurate, and that currently accepted analytical techniques show that most residual fuel oils have a mercury content at roughly the

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* Reference is to the Certified Index.

detectable limit of four parts per billion (ppb) or less (Kaulakis at 5-6). Mr. Kaulakis has submitted calculations based on the assumption that the refinery would process what he called "Light Aramco Crude" (Saudia Arabian) having a mercury content of four ppb, that 4,700,000 lbs. of No. 5 fuel oil per day would be burned in the refinery boilers and that 50% of the mercury would be retained on or removed by the hydrodesulfurizer catalyst (Testimony at 9-12). He concluded that mercury emission from the boilers would be 0.0119 lbs. or approximately 5.5 grams per day at most. However, these calculations failed to consider that essentially all of mercury content of the crude could be concentrated in the No. 5 fuel oil (48.5% of daily refinery input) and that consequently, mercury emitted from No. 5 fuel oil burned in the boilers (4,700,000 lbs. a day) would be higher (Tr. 1987-95). With this revision, mercury emissions, assuming 50% mercury removal on the HDS catalyst, would be .0194 lbs. per day or 8.8 grams (Tr. 1995, 4940).

4. Mr. Kaulakis' assumptions regarding the mercury content of mid-Eastern crudes were based on the work and testimony of Dr. Royston Filby, Director of the Nuclear Radiation Center, Washington State University, and an unquestioned expert in the analysis of the trace metal* content of various substances. Dr. Filby testified that the mercury content of crude oils was very low ranging from less than one ppb up to 50 ppb except for certain atypical crudes associated with mercury mineral deposits such as crude from the Cymric fields in California (Testimony at 4). He stated that because

* Trace metals is a term of art used to define metal present in almost all substances in very low quantities (Testimony of Dr. Filby at 2, Pittston Exh. 10). Dr. Filby stated that a convenient reference point was to define trace metals as those found in substances at levels less than 100 ppb.

of the extremely low levels of mercury present in natural materials and the possibility of contamination of samples there were difficulties in determining the precise mercury content of natural substances. He asserted that analytical techniques used prior to 1970 were reliable only if the concentrations were in the ppm range and that the current state of the art for establishing trace metal content of fossil fuels, including petroleum and coal, was atomic absorption spetroscopy and neutron activation analysis (NAA). These methodologies allowed detection to the level of one ppb or less.

5. Relying on a study "Determination of Trace Elements In Canadian Feedstocks and Products" performed by the Nuclear Radiation Center," Pace Report No 77-5, August 1977 (Pittston Exh. 12), Dr. Filby testified that Mid-Eastern crudes had mercury concentrations ranging from less than four ppb to seven ppb (Testimony at 5). He further testified that heavy metals in crude oils when refined tended to concentrate in residual oils, No. 5 in particular (Tr. 371-72), and that mercury concentrations in residual oils resulting from refining such crudes would range from less than four ppb to 5.8 ppb He discounted studies showing greatly elevated levels of mercury in crude oils, An Assessment of Mercury Emissions From Fossil Fueled Power Plants, EPA- 60017-78-146, July 1978 (DOI Exh. 17) and Determination of Trace Elements In Petroleum By Neutron Activation Analysis (Certified Index, Item VIII-4), the latter in part his own work, by the assertion that the former study relied upon outmoded techniques and data, including data on atypical California crudes and that the latter study involved atypical crudes suspected of being high in trace metal content which were analyzed for the purpose of developing an analytical technique (Tr. 330-31).

6. The 200 grams per day average mercury emission figure calculated by EPA was based on the EPA report cited in the preceding finding (DOI Exh. 17) which states at page 27 that an average mercury concentration which may be applied to fuel oil is 0.1 ppm (Testimony of Thomas Michel, EPA engineer, at 3-4, EPA Exh. 6). This figure was derived from an EPA report, Emission Factors For Trace Substances, EPA-450/2-73-001 (December 1973, EPA Exh. 1) showing an average mercury content for six imported residual oils, none of which were from the Mid-East, of 0.13 ppm, which rounded to the nearest tenth equals 0.1 ppm. These results were obtained by neutron activation analysis performed by the Lewis Research Center, National Aeronautics and Space Administration, Sandusky, Ohio at an unspecified date. Dr. Filby pointed out that the cited analysis relied on only one source, was not published and that in the absence of such publication, it was not possible to evaluate the validity, precision or accuracy of the analysis (Tr. 333-34, 375-76). He stated that other published analyses of mercury in crude oil were neglected or ignored in compiling the EPA report.

7. Catalytic hydrodesulfurization (HDS) is a process for removing sulphur and heavy metals from crude oils, so-called sour crudes. The PSD permit (attachment 5 to Mr. Kaulakis' testimony) requires that fuel oil with a sulphur content not to exceed 0.18% by weight be used in the operation of the refinery. Mr. Kaulakis testified that HDS would remove from 50% to 90% of any metals and sulphur in the oil (Testimony at 6) and it will be recalled (finding 3) that his calculations assumed a 50% HDS mercury removal. He indicated that this figure came partially out of his extensive experience in

that type of work and that he also relied on an article "HDS + HOC = high resid conversion" published in The Oil and Gas Journal on June 25, 1979 (EPA Exh. 3), which shows that as the percentage of sulphur removed from the oil rises, the percentage of metals removed also goes up (Tr. 1953-58). At 90% sulphur removal, in excess of 80% of the metals are removed (Tr. 361, 1955; Figure 4 at 136, EPA Exh. 3). Although the cited article was specifically applicable to nickel and vanadium, Mr. Kaulakis maintained that it applied to other metals as well (Tr. 1956). Regarding lead and mercury, he stated that these metals were essentially not present in crudes.

8. Although he conceded that there were no data to support a 50% mercury removal on the HDS catalyst and that mercury was more volatile than nickel and vanadium, Dr. Filby defended 50% mercury removal as a reasonable judgment based on approximately 80% removal of the cited metals (Tr. 361-62). A paper prepared by Dr. Filby entitled "Trace Element Emissions from No. 5 and No. 5 Fuel Oil Combustion" (FOE Exh. 1) was submitted to the Maine DEP in October 1979. This paper was prepared on the assumption that the refinery would process light Middle Eastern or Nigerian Crudes. Metal content of the various crudes (Light Iranian, Khafji, Murban, Oman and Nigerian Forcados) was based on the Pace Report and for Nigerian Crude on unpublished data from Washington State University generated by the Nuclear Radiation Center. Emission calculations in this paper were made based on 50% removal of mercury on the HDS catalyst (80% for all other metals) and on a "worst-case" basis, assuming no HDS removal. This showed a "worst-case" emission rate for mercury utilizing Middle Eastern crudes of less than 2.04 x 10^{-4}g/sec which equals 17.6 grams per day (Tr. 365).

9. Dr. Filby was of the opinion that the assumptions made by Mr. Kaulakis concerning the mercury content of the crude feedstock and the products derived therefrom were completely consistent with work undertaken by the Nuclear Radiation Center and acceptable literature. He testified that the 0.1 ppm mercury content figure for residual oils utilized by EPA and FWS was not supported and ignored all recent publications on the mercury content of crude oils and petroleum products (Testimony at 6-7). It is found that the 200 grams per day average mercury emission rate utilized by EPA/FWS from the combustion of fuel oil in the refinery boilers overstates actual emissions by a factor exceeding 11-fold on a worst-case basis, that is, assuming no mercury removal on the HDS catalyst. Dr. Filby cited literature (National Academy of Sciences) estimating that 30.1% of mercury emissions in Maine were man made and testified that under a "worst-case" basis and assuming that all mercury emitted by the refinery remained within the State, 0.0775% on an annual basis would be added by the refinery to mercury present in Maine (Rebuttal at 2).

10. The Pace Report shows Oman Crude having a lead content of 420 ppb ± 31. Other results were 40 ppb lead for Murban Crude, 24 ppb for Light Iranian Crude, 16 ppb for Nigerian Forcados and 15 ppb for Khafji. No analysis of lead content of Nigerian Crude was undertaken. Dr. Filby testified he would not stand by the values in the Pace Report for lead, because he had learned subsequent to the publication of that report that the samples had been contaminated by being placed in metal cans (Tr. 370). Although he was of the belief that there was essentially no lead present in crude oil (Tr. 1956-58), Mr. Kaulakis assumed a lead content of 50 ppb in his emissions calculations

(Testimony at 11, 12). Under this assumption and on the further assumption that 50% of the lead would be removed by the HDS catalyst, lead emissions from combustion of fuel oil in the refinery boilers would be 0.0969 lbs. per day or 43.95 grams per day (Tr. 1996, 4940). Assuming Middle Eastern crudes having an average lead content of less than 40 ppb and a worst-case basis (no lead removal on HDS catalyst), lead emissions per day would be .3864 lbs. or approximately 175 grams (Table 4, FOE Exh. 1).

11. Mr. Kaulakis assumed an average vanadium concentration of 12 ppm for Light Aramco Crude (Tr. 1983, 5014; Testimony at 11). Assuming 80% removal on the HDS catalyst, vanadium emissions from combustion in the refinery boilers would be 23.26 lbs. a day under Mr. Kaulakis' calculations as corrected (Tr. 1996, 4940). Vanadium content shown by the Pace Report is 9.5 ppm for Nigerian Forcados Crude, 17.2 ppm for Murban Crude, 24.9 ppm for Oman Crude, 36.1 ppm for Khafji Crude and 53.5 ppm for Light Iranian Crude. Using Dr. Filby's calculations and an assumed average vanadium content for Middle Eastern crudes of 29.2 ppm (actual average vanadium concentrations of the above crudes exclusive of Nigerian Forcados is 32.9 ppm) and assuming no removal on the HDS catalyst, vanadium emissions would be 11.8 lbs. per hour or 283.2 lbs. per day (FOE Exh. 1). Correcting for the above error as to average vanadium content, it appears that vanadium emissions would be 13.2 lbs. per hour or 316.8 lbs. per day. This, of course, is on a worst-case basis and it is simply unrealistic to expect no vanadium removal on the HDS catalyst. That the 80% removal figure is realistic is supported not only by the article (EPA Exh. 3) cited by Mr. Kaulakis (finding 7), but also by an EPA report (Scientific and Technical Assessment Report on Vanadium, EPA-600/6-77-002, October 77 (EPA Exh. 9)), which states at page 5-2 that the desulfurization process reduces

significantly the vanadium and other metallic impurities in fuel oil and that there appears to be an almost one-to-one relationship between vanadium reduction and the degree of desulfurization.

12. Dr. Filby testified that soils typically contain from 50 to 500 ppm vanadium and that if all vanadium from the refinery on a worst-case basis was deposited within a 20-mile radius, 0.00951 ppm on an annual basis would be added to the area (Testimony at 2). He pointed out that this amount was negligible in comparison to the 50 to 500 ppm vanadium occurring in natural soils. The FWS biological opinion, dated June 4, 1979, states that vanadium concentrations in petroleum may reach 500 ppm or higher. The source of this figure is apparently an article "Effects of Dietary Vanadium in Mallard Ducks" (White and Dieter, 1978 (DOI Exh. 14)), which in turn cites "Committee on Biologic Effects of Atmospheric Pollutants, 1974" for the 500 ppm figure. Dr. Filby testified that the cited article was of questionable relevance, not only because it involved specific feeding of high amounts of vanadium in a steady diet for 12 weeks, but because of the high values of vanadium in typical soils and the small amount of vanadium that would enter any streams as soluable salts. He emphasized that the article showed that birds remained healthy on a diet of 100 ppm vanadium.

13. The 500 ppm vanadium petroleum content figure cited by FWS should be compared with the vanadium fuel oil content of 0.1 to 500 ug/g or ppm cited in the EPA report (EPA Exh. 9) referred to in finding 11. The refining process tends to concentrate metals in residual oils and it does not appear

that 500 ppm figure takes into account 80% vanadium removal on the HDS catalyst. Crude oil vanadium concentrations shown by the mentioned EPA report range from 0.02 to 140 ppm with an average of 25 ppm, while vanadium concentrations in residual fuel oil shown by the report ranged from 0.38 to 230 ppm and had an average concentration of 67 ppm. These results were derived from a report "Development of Nuclear Analytical Techniques for Oil Slick Identification," Gulf General Atomic Incorporated, January 21, 1970 (EPA Exh. 10), which in Table 5 lists element concentrations of 20 samples of crude oil and shows vanadium concentration of 48 ppm for an Egyptian Crude, 60 ppm for a Saudia Arabian Crude, 29 ppm for Kuwait, .28 ppm for Libyan, 39 ppm for Iranian Crude, 26 ppm for Kuwait Export Blend and 14 ppm for Arabian Light Export Blend. These figures result in an average vanadium concentration of 30.9 ppm. Vanadium concentrations in crude oils shown by the Pace Report have been detailed above (finding 11). It is found that the 500 ppm vanadium concentration figure cited by FWS is many times greater than the vanadium content of any crude Pittston has indicated is likely to be processed in the refinery.

14. Mr. Kaulakis indicated that the refinery would be able to process a variety of crudes and that the vanadium content might be higher or lower than the figures he used (Tr. 1962-64, 5014). He further indicated that Venezuelan crudes couldn't be processed because of their high metalic content, that is they couldn't be desulfurized in the desulfurizer Pittston plans to use. It should be emphasized that vanadium emissions from power plants, etc. are controlled by particulate standards under the Clean Air Act and that the EIS finding that the refinery's primary emissions will not result in violations of ambient air standards (VI-65; Vol. II, EIS), has

not been disputed. It should also be noted that the concern expressed by the White and Dieter study cited by FWS appears to be exposure of aquatic birds through the food chain by the ingestion of invertebrates with high vanadium concentrations as a result of oil spills.

15. Although conceding that emissions from the proposed refinery, in and of themselves, were unlikely to cause sufficient acidification of lakes (even within a 25-mile radius where the impacts were expected to be greatest) to significantly reduce fish populations of value to the eagle as food, the FWS biological opinion asserted that acidification of rainfall would increase the availability of mercury and other metals in the food chain of eagles in Washington County. The opinion asserted that these impacts of the Pittston project would be cumulative with the more severe acid rain effects associated with a proposed coal-fired power plant to be constructed in Searsport, Maine and with the general trend toward increasing acidification of rainfall in the Northeastern United States. The application to construct the mentioned coal-fired power plant at Searsport has been rejected by the Maine Public Utilities Commission (Tr. 4927).

16. The contention that acidification of rainfall would increase mercury and other metals in the food chain of eagles is based upon the statement of Dr. Terry Haines (DOI Exh. 26), Leader of the FWS Field Research Station at Orono, Maine, who in turn cites a 1977 paper by Browzes, et al., Research Center at Senneville, Quebec (DOI Exh. 14) for the proposition that acidification appears to result in an increase in mercury levels in fish. While the cited paper references analyses purporting to show that mercury input to lakes, etc. could result from rain and refers to studies which

appear to show a correlation between low pH and increased mercury levels in fish and attempts to explain why this may be so, i.e., biological methylation of mercury and the nature of products formed is dependent upon pH, the authors refer to various conclusions in their paper as postulates or hypotheses requiring further study. Dr. Haines is hardly unequivocal stating "It is therefore at least possible that a source of acid and mercury, such as the proposed refinery, could result in an increase in mercury levels in freshwater fish from eastern Maine" (Statement at 5). He further states that fish from Maine, Quebec and Ontario contain high levels of mercury. This latter statement is apparently based in part on his personal work and in part on studies in connection with the EIS for the Corps of Engineers Dickey-Lincoln School Lakes Project, which shows mercury levels in lake trout (taken from lakes in extreme northern and western Maine, Aroostook and Piscatiquis Counties), as high as 2.00 ppm on a wet weight basis (Tr. 4274-78; Appendix E, Dickey-Lincoln School Lakes EIS, DOI Exh. 34).

17. There is no comparable data on mercury content of fish from lakes in eastern Maine in the record. Dr. David Page, Associate Professor of Chemistry at Bowdoin College, reported tests on pollack tissue, including liver, ranging from 0.57 ppm to 0.82 ppm (dry weight basis), the fish being described as taken from the Eastport area (Rebuttal at 21, 22, Pittston Exh. 46). Pollack is an ocean rather than a fresh-water fish. Normal accepted mercury levels for fresh-water fish is .2 ppm or lower (Tr. 4286). The action level for unavoidable mercury residues in the edible portion of fish and shellfish for human consumption has been established at 1.0 ppm by the Food and Drug Administration (44 FR No. 14,

January 19, 1979, at 3990 et seq.). Even though the biological opinion states that bald eagles prey principally on fish, FWS's own evidence indicates that as much as 81% of the diet of bald eagles in a marine area such as Cobscook Bay consists of birds (Supplement to Todd Thesis, DOI Exh. 23). In this connection, the biological opinion asserts that mercury levels in Maine eels, a major eagle food, have been found to range from 0.3 ppm to 0.5 ppm and that mercury levels in livers of mergansers are even higher, reaching a concentration of 16 ppm. While the source of the data for the eels is not stated, Mr. Gramlich testified that some of the eels sampled were taken from the Cobscook Bay area (Tr. 1556-57). A test report which apparently gives the source of the tissue sample or samples and the test results were referred to by counsel (Tr. 1558, 1565) but is not in the record. It is noted that Table 8 of the Supplement to the Todd Thesis shows mercury content of an American eel from the Penobscot River of 0.43 ppm. The duck tissues analyzed in the above test cited by FWS were taken from the Kennebec and Penobscot River areas, industrialized rivers where tissue concentrations of mercury could be expected to be higher (Tr. 1018-19, 1552). Results of tests of Black Duck liver tissue (ducks taken from the Eastport area) reported by Dr. Page (0.19 to 1.09 ppm, dry weight) are consistent with tests on Black Duck liver tissue (ducks taken from Jordan and Skillance Rivers out of the industrialized area) reported by FWS (mercury concentration from 0.31 to 1.7 ppm, wet weight basis, Tr. 1028; DOI Exh. 15). Indeed, subsequent tests reported by FWS show lower mercury concentrations in livers of mergansers and goldeneyes taken from the Cobscook Bay area, concentrations ranging from 0.86 ppm to 3.8 ppm, wet weight basis (Memorandum, dated January 9, 1980, DOI Exh. 25). Mercury residues in eagle eggs (collected during the period 1968-77) taken from Washington County range from 0.22 ppm to 0.40 ppm (Table 4, Supplement to Todd Thesis). These values are all substantially below the levels (excess of 0.50 ppm) which the FWS asserts is the level usually considered to have the potential for adversely effecting reproductive success (memo, dated March 30, 1978 from Wildlife Research Center, Eagle Biology, DOI Exh. 34). Attached to the cited memorandum is an analytical report of the results of tests on eight bald eagle eggs collected during the years 1976 and 1977 showing mercury residues ranging from 0.22 ppm to 0.90 ppm, wet weight. As might be expected, the highest residues (0.71 and 0.90 ppm) were taken from Passadumkeag (Penobscot River), although one sample taken from Passadumkeag in 1976 showed a mercury residue of only 0.26 ppm. An egg sample from Nequasset Lake shows 0.66 ppm mercury.

18. The pH of precipitation in eastern Maine is about 4.3 (Haines at 1). Normal "clean rain" in eastern North America is slightly acidic and has a pH of about 5.6 (Long-Range Transport of Air Pollutants, DOI Exh. 28). The effects of acid precipitation are dependent upon the buffering capacity of the soils and lakes upon which the precipitation falls. Buffering capacity is dependent upon bicarbonate content which acts to neutralize or reduce acidity. Because large areas of eastern Canada and northeastern U.S. are underlain by or composed of granitic and siliceous rock or soils therefrom low in calcareous content, these areas are thought to be sensitive to acidification (LRTA, supra, at 15-16). Dr. Haines cites a study to the effect that 27% of Washington County lakes are underlain by bedrock low in buffering capacity and that an additional 37% are underlain by rock with

moderately low buffering capacity (Haines at 3). From this he states that it could be inferred that 64% of Washington County lands are vulnerable to damage from acid precipitation. The decline in pH in Maine lakes is not in dispute, readings from 1368 lakes having declined from a mean of 6.81 during the period 1937-1942, to a mean of 6.09 during the period 1969-1974, or a 5.2-fold increase in acidity (Acidification of Maine (U.S.A.) lakes by acidic precipitation, Pittston Exh. 17). The cited study indicates that most of the change in pH occurred in the early 1950's (about 75% of the change occurred between 1950 and 1960) and the remainder more gradually since that time. No biological effects have yet been discerned.

19. Data in the record from the Maine DEP on the pH of Washington County lakes indicates that the majority have a pH range of 6.3 to 6.7 (Telecon Record, May 15, 1979, Acid Rain, DOI Exh. 17). Dr. Haines admits that he has no direct evidence for the belief that lakes and streams in Washington County are sensitive to acidification (Haines at 3). Because of its logarithmic nature, the same amount of acid will effect a greater change (reduction) in pH when the receiving water is near neutral (pH of 7) than it will when the pH is at a lower level. Because of this and the presence of some buffering capacity, it has been concluded that the acidification trend does not appear to be cumulative, that surface water pH values will reflect an approximate equilibrium between input of acid precipitation and rate of leaching of alkaline minerals from sediments and rocks and that pH values should not decrease further in the absence of a further increase in the rate of input of acid pollutants (Acidification and other changes in Halifax County lakes after 21 years at 116, DOI Exh. 27). Confronted with the foregoing conclusions on

cross-examination, Dr. Haines asserted that based upon projections of fossil fuel consumption, the rate of acid input would probably increase and that the buffering capacity of the watersheds was not infinite (Tr. 4257-58). He stated that sooner or later the easily leached buffering capacity would be titrated away and then lake pH would decline more rapidly until it stabilized at a lower level. Although Dr. Friend and Mr. Cohen (Pittston witnesses) appeared to support Dr. Haines in part, Dr. Friend stating that depending upon the nature of the soil, acid rain may leach out the buffer material (Tr. 443-44) and Mr. Cohen stating that acid rain can tend to reduce the buffering capacity of soil (Tr. 493), it is clear that Dr. Haines' concerns are primarily the product of speculation as to impacts of refinery emissions. See in this connection testimony of Dr. Clayton White (Pittston Exh. 2 at 7) wherein he states that the FWS opinion that emissions from the refinery will cause a decrease in productivity of eagles is based on generous speculation, citing data from Dr. Owen to the effect that none of the known causes of eagle mortality in Maine are linked with pollutants to be emitted by the refinery. Moreover, SO_2 emissions of 4860 tons per year relied upon by Dr. Haines are overstated, actual SO_2 emissions being 3705 tons per year (Tr. 412, 4268).

20. Dr. James Friend, Professor of Atmospheric Chemistry at Drexel University, mentioned in finding 19, performed calculations to ascertain the incremental additions of sulphur by emissions from the proposed refinery on lakes within a 25-mile radius of Eastport (the area of concern expressed

by FWS in the initial biological opinion of December 21, 1978) and the impact of those additions upon the acidity of such lakes (Statement of Dr. Friend, Pittston Exh. 13). Using a Climatological Dispersion Model (CDM) obtained from Francis Davis, Dean of Science, Drexel University, and a nationally recognized expert in meteorology, and certain dispersion calculations for sulphur dioxide (SO_2) based on expected SO_2 emissions from the proposed refinery and meteorological data from Portland, Maine, also obtained from Dean Davis, Dr. Friend calculated pH changes resulting from a single year of stack emissions of SO_2. He did this by calculating average annual SO_2 depositions on a grid extending 100 km west of Eastport, 50 km south and 50 km north. Lacking data on lakes within a 25-mile radius of Eastport, and using the results of research on Maine lakes generally, he assumed the existence of an acidic lake having a pH of 5.5, a nearly neutral lake having a pH of 6.5 and an average lake with a pH of 6. He also assumed that each of the three lakes was located in three different grid areas: that which contains the closest lake (closest to the emission source), that with the average deposition rate and that with the lowest deposition rate. No lakes were located in a grid with the highest deposition rate. His calculations showed pH changes of 0.01 for all three assumed locations of the acidic lake, pH changes of less than 0.03 for the average lake closest to the emission source, less than 0.04 for the average lake having an average deposition rate, less than 0.02 for the average lake having the lowest deposition rate, less than 0.10 for the nearly neutral lake closests to the source, less than 0.14 for the nearly neutral lake having an average deposition rate and less than 0.06 for the nearly neutral lake having the lowest deposition rate. Dr. Friend was of the opinion that emissions from the refinery would have no important impact on the acidity of lake water (Statement at 8). He explained that the calculated changes were generally less than a tenth of a pH unit and that he considered those to be not important impacts (Tr. 454-55).

21. Dr. Friend's analysis of SO_2 depositions was conservative in that he assumed a dry deposition rate of 1.5 cm/sec when the average dry rate is less than one cm/sec, he assumed no conversion of SO_2 into SO_4 (sulphate) in calculating the dry deposition rate (for calculating wet deposition as a result of "rainfall" which includes snow and rain, he assumed a constant conversion rate of 10% per hour whereas the actual conversion rate of SO_2 into SO_4 is from 1/4 to 1/7 of that and dependent upon atmospheric conditions such as sunlight and temperature) when the SO_2 deposition rate is 7.5 times the rate for SO_4, he assumed that SO_2 concentrations over a given point were only negligibly affected by upwind removal thereby maximizing estimates of available sulphur to be deposited on any given point of the grid, he assumed a mixing layer of constant thickness of one km or 3000 ft. whereby SO_2 concentrations were uniform within that height and lastly, the impact of sulphur deposition on the lakes was calculated as representing the sum of the wet and dry deposition which would not actually be the case (Tr. 420-26, 432, 439-40, 459-60; Statement at 3-4). Dr. Friend's calculations described above assumed no flushing or turnover of the water volume of the lakes. He subsequently assumed a turnover time of four years, multiplying the deposition rates and calculated pH changes by four (Tr. 441; Friend letter of April 10, 1979, Pittston Exh. 14). He reiterated the conservative nature of his assumptions, that is, that his estimated SO_2 depositions would be higher than actual for

the reasons previously stated and for the additional reason that the yearly duration of rainfall used (approximately 1252 hours) was over twice the actual duration (624 hours) of rainfall (Tr. 431-32, 467). He assumed no buffering capacity in Maine lakes and testified that he had seen data estimating actual turnover of the lakes as less than a year (Tr. 443, 471, 473-74). While he agreed that nitrogen oxide (NO_x) emissions are generally considered to be about 30% of SO_2 emissions, Or. Friend asserted that the conservative nature of his assumptions concerning SO_2 deposition more than made up for the NO_x contribution to acidification (Tr. 447-48, 471; Pittston Exh. 14 at 3). He considered that his assumptions were conservative by a factor of at least two (Tr. 468). He maintained this position even though NO_x emissions in hourly terms, 1727 lbs., are over twice the SO_2 emissions of 846 lbs. per hour (Tr. 412, 452, 464). Placing the refinery's emissions in prospective, he testified that one year's exposure to the average deposition from the refinery over his grid would be equivalent to the acidity that is attained by six hours of precipitation at present (Tr. 469).

22. Mr. Irving Cohen, a chemical engineer and President of Enviro-Sciences, Inc. (ESI), Pittston's primary environmental consultants on the project, submitted evidence as to the result of his firm's study of the potential impacts of SO_2 emissions from the refinery. ESI concluded that biological and chemical impacts on lakes having a pH of 6.0 to 6.5 would not be of significance (the overall pH change being less than 0.14 pH unit) and as to the more acidic lakes, no discernable pH changes could be attributed to the refinery emissions and biological impacts attributable to low pH would

already have occurred (Statement at 6, Pittston Exh. 15). He stressed the conservative nature of Dr. Friend's calculations, asserting that actual pH changes would be less because projected changes did not include atmospheric losses of SO_2 and SO_4, lake turnover rate and buffering capacity or neutralization reaction [atmospheric]. In a supplement to his statement (letter dated April 12, 1979, Pittston Exh. 16), ESI calculated flushing or turnover time for a so-called representative lake having ten square miles of surface area and an average depth of four meters (specific flushing rates on lakes within a 25 mile radius of Eastport not being available) and came up with a figure of 191 days, stating that this figure would be even smaller if the lake was fed by underground springs. This emphasizes the conservative nature of Dr. Friend's original assumption of a one year accumulation of acidic precipitation and the ultra conservative, even unrealistic, nature of his subsequent four year accumulation assumption. While Dr. Haines testified that he regarded the pH changes calculated by Dr. Friend as significant (Tr. 4282, 4303-04) the limited data available indicates that despite the concern over acid rain, lakes in Maine are not now highly acidic (indicating the presence of buffering even though the buffering capacity of Maine lakes is regarded as low) and he declined to answer as beyond his expertise a question as to whether in view of the prevailing (southwesterly) winds, emissions from the proposed refinery would in fact effect lakes to the west, north and south of the refinery (Tr. 4302-03). It is found that the actual pH changes attributable to refinery emissions will be substantially less than calculated by Dr. Friend on a one year accumulation basis and that there is no reasonable likelihood that these changes will be sufficient to have any adverse effect on the bald eagle.

23. The biological opinion asserted that crude oil and refined product spills would impact eagles through three mechanisms: (1) mortality of embryos and nestlings resulting from oil brought back to the nest by contaminated adult eagles; (2) reduction of food fish populations both in Cobscook Bay and in estuarine areas to the south of Eastport; and (3) localized reduction in numbers of waterfowl and other marine-associated birds preyed upon by eagles. Of particular concern was stated to be the potential for mortality of eagle embryos during incubation. It was indicated that as little as five microliters of No. 2 fuel oil, South Louisiana Crude or Kuwait Crude had been shown to result in mortality of 70 to 98% in mallard eggs and that similar results were expected with eagle eggs. It was stated that such small amounts of oil could easily be transported to the nest by an adult eagle which had been in contact with oil.

24. If contact with oil by adult eagles during the nesting season be assumed, adverse effects on embryos and nestlings could occur. The probability of a major spill is covered in findings below. Evidence as to the effects of oil on eggs in the record indicates that embryos that are in earlier stages of development are more sensitive to oiling and that the hatchability of mallard eggs treated with oil increased as the age of the embryo at treatment increased (Acute and Chronic Studies With Waterfowl Exposed to Petroleum Hydrocarbons; Effects of Petroleum on Birds, DOI Exh 35. While the

first of the cited studies states that mortality of the embryos is a result of toxicity and not oxygen deprivation and the second states that it was evident embryonic mortality was caused by the toxic nature of the oil rather than blockage of normal gas exchange, Mr. Frank Gramlich, a biologist and State Supervisor of Wildlife Services for the FWS, attributed the mortality to blockage of gas exchange (Tr. 1548-49). He asserted that oil which would block gas exchange in mallard eggs would do the same in eagle eggs. He was unaware of any instances of eagle eggs being oiled.

25. Eagle eggs require a 35-day incubation period (Todd Thesis, Ecology of the Bald Eagle in Maine, DOI Exh. 22). Egg laying dates for eagles in Coastal Maine are approximately March 10 through April 14 and hatching dates are approximately April 14 through May 19 (Id. at 17). Fledging (young in nest) requires a period of 10 to 13 weeks and occurs during the approximate period June 23 through August 19. This indicates that the period during which an oil spill would have any affect on eagle embryos does not exceed 35 days and is probably much less because of reduced sensitivity to oil as the age of the embryo increases. Concern was also expressed as to the effects of oil brought to the nest on nestlings. No instances of oiled eagles or eaglets appear to have been reported. However, there have been reports of dead osprey in the Chesapeake Bay area thought to have been caused by an oil spill in early 1978 (Tr. 50, 51, 129; Telecon Record December 6, 1978 included in Eagle Biology, DOI Exh. 34). Heavily oiled osprey young were also observed in a nest near an oil spill in the Lower York River, Virginia which occurred in June 1977. They were

thought to have become oiled by adult osprey bringing oiled windrow material to the nest for use as a lining. Although the osprey were thought to have died as a result of oiling, the fate of these young is unknown.

26. Dr. Clayton White, an expert witness on eagles for Pittston, testified that because of the feeding behavior of eagles (walking along beaches and grabbing objects off of the surface of the water) they were likely to get oil on their legs and feathers if it was in the immediate area (Item VIII-94). He also testified that because of their scavenging behavior, eagles were likely to select birds and marine animals killed or incapacitated by oil as prey. Whether eagles would ingest sufficient oil in this fashion to be harmful or reject such contaminated items as food is unknown. In any event, concern for the eagles ingesting oiled food was not listed as a reason for the FWS jeopardy determination. Of course, the eagles could become sufficiently coated with oil as to cause direct mortality (oil causes mortality in birds through matting of plumage and loss of insulation) and the possibility of contaminating eggs and nestlings remains.

27. Dr. Edward Gilfillan, a marine zoologist, who has worked on a number of major oil spills and has studied extensively the effects of oil pollution on marine animals, and an expert witness for Pittston, testified that a catastrophic oil spill could result in extensive mortality and that the population of seabirds could be significantly reduced on a temporary basis (Item VIII-94). He stated that the severity of the impact would depend upon the amount and extent of the spill and the presence or absence of the prey species in the area at the time. He indicated that the effects of a catastrophic spill on fish that comprise the eagle's food supply, i.e.,

alewives and eels, should be less extensive than on birds and would to a large extent depend on the timing of the spill. Spills during the migration period (six-to-seven week period in the spring) of adult alewives could result in a significant reduction of food supply because during such periods they concentrate in creek mouths. Eagles in turn concentrate near these areas to feed upon the alewives. An oil spill in Cobscook Bay during the migration of adult eels would have a negligible effect on recruitment because eels spawn in the Sargasso Sea.

28. Based on his experience with oil spill sites and his study and familiarity with Cobscook Bay, Dr. Gilfillan testified that he would not expect there would be significant amounts of floating oil in that area for more than a month following a "worst-case" catastrophic oil spill (VIII-94 at 7). He stated that immediately after the spill one would expect to find large patches of floating oil on the surface of the water, but that during the four-week period following the spill, the size and number of floating oil patches would be progressively reduced due to weathering, evaporation and stranding. During this period the consistency of floating oil would change and it would appear in the form of tar balls. Dr. Gilfillan indicated that eagles could come in contact with oil in the intertidal zone where they wade and fish. This could occur while the oil was fluid and sticky, which could be for a period of three to four months if not cleaned up beforehand (Id. at 8). He stated that the primary aim of cleanup efforts should be to remove floating oil from the surface of the water and that this could be done in three ways: (1) through the use of low toxicity dispersants prior to the oil slick entering the western portion of Cobscook Bay; (2) should the oil reach the shoreline an agressive program

of removing oil soaked debris and carcasses of oiled seabirds could be undertaken and (3) the oil could be removed by means of absorbents or in favorable locations, such as coves, the oil could be held in place and removed by skimming.

29. The third reason advanced by FWS for the jeopardy to the bald eagle determination was the stimulation of economic development and human activity which would be caused directly and indirectly by the construction and operation of the refinery. Citing statements of Mr. Kaulakis, the opinion pointed out that construction of the refinery would create 1,000 jobs during the first year, 2,500 jobs during the second year and 1,000 jobs during the third year. It was also pointed out that there would be 1,200 new permanent jobs in the area due to the refinery. A significant amount of secondary development, including housing and commerce, would be stimulated by the influx of money and workers to Washington County. Adverse impacts of such development on eagles were asserted to be: nest desertion caused by human disturbance during early breeding season and permanent nest abandonment caused by human encroachment within nesting territories. The biological opinion stated that direct disturbance or noise and visual impacts occurring during and following construction of such developments could result in nest desertions and decreased reproductive success. It was also stated that increased recreational use of the Cobscook Bay area may be as significant [for impacts on the eagle] as other effects of development. The opinion characterized the growth in population of Washington County over the past ten years as sudden and as a short term phenomena and went so far as to speculate that such growth would level off in the near future. However, it is just as reasonable, if not more so, to regard such growth

as caused by people from other places moving into the area for retirement or escapism and to continue irrespective of whether the refinery is built (EPA memorandum, dated December 23, 1978, Attachment 4 to Pittston Exh. 57).

30. It is clear that eagles are more tolerant of human presence and resulting disturbance at some times of the year, such as the winter months than at other times (Tr. 126; Testimony of Dr. Thomas Dunstan, an Associate Professor of Biology, Pittston Exh. 5 at 2; Todd Thesis at 57-58). He testified that human disturbances that force wintering eagles to move from an area may not have any effect on their breeding success the following spring and summer. It is also clear that eagles are more tolerant of human presence and activity at favorite feeding, perching and roosting grounds than at other area (Behavioral Responses of Wintering Bald Eagles to Human Activity, DOI Exh. 5; BLM Technical Note, Report No. 5, Southern Bald Eagle and Northern Bald Eagle at 29, DOI Exh. 34). Eagles also can be accustomed to routine human activities (DOI Exh. 5 at 512). Dr. Dunstan testified that the crucial distrubance to eagles from humans was not automobiles or boats, but approaches on foot within line-of-sight of the eagles (Dunstan at 3).

31. Eagles are most sensitive to human disturbance and encroachment during nest building, egg laying and incubation periods (White VIII-94 at 11; Dunstan at 2 and Todd Thesis at 41). While the Todd Thesis at 41 states that the early nestling period is also sensitive, Dr. White testified that there were no data to show nest abandonment once fledglings have hatched (Tr. 44). The extensive eaglet banding program undertaken by the FWS is based on the belief that nest abandonment of fledglings four weeks or so of age does not occur (Tr. 1634-37). Dr. White disputed the

implication of the biological opinion that the mere presence of humans within the vicinity of nesting eagles is detrimental (Pittston Exh. 2 at 4). He pointed out that the incubation period in Maine is March through early to mid-May, when the weather is normally inclement and not conducive to outdoor recreation, which is a cause of concern. Accord, Dunstan at 2-3. Dr. White cited experience on Amchitka Island, Alaska, where a workforce of 600 to 700 men were situated within two-miles of bald eagle nests over a six-year period without any evidence of a negative impact on bald eagle production being observed. A busy harbor and docking facility within 3/4 of a mile of the closest eagle nest did not alter productivity at that nest over a six-year period. There is evidence that if a pair of bald eagles returned to a nest site, human activity near the nest site did not effect production of young (Bald Eagle Nesting in Florida, McEvan and Hirth (1979), NELF Exh. 2). Frequent successful nesting at a site in Maine within 50 meters of an occupied year-around home has been reported (Todd Thesis at 41). There is general agreement that the response of individual eagles or pairs to human activity is variable (Tr. 1637; White, VIII-94 at 11; Dunstan at 3; Todd Thesis at 41).

32. The closest eagle nests are within three to six miles of the refinery site (White, VIII-94 at 12). Human activity near these sites (as close as one mile) includes roads, farmhouses, homes and at least six oil storage tanks. These activities have apparently had no effect on productivity of the nests (Id. at 13). This serves to confirm Dr. Dunstan's point that eagles in Cobscook Bay are living in an area which cannot be regarded as wilderness (Dunstan at 3). Because of the distances involved (approximately 25 miles

by road), Dr. White was of the opinion that construction and operation of the refinery would probably have no effect on the eagles' nesting success (VIII at 12). He asserted that the refinery would likewise probably have no measurable effect on wintering eagles so long as perching stations are not disturbed or destroyed. Informed that there was a wintering perching station on the refinery site which would be removed by construction of the refinery, he asserted that an artificial perching station with similar characteristics could be constructed nearby and that eagles had been known to use items such as telephone poles as perches (Tr. 32, 87-88).

33. Dr. White stated that the presence of an additional 150 to 350 people in leisure activities (boating, beachcombing, hiking) near eagle nests was likely to have an adverse effect (VIII-94 at 12). He also stated that the cumulative effects of further development over the long-term and the slowly increasing number of people with leisure time, if such time was spent near eagle nesting areas, was likely to have an adverse effect. However, he pointed out that the distances by road were considerable (approximately 25 miles to the closest nest) and that most of the nests near water and accessible by water were in relatively inaccessible areas of Dennys and Whiting Bay. His overall conclusion was that, considering the location of existing nests with respect to human activity and the probability of people being near the nests during the incubation period when weather was still inclement, the risks [to the eagle] seemed small (Pittston Exh. 2 at 4-5).

Mitigation Measures

34. As mitigation of risks to the eagle, Pittston has proposed disposal of sludge in a landfill rather than incineration to reduce or eliminate mercury emissions; undertaking an aggressive educational program with its employees and residents

of the area as to the importance of the eagles and the consequences of improper human actions and encroachments, including making proper activity with respect to eagles a condition of employment; modifying its oil contingency plan to include explicit protection against accidental spills being carried into specific activity and feeding areas of the eagle in Cobscook Bay, which modifications would include measures such as use of oil dispersants, booming off of important eagle feeding areas and providing food; cooperation and participation in the acquisition of prime nesting areas to prevent possible development; and finally, participation with State and Federal agencies in repopulation programs such as the importation of eagle eggs or eaglets to nests in the refinery site and in adjacent areas, such as the Penobscot. Respecting mercury emissions, the FWS biological opinion stated that landfilling sludge would not eliminate mercury emissions because boiler emissions would still be some six times greater than the level (35 grams a day) FWS was concerned about in its December 21 opinion. Mercury emissions from the proposed refinery and effects thereof have been discussed above (findings 3-9).

35. Respecting educational programs, the biological opinion stated that it appeared unlikely that such programs would have much effect inasmuch as similar programs had already been instituted in Maine by the FWS, the Maine Department of Inland Fisheries and Wildlife and the Audubon Society but have been relatively ineffective in reducing human disturbance to eagles. It was stated that there was little Pittston could do that was not already being done. Owen and Gramlich were of the belief that an aggressive educational program aimed at area residents and Pittston employees could

have some impact, but that it would be outweighed by the increase in population in the Cobscook Bay area (DOI Exh. 21 at 10). Dr. White was of the opinion that there had been a good response to educational programs in reducing eagle mortality (Tr. 89, 90) and the Todd Thesis at 79 recommends the continuation of such programs by State and University Wildlife departments. The FWS opinion appears to overlook the control Pittston would have over its employees and at least indirectly over employees of subcontractors. Although shooting bald eagles is a violation of Federal law, shooting appears to be the predominant cause of known direct human related mortality in eagles (Report No. 5, DOI Exh. 34 at 18; Todd Thesis at 32, 74).

36. Regarding control of oil spills, the biological opinion stated that dispersants were unlikely to be approved in an enclosed area such as Cobscook Bay where their use could result in widespread mortality to benthic organisms and that extreme difficulties were expected in attempting to control oil spills in Cobscook Bay by booming. The provision for alternate food sources in the event of an oil spill was characterized as problematic, the opinion stating that Region 5 of FWS has had little success in attracting eagles by this method. Dr. White had suggested artifical feeding areas as a mitigating measure in the event of an oil spill in his testimony before the FWS during the consultation process (VIII-94 at 14). In his testimony in this proceeding, he disputed the FWS position, asserting that it totally ignored a successful program in Sweden where the closely related Sea Eagle was kept from contaminated areas by artificial feeding (Pittston Exh. 2 at 5). An artical describing the Swedish

experience indicates that while artificial feeding during the fall and winter (October through March) has been successful, the eagles seemed to prefer live prey to carrion once ice on the lakes breaks up in the spring and that artificial feeding during such period has been unsuccessful (Feeding White Tailed Sea Eagles in Sweden, DOI Exh. 1 at 51).

37. Dr. White referred to his observations of eagles feeding at refuse dumps on Amchitka Island and stated that the nesting population increased through time as a function of more food being available (VIII-94 at 11). Dr. Dunstan testified that from personal experience, he could say without reservation that eagles can be drawn to feeding sites established by man and can be returned to the wild for their own sources of food (Pittston Exh. 5 at 4). He referred to breeding bald eagles being lured to floating fish in Minnesota lakes and wintering bald eagles along the Missouri River in South Dakota having picked up and eaten floating fish. He stated that wintering eagles along the Mississippi River in Illinois had been lured to floating fish and that adult and immature eagles in Oregon and Idaho had been lured to deer and cattle carcasses. Owen and Gramlich testified that the success of artificial feeding was marginal (DOI Exh. 21 at 12). While not disagreeing that eagles would feed at garbage dumps and artificial feeding stations, they pointed out that in order to be effective, the eagles must be lured away from normal feeding areas immediately and for potentially long periods of time. They cited other eagle researchers as doubting that large continually operated feeding sites would prevent eagles from frequenting traditional feeding areas and eating traditional foods and asserted that concentrations of eagles at such

points would increase their vulnerability to harassment and shooting.

38. Mr. Gramlich described FWS success in feeding wintering eagles mixed (Tr. 576-77). He asserted that it took a great deal of time and that the amount of food consumed by eagles wasn't sufficient for the attempts to be continued. He did say that they had limited success in getting eagles to feed on beaver carcasses and on alewives over two breeding seasons (Tr. 1577, 1595). He alluded to attempts by Dr. Owen to artificially feed eagles on the Penobscot and stated that most of the food was consumed by foxes or gulls and ravens. He readily conceded that in the event of an oil spill artificial feeding would be one of the methods tried to mitigate the affects of the spill (Tr. 1594-95). In rebuttal testimony, Dr. White pointed out the FWS Draft Contingency Plan For the Protection of Whooping Cranes During a Major Oil Spill in the Gulf of Mexico (Attachment/to Pittston Exh. 3) called for the establishment of artificial feeding sites to attract cranes away from normal feeding areas.

39. While characterizing Pittston's proposal to cooperate and participate in the acquisition of prime eagle nesting areas in order to prevent their development as a positive proposal, the biological opinion stated that the extent of Pittston's cooperation was unclear and that it was also unclear whether Pittston would enter into legally identified areas prior to refinery operation. Difficulties in acquiring necessary land were pointed out and it was asserted that acquisition of relatively small parcels around individual nests and feeding areas would be of

limited value because there would be no way to protect such parcels from disturbance following acquisition. The opinion stated that Pittston's mitigation proposals should have included a commitment to carry out acquisition of a minimum of one square mile of land around each active eagle nest in Cobscook Bay, principal eagle feeding sites identified after a study and additional lands needed to provide buffers or viable management units.

40. Dr. Dunstan described the FWS position that one square mile around each eagle nest be purchased as without scientific reason and inappropriate (Pittston Exh. 5 at 6). He testified that protection of eagle nests by purchase of surrounding lands must be undertaken on a site-by-site basis after analysis of use made of specific areas by the eagles. Mr. Gramlich characterized a square mile as a "rule of thumb" and a good average figure, conceding that some eagle nests might be adequately protected by considerably less than one square mile, but stating that others might require more (Tr. 1583). Nesting territories around Karluk Lake, Kodiak National Wildlife Refuge ranged from 28 to 112 acres with the average being 57 acres (BLM Technical Note, Report No. 5, DOI Exhibit 34 at 27).

41. The final mitigation action proposed by Pittston was participation with appropriate State or Federal agencies in repopulation programs such as the importation of eagle eggs and/or eaglets to nests in the area of the refinery site or adjacent areas such as the Penobscot. Dr. White suggested transplanting eaglets from appropriate areas to Washington County, at the FWS consultation hearing, stating that the

placing of additional young in nests is a viable action in that at least two nests in Washington County in 1978 contained only one young (VIII-94 at 14). The FWS response to this proposal is quoted in full:

> "We expect proposal (e) to result in few benefits to the Maine eagle population. The Fish and Wildlife Service has no plans at this time for an eagle restoration program in Maine involving the importation of eagle eggs of young. Our goal is to restore natural reproduction in the United States eagle population, rather than to artificially supplement it. The Fish and Wildlife Service and various State fish and game agencies have experimented with egg and fledging transfers. Egg transfers have proved ineffective and even harmful because of the disturbance caused to incubating eagles both at the donor and recipient nests. The transfer of fledglings remains an experimental technique. There are no data yet to show that any manipulated eagle will become a normal, reproductive adult. At best, fledgling--transfer is a method of last resort which can never completely substitute for a healthy, naturally reproducing adult population."

42. Dr. White testified that the question was not whether transplanting eagles would produce a healthy normal population, but whether transplanting was a viable mitigation measure (Pittston Exh. 2 at 6). He pointed out that FWS was involved in the transfer of eagles into nests in Maine. He asserted that there was data to indicate that such transfers can be successful, referring to young eagles being raised in an artificial nest in Montezuma Refuge, New York, in 1976 and being seen in 1979 at a nest site north of Watertown, New York, about 100 miles from where they were successfully fledged. Dr. White pointed out that the entire FWS recovery effort for the California Condor was based on techniques similar to those proposed by Pittston and that simply because FWS had no plans to artificially enhance eagle population did not preclude its usefulness.

43. Mr. Gramlich's Monthly Activity Report for May 1979 (NELF Exh. 2) reports that three young captive-reared eagles were placed in Maine nests with histories of long-time non-productivity. The report indicates that two were successfully adopted by foster eagles but that one was killed by adults within minutes after being placed in the nest. Eagle eggs removed from nests (number not stated) were placed in incubators and two viable embryos successfully hatched. The report indicated that these young would be placed in unsuccessful nests. Mr. Gramlich testified that a program of introducing eagle eggs and eaglets into Maine from other areas, chiefly Minnesota and Wisconsin, had begun in 1974 or 1975 (Tr. 1632). He asserted that no eggs had been moved since the bald eagle was placed on the Endangered Species List and explained the transplants referred to in his monthly activity report by the fact that they were leftovers from introduction into other states (Tr. 1642). While the biological opinion states that FWS has no plans at this time for an eagle restoration program in Maine involving the importation of eagle eggs or young, Mr. Gramlich added an important qualifier stating FWS had no plans for such a program "as long as natural reproduction is occurring at its present rate" (Tr. 1633).

44. The 66 percent rate acceptance by adult eagles of fledglings indicated in Mr. Gramlich's monthly activity report supports Dr. White's opinion that such programs are feasible. See also "The Bald Eagle: 1776-1976" which describes experiments in Michigan and Maine as demonstrating that bald eagles would adopt and raise nestlings given to them (Pittston Exh. 54 at 18). Owen and Gramlich do not dispute Dr. White's opinion, but asserted

that transplants of eagle eggs or nestlings are most suitable as a last resort method of maintaining breeding pairs at traditionally unsuccessful nest sites (DOI Exh. 21 at 12). They emphasized the limited availability of eggs or nestlings, the risk of nest abandonment from the transplant and the time and expense involved. Dr. White noted that the FWS had been successful in treating foster parents for whooping cranes by moving eggs from one nesting area to another and stated that there were good sources for eagle eggs and chicks if the effort was made to obtain them (Further comments by Dr. White at 6-7). There is evidence that eagle eggs have been successfully transplanted (Todd, Summary of Field Work on the Bald Eagle in Maine, Eagle Biology, DOI Exh. 34). However, if transplants of eagle eggs be regarded as too risky or unfeasible, artificial incubation as detailed in Gramlich's monthly activity report appears to be a viable alternative (Id. at 2).

45. Dr. Dunstan testified that in his opinion an essential part of any program that would enable the proposed refinery and the bald eagle to co-exist was not only a commitment by Pittston to its responsibilities toward the bald eagle, but that State and Federal wildlife agencies must cooperate in any such program (Testimony at 1). Based upon his review of the biological opinion, he asserted that he could see little indication of any effort by FWS or the State Wildlife Service to assist in developing or implementing methods whereby the project and eagles could co-exist. He stated that such cooperation was essential in order for mitigation measures to be meaningful and successful and that a blanket negative attitude did not foster a cooperative effort and did not represent a professional approach to the

problem. Dr. White was even more forceful characterizing the biological opinion as a casual and even flippant dismissal of the value of mitigation measures (DOI Exh. 2 at 7). He characterized the FWS response to certain proposed mitigation measures, e.g., the suggestion that large tracts of land were necessary and the rejection of the Pittston proposal to augment the eagle population in Maine, as inaccurate, misleading and not totally honest (Testimony at 6; Further comments at 7).

Status of the Eagle

46. It has been estimated that there are approximately 100,000 bald eagles on the North American continent, the summertime population of Alaska being about 50,000, the Canadian population being 40,000 to 45,000 and the year-around population of the lower 48 states being placed at about 5,000 (National Wildlife Federation News Release, dated May 21, 1979, Pittston Exh. 53). The cited News Release states that a census during the first two weeks of January 1979 revealed nearly 10,000 bald eagles in the lower 48 states, consisting of 6,196 adults, 3,413 immatures and 227 of indeterminate age. There is data suggesting that the Maine population of bald eagles was 100 breeding pair in 1900 and that a liberal estimate in the late 1940's would be 60 pairs (The Endangered Bald Eagle, Eagle Biology, DOI Exh. 34). The Maine winter population of 109 (93 adults, 16 immatures) stated in the News Release agrees with FWS figures for 1979 (Table 5, Owen & Gramlich, DOI Exh. 21).

47. Available data indicates that in 1962 there were 27 active eagle sites or nests in Maine, of which eight were successful (eight fledglings produced), equaling a success rate of approximately 30 percent (Table 2, Owen & Gramlich).

A nest is considered active if an adult eagle is seen on the nest in an incubating position or if eggs or young are observed. Productivity data for the period 1972-79 as compiled by Owen & Gramlich (Table 3) is in pertinent part as follows:

Statistics	1972	1973	1974	1975	1976	1977	1978	1979
* * *								
Active Sites	28	31	34	31	39	45	54	46
Successful Sites	8	6	12	9	12	24	20	29
* * *								
Fledglings	8	6	12	11	19	35	32	38
* * *								
Successes Active Sites	0.29	0.19	0.35	0.29	0.31	0.53	0.37	0.63
* * *								
Fledglings Active Sites	0.29	0.19	0.35	0.35	0.49	0.78	0.59	0.83

Productivity has clearly substantially increased both in terms of numbers and in terms of the ratio of successful nests or sites to active nests. However, the number of active nests declined in 1979 from 54 to 46, and total productivity of 38 is attributable to the fact that 20 nests had one young and nine nests had two young (Table 2). Owen & Gramlich (Id. at 2) state that the reduction in 1979 may have resulted from a ten-day delay in the April breeding survey as some adults may have already deserted their nesting territories, or there could have been an actual loss of breeding pairs. They state, however, that five pairs of adults, unproductive since the early 1970's produced young for the first time in 1979. In 1977, 16 nests produced one young, five nests produced two young and three nests produced three young. In 1978, nine nests produced one young, ten nests produced two young and one nest produced three young (Table 2).

48. Supporting the FWS biological opinion, Owen & Gramlich state that Cobscook Bay continues to be a focal point for the Maine eagle population, that the Bay contains the highest density of breeding eagles in the northeastern United States and that nesting success (young fledged per active site) is higher in Cobscook Bay than elsewhere in the northeastern U. S. and Maritime Provinces other than Nova Scotia (DOI Exh. 21 at 1). Data cited to support these assertions (Tables 1 and 4) are given in terms of occupied sites as distinguished from active nests. Nest occupancy is considered a superior measure to nest activity because the former takes into account adult pairs, which apparently do not breed (Todd Thesis at 22). In their comments on the testimony of Dr. White, Owen & Gramlich state that basing productivity calculations on an occupied site basis as distinguished from active nests, lowers the figures about ten percent (DOI Exh. 24 at 4, footnote 1). Table 1 mentioned above shows that occupied sites in the Cobscook Bay Region for the years 1977, 1978 and 1979 were eight, eight, and six respectively, that production of young was seven, six and eight respectively, amounting to 20%, 19% and 21% respectively, of Maine eagle production. This is to be compared with Table 4, which for 1979 shows that five sites in Cobscook Bay were occupied, that three or 60% were successful and that six young were produced. The difference is apparently attributable to the addition in Table 1 of a nest in the Cobscook Bay Region which allegedly would be impacted by the refinery. The location of this nest is not stated. Using figures in Cobscook Bay shown in Table 4 results in Bay production being approximately 17% of the total State production in 1977, approximately 18% in 1978 and approximately 16% of total State production in 1979.

49. Commenting on the original FWS biological opinion, Dr. White noted the absence of any mention of the eagle population in the Canadian Maritime Provinces (VIII-94 at 4-5). While conceding that this omission may be a function of political boundaries, he pointed out that it seemed biologically correct to consider the Maine population along with those in the Maritime Provinces, citing information to the effect that about 15 pairs were known to nest in New Brunswick (mostly between the Maine boundary and the St. John River) and that about 65 pairs nested in Nova Scotia, approximately one-third of which were on Cape Breton Island. He quoted a personal communication from Mr. R. Stocek of the Fisheries and Wildlife Service, New Brunswick, to the effect that there may be as many as 100 pairs of eagles in Nova Scotia, noted that these areas are within 200 to 300 statute miles from the principal coastal population of Maine and stated that there may be dispersion of young eagles from that population into Maine. Mr. Gramlich agreed with the estimate of the eagle population of Nova Scotia, including Cape Breton Island, as being 100 pair (Tr. 1649). In the biological opinion of June 4, 1979, FWS conceded that there was some justification for considering the New Brunswick/Nova Scotia eagle population along with that of the northeastern United States. Eagles banded in Maine have been observed in New Brunswick (Tr. 1605; Supplement to Todd Thesis at 17). However, the opinion stated that the eagle population of New Brunswick was considered endangered by that Province. Limited data in the record indicates that New Brunswick averaged 0.7 young per active site during the period 1974-77, 1.0 per active site in 1977 (7 nests), 0.6 per active site in 1979 (11 nests), having conducted no survey in 1978; that based on partial surveys Maine and Nova Scotia averaged 0.6

young per active site in 1978 (8 nests), 0.9 young per active site in 1979 (10 nests), and that Cape Breton averaged 1.3 young per active site in 1978 (45 nests) and 1.4 young per active site in 1979 (60 nests) (Table 6, DOI Exh. 21 at 14).

50. The so-called southern bald eagle was placed on the endangered species list in 1967. By a notice published in the Federal Register on July 12, 1976 (41 FR 28525 et seq.), FWS proposed to delete the southern bald eagle from the list and designate the bald eagle as endangered in the 48 coterminous States, except Washington, Oregon, Minnesota, Wisconsin and Michigan where it would be listed as threatened. This proposal cited data based on 1974 surveys, and was finalized and made effective as of March 16, 1978 (43 FR No. 31, February 14, 1978 at 6230 et seq.). Although data from surveys subsequent to 1974 were available, the final rulemaking continued to rely on 1974 data.

51. It is generally accepted that the decline in the bald eagle population is attributable to reproductive failures caused by organochlorine pesticide residues (DDT and its metabolites; dieldrin, chlordane, heptachlor epoxide, etc.), other contaminants such as PCBs, habitat destruction caused by man and nature, and human-related direct causes of mortality such as shooting, electrocution and poisoning (National Bald Eagle Nesting Surveys-1973 and 1974 and BLM Technical Note, Report No. 5, Eagle Biology, DOI Exh. 34). These contaminants and mercury have been detected in unhatched eagle eggs from Maine and are thought to explain the lower productivity of Maine eagles in comparison to those from other states such as Florida and Wisconsin (Todd Thesis at 34-41). Residues in eggs

taken from western Maine were higher than contaminant residues in eggs taken from eastern Maine and are considered to explain the lower productivity in Western Maine. Prohibition of the use of DDT and dieldrin is also considered by FWS to explain the increased productivity of eagles in Maine in recent years (Bald Eagles in Maine, NELF Exh. 1).

52. An accepted criteria for eagle population stability is that at least 50 percent of the breeding pairs of bald eagles must be productive and the population as a whole must produce at least 0.7 young per active nest (Sprunt, et al., Comparative Productivity of Six Bald Eagle Populations, DOI Exh. 3 at 104). Dr. White endorsed this standard as did Dr. Dunstan (Tr. 65, 78, 93, 106-08). Dr. White pointed out that the Maine population approximates these values based on Owen & Todd Reports (Tr. 65, Testimony at 3). Although the cited Owen & Todd Reports are not in the record, their substance is in the Todd Thesis or its Supplement (Tr. 42). There is evidence in the record that the Maine winter eagle population has achieved stability at relatively low levels during the period 1965 through 1974 (Bald Eagle Management Plan, DOI Exh. 34, at B.1.-3). That eagle population stability has been achieved is suggested by Drs. White and Dunstan (Tr. 64, 144) and is supported by the figures cited below (finding 54). The stated criteria for eagle population stability are also approved in the BLM Technical Note, cited in the preceding finding, at 33-35. Calculating life expectancy necessary for a stable eagle population at various productivity per occupied site rates and asserting the belief that eagle life expectancy is decreasing, Owen & Gramlich maintain that a reproduction level of 1.0 to 1.2 per occupied site is necessary for population stability (DOI Exh. 24 at 1-4). It is noted that during the FWS consultation hearings, Dr. Owen

described a productivity rate of 1.0 to 1.2 per occupied nest as "characteristic of healthy populations" (VIII-91 at 82). Stating that population stability is a function of births [hatchings] and deaths, they conceded that few data on eagle mortality are available. Mr. Gramlich admitted that FWS had no idea of the eagle mortality rate in Cobscook Bay or generally in the State of Maine (Tr. 1618). The fact that the Florida eagle population has apparently achieved population stability at productivity levels in conformance with criteria stated in the opening sentence of this finding is explained by the assertion that these additive mortality factors, i.e., reduced life expectancy, may not have been important in the Florida Everglades Eagle Population (Owen & Gramlich, supra, at 4).

53. A survey in 1978 indicated that there were 99 eagle breeding sites in the State of Maine, of which 62 were occupied and 37 were unoccupied (Supplement to Todd Thesis, Table 1). Owen & Gramlich place the number of breeding sites in Maine at 93 in 1978 and 93 in 1979 (Table 3). The Todd survey also indicated that there were 136 intact nests in 1978 as compared to 171 on a historical basis, that is known from surveys during the period 1972-78. The cited table indicates that in 1978 Cobscook Bay had 9 breeding sites of which 7 were occupied, and 12 intact nests as compared to 15 on a historical basis. Nest occupancy and productivity figures for Cobscook Bay for 1979 have been recited above (finding 48). Frenchman Bay, a bay to the southwest of Cobscook Bay and east of the mouth of the Penobscot River, had 14 breeding sites in 1978 of which 7 were occupied and 23 intact nests as compared to the historical number of 29. Coastal marine habitat, which include Cobscook and Frenchman Bays, had a total of 48 breeding sites in 1978 of which 29 were occupied and total of 68 intact nests against the

historical total of 84. Winter eagle population in Maine in 1977 was placed at 97 adults and 19 immatures for a total of 116 (Supplement to Todd Thesis, Table 6). The 1978 winter population was placed at 109, consisting of 89 adults and 20 immatures (Id.). Eagle population in the winter of 1979 was also 109, consisting of 93 adults and 16 immatures (finding 46). In 1977 the winter population of bald eagles in Cobscook Bay totaled 13 (10 adults and 3 immatures) and in 1978 the winter population was 14 (12 adults and 2 immatures) (Table 6, Supra). Frenchman Bay winter population was 15 in 1977 (10 adults and 15 immatures) and 11 in 1978 (10 adults and 1 immature). Coastal Marine winter eagle population including Cobscook and Frenchman Bays was 56 in 1977 (47 adults and 9 immatures) and 61 in 1978 (52 adults and 9 immatures). These figures plus the productivity data (finding 48) provide little support for Owen & Gramlich's assertion that Cobscook Bay continues to be a focal point for the Maine eagle population (DOI Exh. 21 at 1). The biological opinion didn't go that far merely asserting that the Cobscook Bay area, northern Washington County, and Coastal Maine east of Penobscot Bay are expected to provide the nucleus for the survival and recovery of the bald eagle in the northeastern U.S.

54. Mr. Frank Gramlich, identified in finding 24, collaborated with Dr. Ray B. Owen of the University of Maine in testimony in support of the FWS biological opinion (DOI Exhs. 21 and 24). In Mr. Gramlich's own words he was violently opposed to the refinery, considering it a biological disaster (Tr. 1567-68, 1570). He did not deny making statements to the effect that he wished there was something they could do to stop the refinery (Tr. 1570). Available data (finding 46) reflects that there were approximately 60 breeding pairs of eagles in Maine in the late 1940's which had declined to 54 in 1978.

which contrasts the decline in breeding pairs in the western half of coastal Maine with the healthy status of the eagle population in areas of eastern Maine. The opinion states that in the last several years productivity of this eastern area has begun to increase.

56. An eagle doesn't reach maturity until four or five years of age and a life span of 50 years in captivity is not unusual. Mortality of immature eagles is known to be high, with mortality rates estimated to range from 80% to 96% (White, VIII-94 at 9; Owen & Gramlich, DOI Exh. 24 at 3). Mr. Gramlich maintained that mortality rates were more important than productive rates and stated that it was very possible to have quite high reproductive rates and a seriously declining population (Tr. 1582). Eagle numbers sited in the preceding findings do not substantiate Mr. Gramlich's contention that numbers are declining and in fact, suggest that a stable population may have been reached. A news release written by Mr. Gramlich states that during the 1977 nesting season 34 eaglets were fledged from 45 active nests and that this was the highest production ratio (.76 young/active nests) reported for at least 15 years and is sufficient to sustain Maine's eagle population if it remains that high in subsequent years (Bald Eagles in Maine, NELF Exh. 1).

57. Dr. White's opinion that the eagle population in the Canadian Maritime Provinces should be considered along with the Maine population has been referred to above (finding 49). In further testimony, he asserted that it appeared to him that the Maine bald eagle population with its concentration in the northern and eastern part of Maine is contiguous with a New Brunswick--Nova Scotia population (Tr. 95). He described the bald eagle population as a rather contiguous coastal sort of population, running up the coast of Maine

and probably ending in Newfoundland, with Cape Breton Island and Newfoundland having a very healthy population. He testified that viewing the population thusly, the hypothetical loss of all Cobscook Bay eagles would not result in the extinction of the eagle in that area [coastal Maine, New Brunswick, Cape Breton Island, Newfoundland] (Tr. 95-96). He asserted that the hypothetical loss of all Cobscook Bay eagles would not result in the extinction of the bald eagle in Maine and answered in the negative a question as to whether the hypothetical loss of all of the bald eagle population in Cobscook Bay would reasonably be expected to reduce the reproduction number or distribution of the bald eagle to such an extent as to appreciably reduce the likelihood of its survival in the wild (Tr. 96). Explaining this answer, he stated that 80% of the Maine population would still be in tact and that if the eagle couldn't make it with 80%, it couldn't make it with the extra 20%. He admitted that loss of the Cobscook Bay eagles would reduce the rate of recovery (Tr. 98).

58. Dr. Dunstan testified that the refinery would most likely have a direct impact on eagles in the Cobscook Bay area, but that the eagle population to be considered ran from Maine into New Brunswick, Nova Scotia, Cape Breton Island and perhaps even further north (Tr. 144-45). He was of the opinion that the hypothetical loss of all Cobscook Bay eagles would not result in their extinction in Maine and would not reduce the reproduction number or distribution of eagles so as to appreciably reduce the likelihood of their survival and recovery in the wild (Tr. 145, 148).

59. Mr. Gramlich testified that in his opinion construction and operation of the refinery would reasonably be expected to reduce the reproduction numbers or distribution of bald eagle to such an extent as to appreciably reduce the likelihood of the survival and recovery of the species in the wild (Tr. 1585-86). Explaining the basis of this opinion, he asserted that the refinery would certainly destroy or adversely modify habitat that is critical to eagle survival (that beyond question a good part of that area [Cobscook Bay] would be declared critical habitat in the future), that the most important thing was the elimination of breeding pairs either by direct mortality from the effects of oil or direct mortality from human disturbance and that the biggest effect would be that the refinery would reduce the ability of the population to restore formerly occupied and still suitable habitat (Tr. 1586-87). Although he stated that the eagles did not recognize the boundary between the United States and Canada and appeared to recognize that the Maine, New Brunswick and Nova Scotia eagle populations could be considered as one (estimating that there may be as many as 60 to 65 breeding pairs of eagles in Maine, 15 to 20 in New Brunswick and as many as 100 pairs in Nova Scotia, including Cape Breton Island), he nevertheless insisted that the loss of six breeding pairs in Cobscook Bay would significantly reduce the likelihood of the survival of that eagle population (Tr. 1604, 1647-51).

Endangered Species - Whales

60. As indicated in the opening paragraphs of this opinion, NMFS requested that EPA initiate consultation under the Endangered Species Act with respect to endangered marine mammals, such as the right whale, in the area to be impacted by the refinery by letter, dated August 16, 1978 (Pittston Exh. 105). EPA requested such consultation on September 1, 1978, and under date of November 15, 1978, NMFS determined that insufficient information exists to conclude that construction and operation of the refinery and marine terminal is or is not likely to jeopardize the continued existence of endangered whales or result in the destruction or adverse modification of habitat that may be critical to the species (Pittston Exhs. 107 and 108). NMFS pointed out that important issues regarding marine mammals in the Eastport-Bay of Fundy area are the potential effects of oil spills and human activities related to the refinery. The opinion stated that the Passamaquoddy region is highly diverse and that a significant number of endangered marine mammals utilized the area at all trophic levels and as an important nursery ground. Turning to the specifics, NMFS stated that estimates of the northwest Atlantic population of the right whale did not exceed a few hundred, that right whales frequented the Bay of Fundy area in the spring and summer and occasionally into fall and that they were commonly sited in the Bay of Fundy and Eastport areas, often with calves, but in low numbers. NMFS further stated that because these animals are low in number, slow moving, and surface feeders, the proposed activity may have an adverse impact on the population, but the degree is unknown. Essentially the same conclusion was reached with respect to the humpback whale, the northwest Atlantic population of which was

estimated to be approximately 1200 and which were asserted to be commonly observed in the Gulf of Maine during the spring and summer.

61. By letter, dated March 8, 1979 (Pittston Exh. 112), NMFS outlined a research program necessary for it to make a scientifically based determination as to whether the Pittston refinery is or is not likely to jeopardize endangered whales. The letter offered the opinion that without the research program, EPA would not be able to insure that licensing the refinery would not jeopardize one or more species of endangered whales. The outline (Appendix A to the cited letter) stated that the first need was for a systematic study or assessment of the species and numbers of endangered whales in the Passamaquoddy--Upper Bay of Fundy areas, but including the Lower Bay of Fundy--Gulf of Maine areas because it was impossible to separate these areas in terms of the potential for migrating whales to move into or near the area of prime interest. The most direct and cost effective way of estimating the frequency of occurrence of endangered whales in the study area was stated to be aerial surveys during an initial 18 month period. If it was determined that a significant number of whales occur in the area (no quantification of significant was attempted), then a more complete assessment would be required. NMFS also stated that studies should be conducted to describe and quantify normal behavior of endangered whales by age and sex so that behavioral modification from the refinery and related activities could be assessed. The outline of the suggested research program indicated that there were no data on the direct or indirect effects of oil on cetaceans and even whether cetaceans could or would avoid oil spills and that the effects of oil over the long term (kidney & liver damage, reproductive anomalies, etc.) should be monitored

through time. Research that was stated to be feasible in a relatively short period of time (two to three years) that was directly applicable to enable NMFS to make an ESA determination included: determination of the effect of oil on the integument, ocular, respiratory, reproductive, digestive and urinary systems of cetaceans (NMFS asserted that laboratory studies on large whales were impractical and that studies on small cetaceans such as dolphins were of questionable relevance); evaluation of the various frequencies and magnitude of sound emitted from the refinery and servicing ships to determine possible impacts on endangered whales, and evaluation of the likelihood of short-term impacts on food organisms. Studies asserted to be necessary to determine long-term impacts of the refinery, oil and related activities on whales included: evaluation of the long-term impact on feeding, calving and migration; analysis of the potential for accumulation over time of petroleum hydrocarbons and metabolites in cetaceans, including where practical, determination of toxic threshold levels; evaluation of the likelihood of long-term impacts on food organisms; determination of the ability of cetaceans to detect and avoid oil (slicks, in suspension); and evaluation of the impact of ship traffic on endangered whales. These studies were estimated to cost up to $1,000,000 and require up to five years to complete.

62. In outlining the suggested research program described in the previous finding, NMFS referred to research efforts being conducted or sponsored by BLM in connection with the Outer-Continental Shelf leasing program. EPA's attempts to ascertain the extent and scope of these research efforts led to the conclusion that they consisted chiefly of surveys to determine the numbers

and distribution of cetaceans and sea turtles and that behavorial, food study work, etc. was not undertaken because it was considered impractical and unlikely to yield useful information (EPA memo, dated April 17, 1979, with attachments, Item VIII-99). In any event, EPA considered that the research program suggested by NMFS was Pittston's responsibility. Pittston was unwilling to undertake such a program and by letter to EPA dated March 15, 1979, Pittston requested that the consultation be terminated immediately (Item VIII-87). By letters, dated April 17, 1979, the Regional Administrator terminated consultation with NMFS regarding endangered whales and simultaneously informed Pittston of the decision to deny issuance of a wastewater discharge permit upon the ground that there was insufficient information as to the impacts of the project upon endangered whales to enable EPA to insure that granting the permit would not result in jeopardy to the species (Item VIII-100).

63. NMFS issued its biological opinion concluding that granting of a permit for the Pittston refinery may jeopardize the continued existence of the right and humpback whales on May 30, 1979 (Item VIII-110). The opinion incorporated by reference its initial determination of November 15, 1978 and the letter of March 8, 1979 outlining a suggested research program (finding 61) and stated that the best scientific data on the risk of the operation of a majory oil refinery at Eastport Maine was largely inconclusive. Discussing reasonable and prudent alternatives, the opinion stated that because right and humpback whales are believed to use coastal waters north of Cape Cod, Massachusetts as important feeding and nursery areas, a large oil spill in these waters could have a serious impact on

these species, either directly or by adversely effecting their habitat. The opinion noted that a census of endangered whales in the Passamaquoddy Bay of Fundy area as suggested in its March 8, 1979 letter, would have been useful in determining the question of adverse effects of the project on endangered whales, but that because of EPA's decision to terminate consultation, the opinion was issued without such an assessment. In a letter, dated June 29, 1979 (Item VIII-113), the Regional Administrator informed Pittston that the January 17, 1979 determination to deny the permit application was expanded to include the following: "Based upon NMFS's letter of March 8, 1979, and biological opinion dated May 30, 1979, EPA believes that NMFS findings of jeopardy to endangered species of great whales precludes the issuance of an NPDES permit for the project."

64. The NMFS biological opinion on the right and humpback whales described above should be compared with its opinion issued to BLM on the proposed OCS lease sales Nos. 51, 58 and 65 in the Gulf of Mexico (NMFS letter to BLM, dated June 30, 1978, NOAA Exh. 88). This opinion recognized that several species of whales, including the humpback and black right whale, could be impacted by the leases and resulting activities but concluded that: (i) no unfavorable impacts from seismic activities would result; (ii) that while it was conceivable that a large oil spill occurring in the immediate vicinity of whales could be harmful through intake of oil through the blowhole, fouling of the baleen plates and ingestion of oil contaminated food, there was no historical record of such an occurrence; and (iii) due to the migratory nature of whales, the small increase in boat traffic would have minimal (non-measurable) impact. It is also noted that NMFS concluded that proposed OCS lease sale No. 42 (Georges Bank) would jeopardize the

right whale, but subsequently withdrew that opinion, concluding in substantially similar language as enunciated herein, that there was insufficient information to determine if the lease sale and resulting activities would jeopardize the right and humpback whales (NMFS letters to BLM, dated June 30, 1978 and July 25, 1979, NOAA Exh. 88).

65. Dr. Howard Winn, Professor of Oceanography at the University of Rhode Island, and an expert witness for Pittston, who has studied whales for 12 years, testified that the right whale was most definitely an endangered species, its most likely population being between 70 and 100 plus (Testimony at 5, 6, Pittston Exh. 7). Other earlier estimates had placed the population range from the low 10's to the low 100's. The right whale ranges from Iceland to Florida and the Gulf of Mexico (Summary and Analysis of Environmental Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras, NOAA Exh. 4 at XIV-17). Although a southward migration has not been observed because it is thought to take place offshore, these whales move southward for the winter where calving takes place (Id.; The Right Whale, Eubaleena glacialis, in the Western North Atlantic, NOAA Exh. 6 at 309). The whales apparently stay close to shore during the northward migration, being observed off of the Southeastern Coast of the United States (Florida to North Carolina) principally during the period January through late March. Sightings increase off of the Mid-Atlantic States (Virginia to New York) during the period late March and April. The greatest number of sightings occur in the Cape Cod Region during late April and early May when the whales are distributed on Stellwagen Bank, Jeffrey's Ledge and nearby areas (NOAA Exh. 4 at XIV-20). After this time information and sightings of

the whales become less abundant as they move offshore toward Nova Scotia and perhaps beyond. Right whales have been observed in the mouth of the Bay of Fundy and in the Passamaquoddy Bay area during August and September.

66. Right whales feed on zooplankton and crustaceans, especially euphausids and copepods (NOAA Exh. 4 at XIV-21). Although it has been stated that they often feed at or near the surface, observations over a 19-year period have established that most of their feeding is well below the surface and that they spend a relatively small part of their time near the surface, except when the food is there (Right Whale Feeding and Baleen Rattle, NOAA Exh. 7 at 60).

67. Dr. Winn testified that the humpback whale was in a reasonably healthy state with a population of around 1,200 animals (Testimony at 4). As support for this figure, he cited a 1973 paper by Mitchell and a 1975 paper of which he was one of the authors (Population estimate of the Humpback Whale in the West Indies by Visual and Acoustic Techniques, Pittston Exh. 89). The Mitchell paper is not in the record, and was apparently based on 1969 or prior data (Tr. 160). The Winn paper was based on data collected in 1972 and 1973. Dr. Winn stated that more recent estimates of the population of humpbacks were in the range of 2,000 (Testimony at 4; Tr. 162-63). This testimony was based in part on a draft paper "Comparative Evaluation of Aerial and Shipboard Sampling Techniques for Estimating the Abundance of Humpback Whales" submitted to the Marine Mammal Commission on October 31, 1979 (Pittston Exh. 93). This draft, of which Dr. Winn was one of the authors, was based on surveys of Silver and Navidad Banks, West Indies, conducted in March of 1978 and resulted in an estimate of the number of

humpback whales of from 1,375 to 1,744. Over-estimation which may range upwards to 20% was considered to be due to resightings, while underestimation which may range up to 26% was considered to be the result of, inter alia, visibility bias. Dr. Winn also relied in part on a 1977-1978 winter survey of the Silver, Navidad and Mouchoir Banks by Hal Whitehead of Cambridge University, England (Pittston Exh. 92), which resulted in an estimate of a total of approximately 3,000 whales (Tr. 166). This estimate was apparently not excepted by the Scientific Committee of the International Whaling Commission because some of the assumptions upon which it was based, e.g., the manner of accounting for resightings, were considered unfounded (Report of the Scientific Committee, NOAA Exh. 3 at 85; Rebuttal Testimony of Dr. Michael Tillman, NOAA Exh. 71 at 4). The accepted IWC estimate of the population of the western Atlantic humpback whale stock is 800 to 1,500 animals (Id. at 3; Tr. 166). Dr. Winn defended Whitehead's work, asserting that Whitehead's surveys and analyses were carried out as well, if not better than, earlier work by Mitchell and himself (Tr. 166). He also pointed out that the IWC and Dr. Tillman did not have the results of Scott & Winn's recent work (Pittston Exh. 93) (Tr. 237-38).

68. Humpback whales in the western North Atlantic migrate between the Caribbean and New England, Canadian, Greenland and Icelandic waters (NOAA Exh. 4 at XIV-39). They are frequently sighted in the area from Cape Cod northward from spring to late fall. The Gulf of Maine appears to be an important feeding area and they congregate at productive locations, including Jeffreys Ledge--Stellwagen Bank, Mt. Desert Rock, Grand Manan Banks and Brier Island--St. Mary, Nova Scotia (Id. at XIV-40). Calving and breeding take place in the Caribbean in the winter and they begin their northward migration in the early spring. Humpbacks are basically a

coastal species and the majority of sightings are relatively close to shore. Humpbacks feed only in the northern grounds and on euphausids and small fish, such as capelin, herring and cod (Id. at XIV-44; Tr. 188, 191).

69. Based upon his estimate of the population of humpback whales in the western North Atlantic as being in the range of 2,000 animals and upon the fact that only a small segment of the population is in the Gulf of Maine at any one time, Dr. Winn concluded that even in the event of a worst-case scenario and the loss of all of these animals because of an oil spill, the continued existence of the humpback whale would not be jeopardized (Tr. 306-09, Testimony at 4, 5). He asserted that the humpback feeds on fish to a much greater extent than the right whale, that there were no special or critical nursing grounds north of Cape Cod, but that there were critical feeding grounds such as Stellwagen Bank, Jeffreys Ledge and the western edge of Georges Bank off of Cape Cod. He stated that given the worst case that could be imagined only a few local animals would be impacted, and that the probability of jeopardy as defined by regulation to the humpback whale from the construction and operation of the refinery was so low that it need not be considered (Id. at 5, 10). Dr. Steven Katona of the faculty in biology at the College of the Atlantic, Bar Harbor, Maine, an expert witness for NOAA, concurred with the NMFS jeopardy determination insofar as humpback whales were concerned only if it be interpreted as jeopardizing the existence or recovery of that portion of the humpback population that regularly feeds in the New England region (Testimony at 20, NOAA Exh. 78). He agreed with Dr. Winn's estimates of the humpback whale population as in the range of 2,000 in the western North Atlantic (Tr. 4154, 4192).

70. With regard to right whales, Dr. Winn testified that based on available sighting data five or so animals could occur in the Grand Manan area during the period May to November, but that the low probability of a major oil spill as indicated by Pittston together with the improbability of right whales encountering such a spill and the improbability of the spill having a major impact on the whales led him to conclude that the proposed refinery could not reasonably be expected to result in jeopardy as defined by the regulation to this whale (Tr. 306-10; Testimony at 5-8). If the whales encountered oil, he indicated that some adverse impact could occur. He asserted, however, that the effects of ingestion of oiled plankton should be transitory and only in the most unusual circumstances could result in death. His opinion that the effects of ingested oil would be transitory was based on experiments with seals which indicated that the oil would be excreted. He stated that it was possible for oil to foul the baleen, horny plates on each side of the jaw used to filter food from the water (the baleen of a right whale is finer than the baleen of the humpback), and that this fouling could interfere with feeding, but that the effects of oil on baleen were unknown. Despite numerous oil spills, no reports of deaths or adverse impacts on cetaceans have been reported. Dr. Winn indicated that there was always the possibility of long-term, undetermined effects of oil on cetaceans, but asserted that there was no real way of measuring this potential impact in the near future. Referring to other areas of concern as to impacts on whales raised by NMFS (ship collisions, noise, blasting, etc.), Dr. Winn stated that there was no information to indicate that ship collisions or sound effects were of any significance in mortality or the decline of whales and that the concern over blasting seemed unrealistic (Id. at 10, 11).

While he suggested that it was possible that the right whale had already been reduced below the critical population size necessary for its survival, in which case it would become extinct, he was of the opinion that the worst-case analysis of the elimination of five animals, the probability of which was very low, would not seem to jeopardize the population or result in its extinction.

71. Dr. David Gaskin,* Associate Professor of Marine Biology at the University of Guelph, Ontario, Canada and an expert witness for NOAA, disputed Dr. Winn's population estimates for the humpback whale (Testimony at 9, NOAA Exh. 71). There is no evidence that Dr. Gaskin has personally undertaken any surveys or analyses of the humpback whale population. He cited surveys by a Stephen Price of the University of Guelph at a date not stated which indicated that the population of the Silver and Navidad Banks, West Indies, may be in the range of 350 to 400 animals with the best estimate at 417. Dr. Winn testified that he had reviewed Mr. Price's draft manuscript entitled "Western Atlantic Humpback Whales" and found inconsistencies, questionable sampling techniques and failure to sample in areas where humpbacks are known to exist in numbers (Rebuttal Testimony at 3, Pittston Exh. 8). This testimony has not been disputed. Moreover, a paper entitled "The Humpback Is not Over the Hump" by Lien & Merdsoy, cited by Dr. Gaskin, states that the last census of humpbacks taken in 1972 resulted in an estimate of 1,000 to 1,500 animals and that assuming a steady growth rate of 5% to 7% the 1979 North Atlantic stock should consist of 1,600 to 2,400 whales. This paper provides additional

*Dr. Gaskin's schedule was such that he could appear as a witness on only one day. Because of the sudden illness of Pittston counsel during the hearing and Dr. Gaskin's subsequent illness, his cross-examination was never concluded. In lieu thereof, it was stipulated that the Lien & Merdsoy paper cited by Dr. Gaskin and another paper "Age determination of harbour porpoise" of which Dr. Gaskin was one of the authors would be admitted into evidence (Letter from counsel for Pittston w/enclosures dated February 27, 1980, admitted into evidence as Pittston Exh. 116).

support for Dr. Winn's estimate of the humpback population. Dr. Gaskin cited the Lien & Merdsoy paper as well as an additional paper by Hal Whitehead (The Baleen Whales of the Northeast Coast of Newfoundland, Pittston Exh. 91), to support his assertion that there has been a drastic change in the summer distribution of humpbacks on the feeding grounds of Canadian waters, that this massive inshore movement from the Grand Banks may be attributable to overfishing of Newfoundland capelin stocks upon which the humpbacks have hitherto largely fed and that they are believed to be moving shoreward in search of alternative food supplies. He further testified that in view of the continued depression of the capelin stock, it was expected that humpbacks will form a regular fraction of the large baleen whale population which frequents the Head Harbor Passage Region during the summer months. While the Merdsoy and Whitehead papers do indeed refer to overfishing of capelin and the possibility that the increased sightings of humpbacks closer to shore are attributable to the search for alternate food sources, they do not support the massive inshore movement asserted by Dr. Gaskin. In fact, the Lien & Merdsoy paper raises the possibility that increased sightings could be attributable to an increased population (although they assert this is unlikely, no reasons are given for this conclusion) and its primary thrust is the threat to the humpback (its numbers being considered insufficient to support renewed whaling) posed by fishermen taking matters into their own hands in order to protect their gear (cod traps, etc.) from damage caused by the whales.

72. Dr. Gaskin testified that two humpback whales with calves spent extended periods within Head Harbor Passage during July-September 1979 (Testimony at 9, NOAA Exh. 71). At another point, he asserted that mother humpbacks with calves used the Head Harbor Passage area throughout the summer of 1979, spending extended periods in the Passage (Id. at 14). Regarding the right whale, he alluded to various sitings, some of which were

unconfirmed, in the Campobello-Grand Manan Island areas, chiefly during the period 1978-1979, and referenced a 1972 paper of which he was one of the authors to support the assertion that five right whales were within Head Harbor Passage for an extended period of time in 1971. This paper is not in the record. However, a map of the area (Id., Figure 2) upon which are placed markings, (triangles for humpbacks and semicircles for right whales) purporting to locate sightings in 1978 and 1979 shows four humpbacks and one unconfirmed sighting of a right whale off of East Quoddy Light, which could properly be characterized as the mouth of Head Harbor Passage (Id. at 27; Tr. 180). A sighting of a pair of humpbacks is shown to the West and North of Whitehorse Island with the majority of the sightings in Grand Manan Channel (between Campobello and Grand Manan) and east of Grand Manan Island. It is therefore found that Dr. Gaskin's assertions that humpback whales with calves spent extended periods of time in Head Harbor Passage during the summer of 1979 and used the Passage throughout the summer of 1979 are exaggerations and inaccurate. Records of Finback Whales 1978, 1979 (Figure 5 of Dr. Gaskin's testimony at 37) show that a single finback whale was sighted in Western Passage, between Deer Island and Moose Island.

73. Dr. Gaskin discussed the likelihood that whales, including right and humpbacks, were very mobile and that there was an interchange of the population between the New Brunswick-Novia Scotian Bay of Fundy coasts as a regular occurrence (Testimony at 10). Apparently considering that any contact with oil would have extremely serious consequences, he suggested that this interchange would increase the number of whales at risk and thus the jeopardy to the right and humpback. Dr. Winn disputed this contention, asserting that a short residency time would drastically reduce the exposure of any given animals to potential oil spills (Rebuttal Testimony at 2).

74. Dr. Steven Katona, identified in finding 69, established the Gulf of Maine Whale Sighting Network in 1972. Under this program forms, photos and drawings of whales are provided to fishermen, boat captains and others who spend time on the sea so that they can identify and report on whales and marine animals they observe (Tr. 4140-41). The observers are encouraged to furnish sketches and photos to aid in identification of the species sighted. These observations are called platform-of-opportunity sightings (POPS) in recognition of the fact that they are not made by trained observers making a survey or census of whales. The major area covered by sighting reports is from Cape Cod to Nova Scotia (Tr. 4142). A compilation of information collected by the Network in 1977 indicates observation of 257 humpbacks in 89 separate sightings and 38 right whales in 24 sightings (Attachments, Pittston Exh. 7). These numbers apparently include repeat sightings of the same whales (Tr. 4200). Sighting data for 1978 is in the form of a computer printout (Exh. A, NOAA Exh. 78) and data for 1979 is not in the record.

75. Dr. Katona testified that if he wanted to find right or humpback whales in abundance from the Bay of Fundy to Massachusetts, he would look in the Stellwagen Bank--Jeffreys Ledge areas and also offshore in the Cashes Ledge areas (Tr. 4147-48). Stellwagen Bank is in Massachusetts Bay north of Cape Cod, Jeffreys Ledge is off of the coast of New Hampshire and Cashes Ledge is to the east toward the central portion of the Gulf of Maine. Dr. Katona indicated that he would look for right whales in the Quoddy area during the period July, August and September and at the latest October (Tr. 4148). The latest reports of right or humpback whales in the Gulf of Maine reported by the Gulf of Maine Whale Sighting

Network in 1976 and 1977 are of sightings in the Jeffreys Ledge area on November 13. At least six humpback whales were sighted in the area between West Quoddy Head and Campobello Island during the period August 9 to August 20, 1979 (Tr. 186; Katona Testimony at 7-11, Tr. 4168-71). Several humpbacks were observed from the shore of West Quoddy Head during this period, the animals apparently being attracted by the tendency of herring and squid upon which they were feeding to move toward the shore and to surface in the late afternoon and evenings (Id. at 13, 16). At least two right whales were observed in the vicinity of Duck Island (one mile south of Grand Manan) on August 17, 1979. A right whale was observed 1.5 miles southeast of West Quoddy Head on September 12, 1979 (Tr. 4163-64). Drs. Gaskin and Katona testified that because of fewer people and less effort, there could be more whales in the Quoddy area than shown by the sightings reported (Tr. 3935-36; 4159). Dr. Gaskin asserted that as many as 30 right whales could be in the Bay of Fundy approaches during the summer months and at risk from a major oil spill (Testimony at 17). By the "Bay of Fundy approaches" Dr.. Gaskin apparently means the area between the east and southern coasts of Grand Manan Island and southwestern Nova Scotia (Testimony at 9, 10). The available sighting data support Dr. Winn's estimate of five as the maximum number of right whales likely to be placed at risk by an oil spill in the Quoddy Region. The "Quoddy Region" is generally or broadly referred to as the area from St. Andrews on Passamaquoddy Bay to Grand Manan Island including Cobscook Bay (Tr. 182, Katona Testimony at 5; Tr. 2862). The "Quoddy Region" has also been described as the area northward of a line connecting West Quoddy Head and North Head, Grand Manan Island and shoreward of a line connecting North Head, Grand Manan and Point Lepreau, New Brunswick (Memorandum, dated September 2, 1976, Item V-II at 2 and Fig. 1).

76. Dr. Joseph Geraci, Professor of the Wildlife Disease Section of the Department of Pathology, Ontario Veterinary College, University of Guelph and an expert witness for NOAA, testified that there have been virtually no studies and few observations of the effects of oil on cetaceans (Testimony at 6, NOAA Exh. 64). Nevertheless, he listed what he characterized as serious speculation as to the effects of exposure to oil on whales and porpoises: (i) cetacean skin is unique among mammals in that it is composed of all living cells and is a metabolically active organ which probably serves as more than a simple barrier against the water environment and exposure of cetaceans to petroleum could result in disruption of metabolic activities, perhaps affecting vital ionic regulation and water balance; (ii) cetaceans inhabit surface waters to breathe and to feed, thereby exposing them to vapors [from petroleum], if present, which have been shown to be harmful or fatal to mammalian respiratory systems; and (iii) the possibility that heavier fractions of oil may foul or clog the baleen, while lighter fractions, being destructive of tissue, might damage the structural integrity of the baleen, in either case interferring with feeding efficiency. He indicated that this threat would diminish dramatically with time as the oil disperses (Tr. 3387). He also referred to Head Harbor Passage and its noise trapping characteristics, narrow deep water and rock-faced channel, implying that large baleen whales had been observed in the Passage, and raised the possibility that noise may be physiologically and behaviorally detrimental to marine mammals (Id. at 4). He asserted that surface dwelling animals such as manatees and mysticete whales appeared prone to encounters with ships and as ship traffic increased, the probability of collisions with such animals increased. He referred to numerous reports indicating oil as the cause of injury or death

in marine mammals and stated that those that can be substantiated show that seals and sea otters tend to be vulnerable because of the fouling potential of their hair and their dependence on the particular area at the time of the incident. He asserted that evidence is emerging that the severity of the impacts of oil depended upon the pre-existing health and physiological status of exposed animals.

77. Attachment 2 to Dr. Geraci's testimony is a report, dated August 1979, hereinafter Geraci Report, prepared for the Marine Mammal Commission of which Dr. Geraci was one of the authors: "Possible Effects of Offshore Oil and Gas Development on Marine Mammals: Present Status and Research Recommendations." Although the Report mentions blasting in connection with seismic exploration and other activities as a possible danger to marine mammals including cetaceans, it refers to the protection against the shock waves from blasting provided by the large size and thick body walls of mammals such as whales (Id. at 4). It also refers to a report stating that California sea lions were killed by blasting in connection with seismic exploration, but that gray whales in the area were apparently undisturbed. In connection with blasting required for construction of the Pittston project, it would seem a simple matter to schedule blasting when whales or other cetaceans were not in the area or to detonate small charges to scare them away from the immediate vicinity. Regarding noise, the Geraci Report refers to sudden disturbances causing stampedes into the water by pinnipeds (seals, walruses) which could lead to disruption of mother-pup pair bonds, accidental injury to or death of pups, injurious aggression upon recolonization of rookeries, and states that repeated disturbances may lead

to abandoning of traditional breeding areas in favor of less suitable sites (Id. at 6, 7). The Report mentions the hypothesis that mass strandings of cetaceans may be due to, inter alia, acoustical confusion, but states that most animals become habituated to low level background noise such as that associated with ship traffic and onshore and offshore petroleum activities. Humpback and gray whales, harbor and elephant seals, bottle-nosed dolphins, walruses and sea lions are listed as seeming to co-exist well with human activities. Regarding boat collisions, the Geraci Report states that accidents associated with industrial activities can be minimized but not eliminated and that it should be possible to minimize disturbance to marine mammals by strategically locating onshore facilities and by carefully planning flight paths and ship routes. While Dr. Geraci referred to one or two apparently stranded whales as having evidenced collisions with boats (Tr. 3371), no specific instances of death or injury to whales resulting from ship collisions were referenced. It is noted, however, that the Gulf of Maine Whale Sighting Report for 1975 refers to two stranded immature minke whales and states that one was hit by a ship and that the other was probably hit by a ship (Id. at 6).

78. The Geraci Report references various news accounts of oil being implicated as the cause of death of seals, sea lions, sea otters and small and large whales (Id. at 10, 11). The Santa Barbara channel blowout of January 1969 is mentioned as the most noteworthy of these incidents. The Report states that critical assessments did not conclusively link marine mammal deaths with the presence of oil. Autopsies of a dolphin and a gray whale which stranded or washed up on California beaches following the blowout did not reveal the presence of oil or that oil was the cause of death (Whales, Dolphins

and Oil Pollution, Pittston Exh. 9). Of probably greater significance is the finding that the number of gray whale strandings in 1969 following the oil spill did not differ significantly from prior years (Id. at 264). It is not known whether cetaceans and other marine mammals can detect the presence of oil and if so, what are the detection limits (Geraci Report at 13-15). Also unknown are the behavorial effects on marine mammals of oil fouling on such activities as feeding, diving, mother-pup interaction, etc. Because the evidence indicates that only mammals which rely on hair or fur for thermal regulation would likely be effected by surface fouling of oil and that the smooth body surface of cetaceans substantially reduces the likelihood of physical fouling, the Geraci Report states that further studies on thermal effects of surface fouling should be afforded low priority (Id. at 16-18). Anticipated effects of surface contact with oil are irritation and inflammation of eyes, skin and sensitive mucous membranes. These effects are asserted to have been well demonstrated by experiments in which ringed seals were immersed for 24 hours in oil-covered sea water so that similar harmful effects on other marine mammals may confidently be predicted (Id. at 20). The Geraci Report concludes that a study directed toward quantifying ocular damage as a result of oil contact appears to be unnecessary. It should be noted that within 20 hours of being placed in clean water eye irritation of the seals immersed in oil-covered water, i.e., squinting, severe conjunctivitis, lachrimation, swollen mutilating membranes, evidence of corneal erosions and ulcers, was no longer apparent (Id. at 19; Tr. 3403). The Report forms the backdrop for the concern expressed by Dr. Geraci (finding 76) that cetacean skin, being a unique metabolically active organ may be particularly vulnerable to oil contact and suggests that high priority be given to studies designed to ascertain the effects of oil on cetacean skin.

79. Expressing concern that marine mammals exposed to an oil spill might ingest and accumulate oil and that ingested oil is potentially toxic, the Geraci Report refers to experiments wherein ringed seals rapidly absorbed crude oil hydrocarbons into body tissues and fluids, ultimately excreting the compounds (Id. at 20, 21). Experiments wherein harp seals, given up to 75 ml of crude oil, showed no clinical, biochemical, or morphological evidence of tissue damage were also mentioned. While stating that these findings cannot be extrapolated to greater quantities oil or other groups of animals, the Report states that these studies tend to dampen the fear that oil ingestion associated with feeding would necessarily be harmful to piscivorous (fish eating) marine mammals. (See also Tr. 3393-94). The other group of animals referred to are sirenia (herbivorous). Dr. Geraci apparently found the results of these experiments sufficiently convincing that he did not address the potential effects of ingested oil on right or humpback whales as a problem in either his direct or rebuttal testimony. The Geraci Report does state that studies on oil ingestion must address long-term effects associated with fractions persistent in the food chain, notes that the persistence of hydrocarbons in at least some molluscs is due to their apparent lack of degrading enzymes and that fish have these enzymes, metabolizing 98% of accumulated hydrocarbon load within two months of exposure, and points out that some of these hydrocarbon compounds, such as benzopyrene, are potent carcinogens. Dr. Geraci was of the opinion that

whales did have the capability to metabolize oil, but testified that they did not have a gallbladder and that he did not know whether the oil could be excreted without difficulty or harm to the whale (Tr. 3394-95). A decline in the number of strandings, and thus apparently of the population, of cetaceans on the Coast of the Netherlands has been attributed to an increase in pollutants, including hydrocarbons, in the North Sea (Id. at 23, 24).

80. A 24-hour experiment wherein ringed seals were immersed in oil-covered water and subjected to a more concentrated exposure of volatile hydrocarbon fractions than would normally be encountered in an oceanic spill, led to the conclusion that short term inhalation of such vapors by marine mammals was not necessarily harmful either in terms of structural damage or gas exchange (Geraci Report at 26). The Report further states that while effects of prolonged inhalation have not been examined in marine mammals, it is likely to have the same consequences as have been observed in rats, i.e., central nervous system disturbance, bronchopneumonia and death. Dr. Geraci referred to the Kurdestan oil spill off of Nova Scotia in 1979 and testified that an autopsy of a seal found coated with oil after that spill revealed oil droplets in the lungs thus indicating a correlation between the oil and death (Tr. 3375-76). He asserted that it was his understanding that the seal died of pneumonia and that the oil may well have triggered the process. He indicated, however, that it could not be stated with certainty that oil inhalation was the cause of death (Tr. 3376-77). The Report indicates that such prolonged inhalation is likely to

feature prominently in a major spill or one in which animals tend to remain (Id. at 27). No attempt was made to quantify "prolonged inhalation" nor to explain why such a mobile animal as a whale would remain in the oil if it was irritating to eyes and other sensitive tissues. See Tr. 3382. The Report concludes that experiments directed at assessing inhalation effects would not yield more than can be deducted from a reasoned interpretation of existing literature and that effects of inhaled vapors will depend on the composition of oil; duration of exposure; environmental conditions affecting evaporation, dissolution and dissipation; and the health of the animal.

81. Elaborating on the health of an animal as effecting its ability to withstand exposure to oil, the Geraci Report referred to captive phocid seals which died within 71 minutes of being placed in a light crude oil-covered water and concluded that the stress of captivity was a factor in the deaths (Id. at 29). The Report states that marine mammals might be more vulnerable to the effects of oil during molt, reproduction, times of low food availability or when weakened by parasites and disease. As an example, the Report refers to the effects of petroleum inhalation, which may be assumed to be minimal in healthy animals, but may be harmful to inshore dwelling animals such as harbor porpoises infected with debilitating heart and lung worms.

82. Dr. Geraci minimized concern that oil might clog the blowhole of a cetacean, asserting that the typical breathing cycle of a cetacean involves an explosive exhalation followed by an immediate inspiration and abrupt closure of the muscular plug (Tr. 3384-85; Geraci Report at 27).

He indicated that this mechanism had evolved to prevent inhalation of water and should do the same for oil.

83. Regarding the concern expressed by NMFS as to the effect of an oil spill on the food supply of the right and humpback whale, Dr. Edward Gilfillan, identified in finding 27, testified that zooplankton, upon which baleen whales were known to feed, were pelagic animals (free-floating in the water column), that they were carried about by ocean currents and that their abundance was frequently very spotty or patchy (Testimony at 3, Pittston Exh. 49). He asserted that laboratory and meso scale experiments have shown that exposure to concentrations of oil in the 200 ppb range for a few weeks can reduce the growth rate of zooplanktonic animals. He indicated that the concentration of oil indicated in these experiments was realistic in terms of what might be expected from an oil spill, but that the length of time required for significant results to appear was not realistic in terms of an open-water spill where oil concentrations in the 200 ppb range might be expected only near an actual slick as a result of rapid mixing and dilution. He stated that plankton live in an area where oil has a very short residence time, that many species of zooplankton have very high reproductive rates and that any reduction in population size caused by an oil spill would be made up very rapidly (Id. at 4). In support of these assertions he cited studies of the North Sea Bravo blowout, the Santa Barbara blowout, and the Arrow and Argo Merchant oil spills where no major deleterious effect on zooplankton in the spill area had been demonstrated. He further testified that plankton production in the Bay of Fundy was low and that it was therefore axiomatic that production of zooplankton, the basic food for fish and whales, was also low.

He indicated that most of the zooplankton in the Bay of Fundy is brought in principally from the Gulf of Maine and that plankton was most abundant at the entrance to the Bay. Dr. Gaskin agreed with Dr. Gilfillan that fresh zooplankton would be brought into the area to replace oiled stocks (Testimony at 25). Dr. Gilfillan relied on studies of plankton in the Bay of Fundy cited and summarized in an Appraisal of the Environmental Consequencies of Developments Proposed for Lorneville, New Brunswick (Appendix 5, Vol. 2 at 273). Summarizing his conclusions, Dr. Gilfillan stated that even an Amoco Cadiz type oil spill would effect a relatively small portion of the Gulf of Maine and Bay of Fundy, that such a spill would not kill all zooplankton in the area, that at no time would whales be totally lacking in food even in the spill area and that deleterious effects on the whale's food supply would be confined to the area of the spill (Id. at 5). He further indicated that because the marine plankton community was supplied from outside the Bay of Fundy, the impact of an oil spill would be transitory and pointed to studies showing that plankton has the ability to cleanse itself of oil once placed in clean water, losing up to 50% of hydrocarbons within one day and up to 90% within one week. Dr. John H. Vandermeulen, a research scientist at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, and an expert witness for NOAA, was aware of these studies and testified that no deleterious effects on zooplankton were observed from the ingestion of oil (Tr. 3755-58; Rebuttal Testimony at 23, 24, NOAA Exh. 69). He agreed with Dr. Gilfillan that zooplankton reproduced rapidly (on the order of about three weeks) but asserted that this was only during the period April through October (Rebuttal at 27).

84. An article, "Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms" (Pittston Exh. 79), authored with the assistance

of, among others, Dr. Donald C. Malins, Director of the Environmental Conservation Divison of the Northwest and Alaska Fisheries Center of NMFS and an expert witness for NOAA, supports Dr. Gilfillan, stating that there has been no strong evidence for major damage to plankton communities as a result of an oil spill. The article further asserts that some effects on phytoplankton were observed after the Torrey Canyon (Coast of Cornwall, 1967) incident but none on the zooplankton. Factors operating to minimize effects of oil on plankton are listed: (1) fractions of oil which enter the water column disperse rapidly so that concentrations are usually very low and (2) plankton populations typically have rapid regeneration rates and usually cover large geographic areas. Even if one assumed 100% plankton mortality at the site of a spill, it would be difficult to demonstrate the significance of the effect on the overall population. While the article recognizes that persistent exposure within a restricted area could lead to a change in community structure and subsequent impact on the food chain, it states that the probability of this happening appears to be low. Phytoplankton are essential for the support of zooplankton (Tr. 3766). Analyses of phytoplankton as early as two to four weeks after the Amoco Cadiz oil spill did not show any noticeable differences in chlorophyll "a" and phaeopigments, which are indices of phytoplankton health, between oiled and unoiled sites (Tr. 3764-68; Amoco Cadiz, Pittston Exh. 82 at 51).

85. Dr. Gaskin testified that an oil spill in the Quoddy region and in particular Head Harbor Passage could not be equated with an open water situation, asserting that the residency time of water in the Passamaquoddy Bay region could be as long as 70 days (Testimony at 21). If true, this would mean that

oil, instead of being rapidly dispersed, might remain in the area for an extended period of time, increasing the likelihood of its contact with any whales in the vicinity and its impact on their food supply. As support for the 70-day figure, Dr. Gaskin appeared to cite Environment Canada Technical Report No. 428, an update of which, Fisheries and Marine Service Technical Report No. 901, was admitted into evidence (NOAA Exh. 58). The latter document shows a calculated flushing time based on 1951 data of 15d for Passamaquoddy Bay, where "d," assuming a steady state with inflow and outflow being equal, represents the rate of inflow of fresh water to the system. Later calculations based on data collected in 1957-58 showed an annual average flushing time for Passamaquoddy Bay of 12d (Id. at 4; Tr. 3862-66). There is evidence that flushing time for Cobscook Bay is approximately 8.7 days (Pittston Exh 84 at 2). Under cross-examination, Dr. Gaskin stated that the 70-day figure was a possible average flushing time for the Bay of Fundy (Tr. 3864-65). There is evidence of a more or less closed, counterclockwise gyre in the Bay of Fundy (Testimony of Dr. Vaughn Anthony, NOAA Exh. 47 at 38). It is indicated that this gyre may retain scallop larvae for periods of up to 45 days. Dr. Gaskin, however, did not dispute the flushing time for Passamaquoddy Bay calculated in Technical Report No. 901 which is in essential agreement with that shown in the Literature Review of Marine Environmental Data For Eastport, Maine (Pittston Exh. 83, Table 4). Citing drift bottle work done in 1959 and 1960, Dr. Gaskin testified that water movement in the western coastal waters of the Quoddy Region was primarily inshore and that oil liberated within the Bay of Fundy would stay there and go ashore sooner or later (Testimony at 21). He asserted that drift marker studies support the concept of significant residence time of water in this semi-enclosed region, that areas of upwellings and shear zones between water bodies had been identified between Deer and Campobello Islands, that high densities of zooplankton, copepods and euphausids were also present within intermediate zones with lower surface current speeds, that these zones (weed patches) could be identified by use of infra-red film, that the residence time of material in these "slick areas" was much greater than heretofore supposed, that the weed patches were zones of concentration for euphausids and herring and that baleen whales worked the edges of these slicks, passing back and forth beneath them to feed. He further stated that the dynamics (eddies) of these areas were such that large quantities of oil could be trapped therein and yet, under circumstances (peripheral speeds of two plus knots), that containment would be impossible.

86. In rebuttal testimony Dr. Gilfillan disagreed with Dr. Gaskin's depiction of the Quoddy region as an area of enclosed circulation where oil would remain for long periods of time (Pittston Exh. 50 at 24-26). He asserted that Dr. Gaskin's description may be accurate for inner Passamaquoddy Bay (accord: Vandermeulen, NOAA Exh. 69 at 27), but was not true for the areas of Dr. Gaskin's principal concern, namely the area between Deer Island, Campobello Island and Grand Manan. As support for this conclusion, Dr. Gilfillan cited evidence of drift bottle releases summarized in Technical Report No. 428 (See finding 85). The apparent same releases or an update are shown in an attachment to the testimony of Dr. Ronald Loucks (NOAA Exh. 50, Figures 32-35). These figures show the recovery points of drift bottles released off East Quoddy Head, in Head Harbor Passage and off

of Estes Head (Moose Island). Figure 35 shows the recovery points of bottles picked up beyond the Quoddy area, which include points on Nova Scotia and as far south as Cape Cod and Nantucket. Time between release of the bottles and their recovery is not stated. Although Dr. Gaskin testified extensively on redirect examination (Tr. 3911-55), no attempt was made to refute Dr. Gilfillan's assertion that the area between Deer Island, Campobello Island and Grand Manan was not an area of enclosed circulation where oil would be likely to persist for long periods of time.

87. Dr. Kenneth Sherman, Chief of the Marine Ecosystems Division, Northeast Fisheries Center, NMFS and an expert witness for NOAA, testified that while under the conditions assumed by Dr. Gilfillan the impact of an oil spill on the Bay of Fundy and Gulf of Maine could be minimal, under other probable scenarios an oil spill in the Eastport area could be detrimental to plankton of the local ecosystem including the survival of herring eggs and larvae (Rebuttal Testimony at 3, NOAA Exh. 57). He asserted that herring eggs are deposited on the bottom and that oil in contact with the eggs can cause extensive mortality and that the most abundant species of zooplankton during the herring spawning and hatching period is the copepod, which is the right sized food for young herring during the critical first breeding period. He stated that an oil spill during the peak hatching period of herring could seriously reduce the local populations of copepods and thereby endanger a year-class of new recruitment to the herring fishery off of the coast of Maine. While it is generally accepted that larvae and juvenile stages of fish and other marine animals are most susceptible to damage from oil (Vandermeulen, Testimony at 31, 32; Malins, Testimony at 16), there has been no documented instance of a material impact on pelagic fish stocks, which includes herring, as a result of an oil spill (Vandermeulen, Testimony at 30, 31, TR. 3790-92).

88. Although Dr. Sherman testified that he disagreed with Dr. Gilfillan's assumption that oil will be rapidly diluted and mixed in the water column (Tr. 3201), evidence in the record supports Dr. Gilfillan. Dr. Vandermeulen generally agreed with Dr. Gilfillan that oil spilled and dissolved in the water column likely persists for a relatively short time (Rebuttal Testimony at 19, 20). Dr. Sherman had coordinated for NMFS the scientific studies of the impact of the Argo Merchant oil spill (Nantucket Island, December 15, 1976) wherein oil concentrations of 250 ppb were measured (The Argo Merchant Oil Spill, Appendix 21A at IV). These concentrations were reduced to background levels by turbulent mixing within a few days. The Argo Merchant was, of course, an open sea spill. Maximum oil concentrations determined by the testing of discrete samples taken in an estuary from seven to ten days after the Amoco Cadiz oil spill (Coast of Brittany, France, March 17, 1978) were 340 ppb (The Amoco Cadiz Oil Spill, Pittston Exh. 80 at 61, 67). Tests by towed fluorometer at the same time as the discrete samples were taken appear to show oil in water concentrations in excess of 2,500 ppb (Figure 3-22, Pittston Exh. 80). The large discrepancies between these results and those obtained by discrete sampling are at least partially attributable to difficulties in properly calibrating the instrument (Id. at 61). Dr. Page, identified finding 17, stated without elaboration and without supporting references that 1.5 to 15 ppm (1,500 to 15,000 ppb) were the concentrations of dissolved hydrocarbons expected after a major oil spill (Rebuttal Testimony at 4). Although Mr. Robert Clark, finding 93, infra, testified that as a practioner [of oil spills] they frequently use a range of 1,000 to 5,000 ppb as the routine upper limit expected to be found of oil in water (Tr. 3498), the evidence in this record provides no support for the

upper range of these figures. Placing concentrations in prospective, laboratory experiments have shown that exposure to oil concentrations of 860 ppb for a seven-day period was fatal to 50% of lobsters so exposed (Tr. 3243-44). Acartia, a species of copepod, died within 24 hours after being placed in seawater containing 100 micrograms per liter of oil (Tr. 3262-64; Pittston Exh. 78 at 106). However, this is a very high concentration (100,000 ppb) and Dr. Sherman was clearly mistaken in describing this concentration as 100 ppb (Tr. 3263, 3271-73).

89. Areas of upwelling (raising of usually colder, nutrient-rich waters to the surface), convergence (where waters of different temperature and salinity come together and mix) and divergence (where waters mix from the bottom and move upward and outward) have been reported and identified along the Maine coast (Sherman, Testimony at 3; Tr. 3202-05). These areas, which have been identified as far up the Maine coast as Machias Bay, sometimes referred to as the southern Quoddy Region, concentrate zooplankton and larvae fish and are expected to concentrate oil as has been observed in other areas including Delaware Bay (Tr. 3206-07; Gaskins, finding 85). This explains the patchy or spotty nature of zooplankton described by Drs. Gilfillan (finding 83), Gaskin (finding 85), and Sherman (Tr. 3203, 3211).

90. A cold-water mass, called the "Fundy front," extends from below Grand Manan, across the Bay of Fundy and past the tip of Nova Scotia (Testimony of Charles S. Yentsch at 5, NOAA Exh. 82). This cold water mass is caused by the intense tidal activity of the area which keeps the water column constantly mixed (Id. at 6). The mixing activity brings nutrients to the surface which together with sunlight are essential for the growth of

phytoplankton. Although highly turbulent waters result in low productivity for phytoplankton and the constant mixing can set up currents which carry light dependent plankton below the euphotic zone resulting in retarded growth, this apparently does not happen along the Fundy front where nutrient levels are near maximum, phytoplankton are plentiful throughout the euphotic zone and productivity is optimized (Id. at 7, 8; Tr. 4728). Mr. Yentsch explained that the Quoddy-Grand Manan area was the transition place between fully mixed conditions due to tidal intensification and the stability of the central part of the Gulf of Maine.

91. Cold water is represented by the lighter areas on an image of the Gulf of Maine-Bay of Fundy area obtained by satellite infrared sensor (Yentsch, Figure 1). While the colder water appears to include the entire Bay of Fundy, intense turbulence above the Fundy front keeps phytoplankton production in that area low. This supports Dr. Gilfillan with whom Dr. Gaskin is in agreement (Testimony at 24) that plankton production in much of the Bay of Fundy is low. However, see Fisheries and Marine Service Technical Report No. 901 (NOAA Exh. 58 at 29), which, relying on improved statistical data and a longer time sequence of herring larval surveys, states that zooplankton productivity in the Bay of Fundy is not low. Yentsch, Figure 3, shows an area of intense phytoplankton concentrations (100,000 cells per liter or more) surrounding Grand Manan, extending eastward toward the Digby Neck-St. Marys Bay area of Nova Scotia and westward toward Campobello Island and West Quoddy Head. The area of intense concentrations does not include Head Harbor Passage, Passamaquoddy or Cobscook Bays and does not extend into the upper Bay of Fundy. Casting doubt on the assumption that intense phytoplankton concentrations are

necessarily coextensive with the greatest zooplankton populations are studies showing distribution of microcopepods in May, June and August 1932, distribution of krill, or "shrimp feed," in November 1972 and March of 1973 and distribution of euphausids and copepods in the Bay of Fundy in October and November 1969 (Figures 2, 4a and 4b, 5 and 6, NOAA Exh. 58 at 47, 48). Figure 2 shows the heaviest concentrations largely skirting Grand Manan, principally remaining on the Nova Scotia side or southward into the Gulf of Maine while Figures 4, 5 and 6 show substantial concentrations in Grand Manan Channel, the mouth of Head Harbor Passage and the upper Bay of Fundy. Dr. Sherman testified that these plankton concentrations in the Quoddy area were present in the summer months as well as the spring and fall (Tr. 3213-15). Technical Report No. 901 supports Dr. Gilfillan in part, i.e., that zooplankton is brought into the Bay of Fundy from the Gulf of Maine (Id. at 29). However, the Report also states that the presence of permanent stocks of zooplankton, including krill or "shrimp feed," in the Bay of Fundy is well documented. Dr. Sherman cited the studies referred to in Technical Report No. 901 in testifying that there were resident populations of zooplankton within the Quoddy Region and the Bay of Fundy (Tr. 3264-65). He nevertheless indicated that there was some replenishment from outside the Bay of Fundy.

92. Copepods are filter feeders and have enormous capabilities for removing oil from surface layers they inhabit (Tr. 3268-70). While they can ingest and excrete large quantities of oil without apparent harm to themselves, the resulting deposits, so-called "fecal rain," can be ingested by fish larvae in the water column and filter feeding shellfish

and other benthos on the bottom in addition to being incorporated into bottom sediments where the residence time can be prolonged to months and or even years depending on hydrographic conditions (Tr. 3269-70; Sherman, Testimony at 5, 6). Laboratory and field observations have shown that groundfish and other marine organisms readily take up petroleum hydrocarbons from oiled sediments and that such exposures can lead to abnormal development of eggs and larvae and to pathology in adults (Malins, Testimony at 3, 6, NOAA Exh. 62; Vandermeulen Testimony at 33, NOAA Exh. 68). For this reason, the cleansing process or depuration by copepods and other zooplankton ingesting oil may be harmful or potentially harmful to other marine organisms. Regarding the question of whether pollutants are transferred through marine food webbs, an article by Dr. Malins states that while PCB's and toxic metals are readily passed through marine food webbs, petroleum hydrocarbons are not transferred extensively because enzyme systems in marine organisms convert them to oxygenated products--a process that naturally limits hydrocarbons available to a predator (Pollution of the Marine Environment, NOAA Exh. 63 at 33). Dr. Malins testified that the price to be paid for making petroleum hydrocarbon compounds water soluble and easy to excrete is that the intermediates formed can be mutagenic, carcinogenic and interact in various ways with important macro-molecules (Tr. 3328).

93. Relying principally on laboratory studies, Dr. Malins testified that accumulated hydrocarbons are extensively converted into a variety of other products (metabolites) in marine organisms and that some of these metabolites were potential mutagens and carcinogens (Testimony at 2, NOAA Exh. 62). He asserted that the uptake and metabolism of ingested

petroleum products is associated with a number of alterations in the viability of marine organisms, including the formation of pathological lesions, disruptions in biochemical systems and changes in behavioral responses (Id. at 3). He stated that studies suggest that complex mixtures of aromatic hydrocarbons are converted to metabolic products which are retained for significant periods in marine organisms, that certain of the aromatic hydrocarbons in petroleum, such as the procarcinogen benzo[a]pyrene, would be expected to yield arene oxides which are known to be ultimate carcinogens in a host of mammalian systems and that it was reasonable to assume that metabolite formation in the case of certain accumulated petroleum hydrocarbons may ultimately lead to neoplastic lesions or other morphological changes in exposed populations (Id. at 11). He indicated that even under conditions of depuration as much as five to ten percent of [petroleum hydrocarbon] metabolites would remain in the organism (Tr. 3322-24). Dr. Page disagreed with Dr. Malins, being of the belief that Dr. Malins had relied almost totally on studies performed by his own laboratory and overlooked or ignored key references providing a balanced review of literature in the field, that laboratory studies cannot be extrapolated to what might occur in an actual oil spill and that laboratory results which are not confirmable in the field must be questioned as to their relevance to the real world (Rebuttal testimony at 10, Pittston Exh. 46; Tr. 1107). As an example of studies cited by Dr. Malins which had little relevance to real world conditions, Dr. Page referred to a study by Hawkes in which the eyes of fish fed crude oil for a year developed cataracts. Dr. Malins failed to mention the one-year period and Dr. Page stated that exposure to an unweathered product for such a length of time in the real world is highly improbable (Id. at 11). Dr. Page also disputed Dr. Malins' testimony to the effect that it was reasonable to assume that metabolite formation in the case of certain accumulated petroleum hydrocarbons may ultimately lead to neoplastic lesions or other morphological changes in exposed populations, stating that this assertion was not supported by field observations of oil spill sites and that there was evidence contradicting Dr. Malins' conclusion. The evidence referred to was work accomplished by Drs. Gilfillan and Page on an oil spill site in Searsport, Maine where the incidence of gonadal tumors in softshell claims did not correlate statistically with hydrocarbon concentrations either in the clams or the sediments from which they were taken. Mr. Robert Clark, who was completing the requirements for a Ph.D. in oceanography at the time his testimony was submitted, supported Dr. Page in part, stating that laboratory experiments provide data which can be used to suggest, but not completely predict, the effects of an oil spill on the environment (Testimony at 7, NOAA Exh. 66).

94. Petroleum is a naturally occurring mixture of organic compounds formed from the partial decomposition of animal and plant matter over geologic time (Testimony of Robert C. Clark at 6, 7). Crude petroleum contains tens of thousands of different chemical compounds and a precise definition is not possible because no two samples are exactly alike (Id., Tr. 1068). Crude oils consist primarily of hydrocarbons, but may contain as much as 50% polar organic compounds (Tr. 3308-09; Pollution of the Marine Environment, NOAA Exh. 63 at 33). These compounds because of their relatively low volatility, their thermal instability, or both, are not quantifiable by gas chromatographic or most state of the art techniques and

are, virtually undetected in routine tests (Tr. 3309; Graph, NOAA Exh. 17). Although these polar organic compounds can be analyzed by high performance liquid chromatography, this is not applied in the routine analysis of marine samples and there are many toxic chemicals in the marine environment which may be undetected (NOAA Exh. 63 at 33; Tr. 3325). Dr. Page agreed that oxidized products of petroleum hydrocarbons (what is left over after petroleum is degraded chemcially) are not routinely analyzed but asserted that the P&I (polars and insolubles) fraction could be weighed and its amount determined (Tr. 1059). In further testimony, he asserted that the amount of polars and insolubles was estimated during liquid chromatography (Tr. 1067-68). Dr. Malins testified that the real issue in terms of environmental pollution was to distinguish or separate highly complex polar compounds associated with petroleum from those compounds which are not part of petroleum but biogenic or coming from some other source (Tr. 3312, 3320, 3329). He stated that it was erroneous to assume that the limited number of hydrocarbons separable by gas chromatography was an absolute index of petroleum pollution (Tr. 3317). Regarding these undetectable or inseparable petroleum hydrocarbon fractions, Dr. Malins indicated that the most that could be said was that they were potentially harmful (Tr. 3330). See also Tr. 3310.

95. The biological effects of oil can generally be viewed as being of two types: (1) the smothering and coating of flora and fauna during the initial release of oil and (2) the less visible but destructive effects of oil being released into the environment (Testimony of Dr. Vandermuelen at 15, 16). The lighter fuels, consisting primarily of the low boiling point molecules which dissolve more readily in water, are generally considered to be more toxic (Id.) Although these lighter fuels are more volatile and evaporate more rapidly, they also mix readily in the water column. Dr. Vandermuelen asserted that oil within the water column was found to persist for two to three weeks after the Amoco Cadiz wreck (Rebuttal at 21). Oil begins weathering or undergoing physical and chemical changes as soon as it is released into the water (Clark Testimony at 4) and there is no evidence that the oil cited by Dr. Vandermuelen as persisting following the Amoco Cadiz spill contained normal quantities of more volatile fractions. Dr. Vandermuelen indicated that it was a choice between toxicity and carcinogenicity or mutagenicity because the larger, less volatile hydrocarbon compounds have potential carcinogenic or mutagenic properties. This latter assertion was disputed by Dr. Page who cited studies to the effect that biodegradation of aromatics in sediments has been demonstrated and that no actual field observation of mutagenic or carcinogenic pressure on biota as a result of petroleum has been found (Rebuttal testimony at 8).

96. According to Dr. Sherman, Dr. Gilfillan made five assumptions in concluding that the effects of an oil spill in the Bay of Fundy on zooplankton and consequently on whales and their food supply would be minimal (Testimony at 1, 2):

(a) The first assumption was that the residence time for toxic petroleum hydrocarbons was minimal and that oil will be rapidly diluted and mixed in the water column. The lighter petroleum hydrocarbons are the more toxic and at the same time more volatile. However, they are also more soluble and this may contribute to their persistence in the water column. That oil is rapidly diluted and mixed in the water column is supported by the record.

(b) The seond assumption was that the mortality of zooplankton caused by oil will be made up rapidly. Because of the normal patchy distribution of zooplankton (distribution of oil following a spill would also not be uniform) and the rapid regeneration rates of zooplankton at least during the period April through October, zooplankton would recover rapidly from effects of an oil spill during that period.

(c) The third assumption is that zooplankton populations in the Bay of Fundy are low and that accordingly, production of such foods for fish and whales is also low. While this assumption is accurate for much of the Bay of Fundy during much of the year, it is not true for the Grand Manan Channel, the area eastward from Grand Manan toward Nova Scotia (the entrance to the Bay of Fundy) during the late summer and fall when tremendous swarms of euphasids and copepods inhabit the area.

(d) The fourth assumption is that the food of whales would not be depleted by an oil spill and the impact of a spill would be transitory. The patchy nature of zooplankton, the fact that an oil spill would not uniformily cover the area and the rapid regeneration rates of zooplankton at least during the period April through October have previously been mentioned. There appear to be permanent stocks of zooplankton in the Bay of Fundy including "shrimp feed" or krill, food for the herring and the right whale. It is possible that an oil spill would have a greater impact on such zooplankton and that these stocks would not be rapidly replenished from the Gulf of Maine.

(e) The fifth assumption is that plankton contaminated with oil can cleanse itself rapidly. There is no doubt that copepods and probably other zooplankton can cleanse or depurate themselves of oil when placed in clean water. It is hypothesized, but not established under actual spill conditions, that the excreted oil products may be harmful to organisms ingesting such products and that metabolic products remaining from the ingestion of oil may be more harmful to the organism than the oil.

97. The effects of an oil spill depend at least in part on its trajectory once a spill occurs. Dr. Malcolm Spaulding, an expert witness for NOAA, performed both single and multiple trajectory analyses for a hypothetical 13,000,000 gallon crude oil spill released over a five-day period at a site 2.5 miles off of the coast of Campobello Island (Testimony at 3, NOAA Exh. 84). For a summer spill, high probability impact areas include Grand Manan Island, Campobello Island, internal bays and passages of the Quoddy Region, the northern coast of Washington County, Maine and the coast of Charlotte County, New Brunswick. Lesser probability impact areas included the south-western coast of Nova Scotia and the mid-to-southern coast of Washington County, Maine. During the winter, the probability of impacts to Canadian coastlines is less due to the prevailing winds. Less oil is likely to be deposited on shorelines from a winter spill than from a summer spill. A

typical large spill will deposit a considerable amount of oil in the water column. Subsurface oil from a typical hypothetical 13,000,000 gallon spill at the site mentioned above will cover an area of 500 square kilometers, assuming a depth of ten meters, within ten days from the start of a spill. Although all of these scenarios show the area around Grand Manan (an area of high zooplankton concentrations at certain times of the year) to be within the zone of high probability of impact, certain caveats are in order. The condition that can vary the most is the velocity, duration and direction of the wind and spill simulations for at least single event models are specific to the wind record employed, no attempt being made to make wind data used in the model correspond to seasonal or monthly averages. Model predictions do not address detailed residual and tidal patterns in Passamaquoddy Bay and Head Harbor Passage. Because of the coarse spatial resolution of the model, Dr. Spaulding recognized that the disposition of oil at specific shoreline points, i.e., Grand Manan, New Brunswick, Campobello, should be viewed with caution (Id. at 41). He asserted, however, that the general trend in terms of area impact appeared reasonable. Oil weathering was accounted for by using a predetermined cut-off period of 50 days. Although this was stated to be conservative residence time for spills at sea based on the Campeche (Gulf of Mexico, Ixtoc I) blowout, this spill was several million barrels over many months (Kaulakis, Pittston Exh 58 at 4, 5) and can hardly be compared with the grounding or wrecking of a tanker of whatever size.

Risks of An Oil Spill

98. The risks of an oil spill from tanker groundings, rammings, or collisions would not seem to be separable from navigational hazards, weather conditions, ship traffic, etc. Because there was no data base for Eastport save the knowledge that a large vessel has occasionally safely navigated those waters (Head Harbor Passage) and because worldwide accident statistics did not account for variables attributable to different ports, ships, traffic and weather conditions, etc., the FEIS concluded that probabilities derived from such statistics could not be applied to a particular port (Vol. II at VI-36). The FEIS also concluded that even if it was possible to calculate a probability or frequency figure of a major or catastrophic spill occurring, e.g., once every 60 years, there was no way to determine if the spill would occur during the first or 60th years or at some point in between. For these reasons, the FEIS made no attempt to calculate the probability of a major oil spill but concluded: "However, the possibility (and probability) of severe spills always exist near oil refineries that receive crude oil from tankers. The proposed Eastport refinery ultimately will experience its share of severe spills as, have other comparable refineries." (Id. at VI-38).

99. Undaunted by the difficulties perceived by the authors of the FEIS, Engineering Computer Opteconomics, Inc. (ECO) used worldwide and domestic oil tanker accident data and tank barge accident data from 44 major U.S. ports to estimate the statistical risk of petroleum spills presented by the operation of the proposed refinery (Testimony of Virgil Keith, NOAA Exh. 32 at 8). ECO considered that excluding catastrophic spills (defined

as those where there is a total vessel loss or an outflow of 365,000 barrels (50,000 long tons) or greater, there would be an oil spill of an average size of 6,470 barrels on an average of once every 5.3 years and that there was a significant risk (0.48) of a catastrophic oil spill in the project area over an assumed 25 year life of the refinery. Mr. Keith maintained that these estimates were conservative because they were based on a typical port handling the volume of vessel traffic expected at Eastport when, in fact, Eastport was considerably more hazardous than most other ports in the world (Keith, Testimony at 8; Tr. 2190). Although Mr. Keith maintained that ECO had used the lower New England accident rate rather than the world-wide accident rate in calculating the probability of a PCI per port call for Eastport, the New England data included only collisions, rammings and groundings while the world-wide data used for comparison purposes included in addition other pollution causing incidents such as fires, explosions and structural failures (Tr. 2089, 2102, 2389-93). If the "all other" category is removed from the world-wide data, the world-wide rate would be the lowest and applying that rate to Eastport, the mean time between spills should have been 7.1 rather than 5.3 years (Tr. 2404-13; NOAA Exhs. 33, 39, 40 and 41). This rate is specific to Eastport only in the sense that it is based on the anticipated annual number of calls by barges, product and crude carriers. Calculating an accident probability rate for a particular port would not be meaningful because the data base is so small (Tr. 2336-37, 2414, 2432-33). This, of course, is especially true for Eastport which has no prior history of extensive large vessel traffic. Another factor considered to make the

ECO comparison of New England and world-wide accident data questionable is that the world-wide data includes pollution causing incidents (PCIs) involving tankers of 2,000 gross registered tons and greater, while the New England data includes only tankers of 10,000 GRT and greater (Tables IV-1 and I-4, NOAA Exh 33).

100. Using the port call method of computing accident rates results in large tankers having a higher accident rate than smaller tankers (Tr. 2093-94; NOAA Exh 33 at I-11-12). The port call method has been severely criticized because most spillage occurs at sea rather than in port and because larger tankers with lower unit transportation costs make longer voyages and have fewer port calls. (Tanker Size and Spill Risk, Pittston Exh 61 at 6; An Analysis of Oil Tanker Casualties 1969-1974, Pittston Exh 60 at 17, 18). There is evidence that larger tankers have no more spills per arrival than smaller tankers (Id. at 4). A better measure of exposure would be per ton of oil carried or delivered. Using this criterion, larger tankers clearly have a lower ratio of accidents to total tonnage as well as a lower ratio of PCIs to total tonnage than smaller tankers (Pittston Exh 61 at 7, 8). It is, of course, true that larger tankers have the potential for larger spills. Although recognizing that spill volume statistics must be treated with caution, the cited paper nevertheless concludes that using larger tankers will not result in a greater volume of oil spillage than use of smaller tankers. Mr. Keith testified that he agreed with the criticisms of the port call method of measuring tanker accidents and PCIs (Tr. 2349-50). He concluded, however, that eliminating accidents that occurred more than 50 miles from Eastport or at sea had taken these

criticisms into account. This contention ignores the fact that the accident rate is in terms of port calls (defined as a transit in and out of a port) and in Mr. Keith's own words seems to be restricted to accidents at entrance ways, coastal piers and harbors (Tr. 2420-21). It is noted that, although the ECO study (NOAA Exh 33 at I-11) states that when tanker accidents are compared on a port call or equal exposure basis larger tankers have a higher accident rate than smaller tankers, a paper of which Mr. Keith was one of the authors (Tankers and the U.S. Energy Situation: An Economic and Environmental Analyses, Appendix D to NOAA Exh 34) states that contrary to popular belief, very large tankers (80,000 dwt and upward) can transport a given quantity of oil over a given distance safer than their smaller counterparts (Id. at 359). In addition, the cited paper states that historical data clearly show that tanker accidents and associated pollution incidents are a function of traffic density and water depth and not tanker size.

101. In computing the probability of a catastrophic spill (as defined in finding 101) for Eastport, worldwide data over a six year period was used indicating a catastrophic spill occurred once in every 16,000 to 20,000 port calls (Tr. 2388; Table IV-4 and accompanying text, NOAA Exh 33). ECO calculated that there was the probability of a catastrophic spill at Eastport once every 27 years or presented in terms of an assumed refinery life of 25 years, the risk of a catastrophic spill was 0.48 (I-12 & -13, NOAA Exh 33). ECO did a similar study on the probability of oil spills in connection with the proposed Hampton Roads Refinery (Pittston Exh 63). Because most of the port calls at Portsmouth are made

by barge and only self propelled tankers are considered in determining catastrophic spills, the expected number of tanker annual port calls is less than at Eastport (223 as compared with 387) and it was determined that a catastrophic spill would occur once in approximately 50 years (Tr. 2425-32; Pittston Exh 63 at I-6). Considering an assumed refinery life of 25 years, the probability of a catastrophic spill during that period was considered to be fifty-fifty or 0.5. Similarly, for Eastport, 25 is approximately 93% of 27 and the probability of at least one catastrophic spill during the life of the refinery was determined to be 0.48 (Tr. 2431-32). It should be noted that the definition of a catastrophic oil spill can lead to anomalous results in that a spill of less than 365,000 barrels from a large vessel would not be a catastrophy, while the sinking of a 35,000 or 40,000 barrel tanker would be considered a catastrophy (Tr. 2398-2400).

102. Admiral Winford W. Barrow, U.S. Coastguard Retired, agreed with EPA's conclusion in the FEIS that worldwide statistics and averaging techniques could not be applied in any meaningful way to determine the probability and size of expected spills at particular ports (Rebuttal Testimony at 18, Pittston Exh 18). He asserted that averaging techniques may be useful to provide comparisons of terminal performance and the general overall performance of different types of vessels, but that any comprehensive and meaningful oil spill study for the development of spill probability and expected spill size must be concerned with site specific factors such as tanker fleet composition, density, navigation systems, route characteristics, operational conditions, regulatory regimes, etc. Moreover, he

pointed out that the criteria for reporting incidences of pollution or shipping accidents varied widely from country to country and that even the U.S. system, which is as good or better than most, produced data that left much to be desired (Id. at 19). Admiral Barrow was of the opinion that comparisons with established ports that have some similar characteristics would provide a more valid means of estimating casualties and oil spill probabilities. He stated that the Port of Milford Haven, Wales, was an excellent candidate for this purpose and noted that because of its excellent supervisory and regulatory system oil spill statistics and casualty information would be more accurate than from ports lacking such systems.

103. Dr. Thomas Stewart, an expert statistical witness for NOAA, analyzed casualty related oil spill data from the Port of Milford Haven and considered that it was consistent with the results of the ECO study used in determining spill probabilities for Eastport (NOAA Exh 31 at 3, 4). Dr. Stewart also purported to confirm the validity of the ECO study and use of the port call method of calculating casualty related oil spill probabilities by using worldwide data on volume of oil transported (estimating the amount carried in tankers of each class expected to be used at Eastport) and applying casualty and spill rates to the volume expected at Eastport (Id. at 7-10). Because probabilities so obtained equal or exceed those obtained by use of the port call method (Id. Table 2), the essential validity of the ECO study is supposedly established. Whatever may be the abstract validity of these statistical exercises, it is clear that acceptance of their central premise, i.e., that this data can meaningfully be applied to Eastport, requires that no recognition be given to the conclusion in

the ECO paper (Appendix D, NOAA Exh 34) referred to in finding 102 that very large tankers can transport a given quantity of oil over a given distance safer than their smaller counterparts. Moreover, Dr. Stewart was clearly troubled by the lack of consideration of site specific characteristics, e.g., weather, current, channel configuration, navigational aids, etc., which would effect operations at Eastport and recommended that emperical modeling, real-time simulation and systematic expert judgment be used to determine the risks involved (Testimony at 10, 11).

Safety of Navigation of Head Harbor Passage

104. The FEIS relied on the opinion of the Coast Guard that the channel through Head Harbor Passage was adequate for safe navigation of 250,000 DWT tankers (FEIS, Vol. II at VI-36). The Coast Guard opinion was expressed in a letter, dated March 28, 1977 (Index, Item V-16; CLF Exh 6) which confirmed an earlier opinion of August 23, 1976 (Campobello Exh 3) that the channel was adequate for safe navigation of 250,000 DWT tankers and those of lesser size, provided certain provisions were made to assure safe passage. The four provisions referred to were: (1) that the channel passage area depths, configurations and current data shown on nautical charts and surveys be confirmed by hydrographic survey, (2) provision for a navigation system wherein the existence and movement of all traffic in the area could be monitored, communicated with and scheduled, (3) provision for means to control movement of tankers in the event of steering and/or propulsion failure during transit and (4)

development and strict adherence to an operating procedure for tanker passage. Concerning objections to the project expressed by the Canadian Coast Guard the U.S. Coast Guard stated that if the provisions cited above were carried out, there would be no technical basis for further objection by the Canadian Coast Guard (Id. at 4). In a letter, dated December 31, 1979 (CLF Exh 7), the Coast Guard, inter alia, clarified its position on provision (2) above to state that whatever the theoretical capability of any installed precise navigational system, there would indeed be meterological conditions which would preclude safe transit - in other words, the Coast Guard was of the opinion that Head Harbor Passage could not be safely transited under all visibility conditions (Tr. 4404-05).

105. At the time the opinion referred to in the previous finding was rendered, the Coast Guard had available to it and considered (Tr. 4380-84):

a. testimony of Henry Steinorf of the Frederick R. Harris, Inc. and the Pittston Company Marine Facilities Plan: Eastport Location (Appendix Item 7);

b. testimony of Keith Dickinson, ITT Decca Marine;

c. testimony of Captain Alister Crombie;

d. testimony of Captain David Kennedy, International Pilots Association;

e. testimony of Captain Earl Allen, Moran Towing Company;

f. testimony of Captain Tallak "Toc" Nilsen, Goltus Larsen, Inc.;

g. testimony of Captain Guilford Dudley, Harbor master, Milford Haven;

h. testimony of Captain Maynard Morrison;

i. Recommended Electronics Navaids for Navigation and Berthing of VLCC Class Vessels at Eastport, Maine, dated April 12, 1973, prepared by ITT Decca Marine, Inc. (Appendix Item 10);

j. Charts No. 8091 and 13328 (Pittston Exh. 1) for Eastport and Head Harbor Passage;

k. moored current meter data and measurements as taken from the FEIS;

l. determination of the maximum current speeds in Proposed Deep Water Port at Eastport, Maine by Richard Hires (February 1976);

m. the current speeds at VLCC Piers (December 3, 1976) by Dr. David Holt, MIT and a report entitled "The Current Pattern Around VLCC moored off Eastport, Maine" (November 5, 1976).

n. Environmental Assessment Report "Proposed 250,000 Barrel-Per-Day Fuels Refinery and Deepwater Terminal at Eastport, Maine" (March 8, 1976) (Item III-17);

o. Dynamic Behavior of Tankers During Transit of Head Harbor Passage (November 1976) and Supplementary Computer Simulation Studies on Tanker Transit in Head Harbor Passage (February 1977) by Dr. Haruzo Eda (Pittston Exh. 51); and

p. draft EIS.

References to testimony are to that before the Maine Board of Environmental Protection (Appendix Item I). This, together with internal correspondence (Campobello Exhs 2-4, CLF Exhs. 8, 12-14; ALJ Exh. 1), establishes that the Coast Guard opinion that Head Harbor Passage could be safely navigated by tankers of up to 250,000 DWT was not arrived at in a cursory or casual manner.

106. The objections by the Canadian Coast Guard to the Pittston project referred to in finding 10 are contained in an undated, unsigned report entitled: "Eastport Ship Terminal System Accessibility and Ship Safety, Preliminary Analyses and Assessment" (NOAA EXh. 35). This report reluctantly concludes that "With highly sophisticated aids to navigation and generous tug assistance, Head Harbor Passage could probably be negotiated by a well-found, well-equipped, well-manned and carefully navigated VLCC of the 250,000

DWT Class during daylight hours in good visibility" (Id. at 7). However, the report concludes that the degree of navigational risk associated with continuous year-round supply of crude oil and product distribution from the refinery poses a serious threat to the ecology of the region. In support of this conclusion, the report cites a U.S. Army Corps of Engineers study "Atlantic Coast Deep Water Facilities Study," which contains the following: "However, its [Head Harbor Passage] approaches are winding; its currents extremely difficult to judge and the area has the highest number of fog days along the coast. Highly sophisticated navigational controls would have to be installed if traffic in this harbor were ever to become heavy" (Emphasis supplied). As indicated in finding 100 above, the lack of heavy traffic is one of the factors tending to mitigate navigational risks of the project. The Canadian Coast Guard stated that the risk of pollution remains high and is environmentally unacceptable (Id. at 8). It is noted that the Certified Index indicates that the Canadian Coast Guard Report was dated or submitted in November 1976 (Item VI-12B) and that the Canadian Government had previously expressed opposition to the Pittston project on environmental grounds (Letter from the Canadian Embassy to the U.S. State Department, dated June 7, 1973, Item VI-16).

107. Computer simulation studies carried out by Dr. Haruzo Eda of Stevens Institute of Technology, Hoboken, New Jersey, have confirmed that 250,000 DWT and smaller tankers, can safely navigate Head Harbor Passage (Testimony of Dr. Eda Pittston, Exh. 51). Computer simulation involves the utilization of a series of comprehensive and complex mathematical equations, including hydro-dynamic co-efficients, to define and account for the effects of wind, wave, current, rudder and throttle activity, etc., on ship behavior

(Exh. B to Pittston Exh. 51). Dr. Eda's initial studies, conducted in 1976, concluded that 250,000 and 80,000 DWT tankers can maintain a trajectory close to the desired track in the Channel [Head Harbor Passage] in currents up to at least 2.7 knots without tug assistance and without anticipatory control input to account for the effects of wind and tide (Id. at 2). A trajectory close to the desired track means that the vessel at no time deviated enough from the center of the channel to approach at all closely the edge of the designated channel. Dr. Eda further concluded that winds up to at least 20 knots from the most adverse directions introduced no serious problem in ship control during transit under fully loaded conditions and that with anticipatory control input such as provided by a pilot, the deviations observed in these studies would be even less. The validity of the mathematical models has been verified by comparing computer predicted responses to a full-scale sea-trial results (Id. at 5; Rebuttal at 3, Pittston Exh. 52). In an addendum, dated February 1977, Dr. Eda reported the results of supplementary computer simulation studies of tankers transiting Head Harbor Passage (Exh. C to Pittston Exh. 51). The results of these additional computer simulation runs indicated that a fully loaded 250,000 DWT tanker inbound in Head Harbor Passage could maintain its trajectory close to the desired track without difficulty and without tug assistance in 60 knots of wind (wind in a SE or NE direction). During the outbound transit, the 250,000 DWT tanker under ballast conditions maintains its trajectory close to the desired track under beam wind conditions of up to 35 knots. This was without tug assistance and with such assistance until the tanker's speed was built up the limiting wind conditions should be higher. Similar conclusions were reached with respect to 80,000 and 150,000 DWT tankers in currents up to 2.7 knots and 20 knot winds.

108. The validity of Dr. Eda's studies has been attacked upon the ground, inter alia, that they do not properly account for the human factor (Rebuttal testimony of John Senders, NOAA Exh 14) and upon the ground that they show only the technical feasibility of transiting Head Harbor Passage but not the actual risk of doing so (Testimony of Virgil Keith, NOAA Exh 32 at 5, 6). According to Dr. Eda, his mathematical simulation model included control commands equivalent to those expected from an average pilot and anticipatory control in negotiating turns in the waterway (Exh B to Eda Testimony at V-9, 20; Exh C at 1; Tr. 1399, 1400-01, 1408-10). Anticipatory control to counteract the effects of wind and currents was not included and in this sense, it was Dr. Eda's opinion that anticipatory control by a human pilot would make the deviations from the desired track shown in his studies even smaller (Tr. 1412-14). It is true that under mathematical simulation, the precise location of the ship relative to the channel was always known and that accurate and precise information on the vessel's heading and rate of change of the heading was always available (Tr. 1410-11, 1430-32). In actual conditions this may not always be true (see, however, finding 127 below) and in Mr. Sender's opinion a failing of Dr. Eda's work was the failure to include or account for a threshold of perception on the part of the pilot (Rebuttal Testimony at 8). He stated that the usefulness of Dr. Eda's work was seriously limited by use of a model of a human pilot which had no statistical variation in its character or response (Id. at 9). These criticisms are not without merit and it is noted that Panel H-10 of the Society of Naval Architects and Marine Engineers, of which Dr. Eda is a member, in its

Proposed Procedures For Determining Ship Controllability Requirements and Capabilities (NOAA Exh. 15) stated that considering the variety of human factors effecting shiphandling, direct computer calculations are not recommended to represent shiphandler reactions in port entry type situations (Id. at 4-6). This paper is dated 1975 and a supplemental paper, Ship Maneuvering Studies (Attachment to Eda Rebuttal Testimony, Pittston Exh. 52) given in 1979 states with respect to an 88,000 DWT tanker negotiating a bend at St. George, Staten Island, New York that when the inherent hydrodynamic characteristics of the ship were adequately represented in the computer simulation model, the rudder commands produced during the simulation run were similar to those observed in actual ship trials in order to negotiate the bend (Id. at 12). This would seem to demonstrate at the very least an encouraging correlation between computer simulations and the results of actual sea trials including a harbor or port entry situation (Eda Rebuttal at 5). With respect to Mr. Keith's attempted distinction between technical feasibility and actual risk, Dr. Eda agreed that his studies were designed to analyze the technical feasibility of vessel traffic in Head Harbor Passage, but pointed out that analysis of the technical feasibility of such traffic gave an excellent indication of the actual risk involved (Id. at 8).

109. The Main Board of Environmental Protection in its Order dated March 12, 1975, required real time simulation studies to confirm the navigational feasibility of vessel traffic in Head Harbor Passage prior to the commencement of operations (Item VII-2). This Order remains in effect and Pittston fully intends to and will be required to comply therewith prior to sending

loaded tankers into Head Harbor Passage and commencing refinery operations. Opponents of the project contend that Pittston should be required to conduct real time simulation studies before being licensed to proceed with construction. Real time simulation studies utilize mathematical models such as those used by Dr. Eda in conducting computer simulation studies (Eda Rebuttal at 2, 3). In fact, CAORF (Computer Aided Operations Research Facility, Appendix, Item 23, Brochure, Index, Item V-2), owned and operated by the Maritime Administration of the U.S. Department of Commerce and the facility likely to be used by Pittston to conduct real time simulation studies, uses mathematical models supplied by Dr. Eda. The difference between real time simulation and computer simulation is that the former measures and records the response of the human pilot under simulated conditions of weather, traffic, visibility, etc. CAORF is primarily dedicated to research and as pointed out by Dr. Eda, real time simulation is a useful tool in training pilots especially for specific ports and for research work on specific problem areas in specific ports (Rebuttal at 2,3). Dr. Eda testified, however, that for obtaining an overall perspective of the suitability of a particular channel for ship traffic of specific sizes under particular conditions off-line computer studies were more than adequate. In this connection, it is noted that real time simulation studies were conducted in the Netherlands for the Port of Valdez, Alaska, prior to the opening of the Trans-Alaska Pipeline, not for the purpose of determining whether VLCC traffic to that port was feasible, but for the purpose of determining limiting conditions of wind, tug assistance, etc. (Appendix C, NOAA Exh.34).

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110. Pittston employed Frederic R. Harris, Inc., consulting engineers, to perform engineering studies and surveys to determine the feasibility of constructing the proposed refinery and marine terminal at Eastport and to examine the navigational aspects of product and crude tankers of the size contemplated (crude tankers of up to 250,000 DWT) transiting Head Harbor Passage. In an initial report (Technical and Operational Feasibility Study For VLCC Terminal Facilities Proposed Refinery, Eastport, Maine, "Harris I," dated May 9, 1972 (see Appendix I, Vol. VI at 1020), to Metropolitan Petroleum Company, a wholly owned Pittston Subsidiary, Frederic R. Harris concluded that construction of a marine terminal to handle crude oil tankers up to 250,000 DWI and product tankers up to 50,000 DWT at Deep Cove was technically feasible (Index, Item V-1). The study stated, however, that during the first year or several years, severe restrictions may have to be imposed on the marine terminal operations due to the nature of the approaches from the sea, swift currents in the passages and often prevailing adverse weather conditions (Id. at 1) "Harris I" further stated that while the approach from seaward to Deep Cove terminal was feasible, a high order of seamanship and prudence must be exercised to avoid placing the vessel in a difficult position (Id. at 2). Respecting currents, the study stated the relatively high range of tides, coupled with relatively narrow inlets into the bay, gives rise to strong tidal currents which were reported to attain a velocity of five knots at times (Id. at 5). The study included summaries of interviews with navigation experts (Captain Tallak Nilsen (finding 105), Captain Harry Breitenfeld (finding 127, infra), Captains Stefanescu and Hjorth of National Bulk Carriers, a Captain Musser of Texaco and a Mr. McIntyre of National Salvage Association, who was concerned with underwriting aspects of navigation to the proposed terminal. While Captain Musser apparently was of the opinion that the difficult approach made the site not feasible from a navigational

point of view, the majority was of the opinion that the site was feasible provided extreme caution was exercised (Id. at 10-13). It is noted, however, that the principal concern reportedly expressed by these individuals, including Captain Musser, was the lack of an adequate turning basin for VLCCs upon leaving the berth and it is clear that the berth referred to was in Deep Cove. See Site Plan Figures 2 and 5. Present plans call for the VLCC berth to be off of Shackford Head (Broad Cove) and only berths for smaller product tankers will be in Deep Cove.

111. Pittston characterizes "Harris I" as cursory and preliminary (Reply Brief at 71). This characterization finds support in the testimony of Mr. Steinorth before the Maine BEP (Appendix I, Vol. VII at 1573), wherein Harris I was described as a limited budget "go or no go" type report. (See also Kaulakis, Appendix I, Vol. X at 2253). The Pittston Company Marine Facilities Plan Eastport Location, dated March 23, 1973, submitted by Frederick R. Harris, Inc. (Appendix, Item 7), clearly contemplated that the VLCC berth would be off of Estes Head (Site Plans Figures 5-8, Id. at 25-28). Turning basins at Estes Head for VLCCs and at Deep Cove for product tankers were considered acceptable (Id. at 23). The proposed VLCC berth was moved to Shackford Head, as indicated in the preceding finding, apparently because of concern expressed by the Maine BEP as to the effects of currents on the ability to contain oil spills. In any event, the cited study (Harris II) concluded that the approach from the sea via Head Harbor Passage and Friar Roads to Estes Head and Deep Cove is satisfactory for the type and size of vessels specified providing navigational aides are installed, and providing recommended operational procedures were followed. Tug assistance was to be provided from the

time a VLCC enters or leaves the channel and during berthing and deberthing operations. Lighted buoys and radar reflectors were to be installed to mark the limits of the navigable channel. An electronic guidance system consisting of land based radar and electronic range finders were to be installed and operated to provide further navigational guidance. Recommended operating procedures until experience justified a relaxation included the following: (i) berthing and deberthing of tankers would be carried out during slack tide, (ii) vessel transit between Head Harbor Passage and the piers would take place only during daylight or clear moonlighted hours, (iii) tankers would not enter or leave Head Harbor Passage when visibility was less than one mile and (iv) tankers waiting for a berth would not be allowed to anchor in Eastport waters.

112. "Harris II," in common with "Harris I," states that tidal currents in Head Harbor Passage may at times reach a velocity of five knots (Id. at 10). Because opponents of the Pittston project emphasize currents as among the factors making navigation of Head Harbor Passage and berthing of tankers of the size contemplated too hazardous, the evidence in this regard must be reviewed in detail. Current observations over one or more complete tidal cycles in Head Harbor Passage have been made by Forrester (1958) and by Loucks et al. (1974). Current meter stations, F for Forrester, and L for Loucks, are shown on Figure 1 (Rebuttal Testimony of Dr. Richard Hires, Associate Professor of Oceanography at Stevens Institute of Technology, Pittston Exh. 45). This shows that four of the meter stations (L-2, F-57, F-54 and L-4) are very close to the proposed ship track through Head Harbor Passage, while two (L-3 and F-58) are to the west of the track. Forrester's observations at stations F-57 (between Campobello and Casco Bay Islands) were made at 10 and 30 meter depths and at F-54 (between Indian Island and

Man-o-War Head, Campobello, almost directly opposite Western Passage), observations were made at 5, 10 and 30 meters depths (Id. at 5-7). Current speed and direction were measured at half-hour intervals (current meters suspended from boats) over one or two complete tidal cycles (12 1/2 or 25 hours). Dr. Hires concluded that there did not appear to be significant variations between current characteristics at different depths or on different days. At Station, F-54 he determined that peak ebb currents were 0.6 knots stronger than peak flood currents and that residual currents at all depths were in the ebb direction with speeds ranging from 0.1 to 0.3 knots. He also concluded that during the ebb, currents at F-54 have a component to the east of the proposed ship track (presumably as a result of outflow through Western Passage), that the angle between the ebb current and the track is about 27° and that during the last hour of the ebb, the component of the current perpendicular to the ship track would have a maximum velocity of about one knot (Id. at 7). At Station F-57, the peak flood current is about 2.5 knots and the peak ebb current is about 2.1 knots. Residual current at this station is in the flood direction with a magnitude of less than 0.1 knots and directions of the flood and ebb are very nearly parallel to the proposed ship track, i.e., the cross current component nearly vanishes.

113. Loucks et. al. made measurements from moored current meters over a longer period of time at locations L-2 (very close to the proposed ship track between East Quoddy Head and Casco Bay Island) and L-4 (almost on the proposed ship track between Man-o-War Head and Eastport) (Tr. 980-81). At Station L-2 currents at five meters depth were recorded at five-minute intervals for a period of 25 days during August and September 1973 (Hires, Rebuttal at 9). Similar records were obtained during the same period at

L-4 at depths of five and fifteen meters. At station L-3 (to the west of the proposed ship track, below Casco Bay Island) measurements were made at 10 meters depth at 10-minute intervals for 106 days. The additional measurements did not reveal any major differences in the character of the currents. At Station L-2, peak ebb currents varied from nearly four knots at spring tides (maximum tidal ranges) to about two knots at neap tides (minimum tidal ranges) (Id. at 11). The variation in peak flood currents was considerably less with a range from 2.4 knots during spring to about 1.8 knots during neap tides. Thus during spring tides, peak ebb currents exceeded peak flood currents by more than one knot, while during neap tides the difference was as small as 0.2 knots. At Station L-4, peak speeds at five meters depth were, on the average approximately 10% less than currents at 15 meters depth. At this station, peak current speeds on the flood exceeded those on the ebb. During spring tides, peak flood currents with speeds up to three knots (five meters depth) exceeded the ebb currents by one knot. During neap tides, the peak flood currents at five meters depth exhibit speeds of about two knots which exceed the peak ebb currents by only 0.3 to 0.4 knots (Id. at 12, 13). The pattern at 15 meters is similar except that peak current speeds are slightly greater. On the ebb current directions at stations L-2 and L-4 are within five to ten degrees of being parallel to the proposed tanker track (Id., Figure 1). On flood tides, current direction at L-2 is slightly to the east of the proposed tanker track (at an angle of about 15°), while at L-4 flood direction is nearly 30° to the west of the proposed track. Ebb current directions at L-2 and F-57, which lie along the proposed ship track at a distance of about 3/4 of a nautical mile virtually coincide. Also, at stations L-4 and F-54 the flood current directions are virtually identical while on the ebb the current directions at these two stations differ by approximately 20° (Id. at 13).

114. Residual currents have been defined as what is left of original observations, e.g., at half-hour intervals, after averaging over a complete tidal cycle (Tr. 986-87). A more understandable definition is contained in the FEIS (Vol. II at III-42) "Residual currents are those which are not caused by tidal flow." Dr. Hires testified that from the measurements of Forrester and Loucks, it was clear that the average residual current was on the order of 10% of the speed of the peak ebb or flood currents (Testimony at 14). The sum of the average residual current and the tidal component forms the entire predictable or deterministic portion of the current observations. The non-deterministic or unpredictable component of the currents at a particular site represents the third and final component of the observed current velocities, which constitutes the variation in the measured current from the predicted current. Dr. Hires explained Loucks' method of determining what he referred to as the frequency of occurrence of the magnitude of change between successive measurements obtained at five minute intervals (Id. at 15, 16). At each station (L-2 and L-4) the observed velocity vector was broken out into an axial component (nearly parallel to the tanker track) and into a transverse component directed laterally across the channel. Secondly, current speeds in the axial direction were sorted by class intervals of 0.1 knots. For all observations contained within each class interval of axial speeds, the frequency of occurrence of current speed changes between successive measurements was obtained in class intervals of 0.1 knots, for both axial and transverse components. The results (presented in Table I at 18) show that from 69.4% to 89.0% of all current speed changes were 0.19 knots or less. It also showed that most of the larger variations (above 0.2 knots) were in the range of 0.2 to 0.39 knots (approximately 10% of measured peak ebb and

flood currents) and that the largest percentage of variations exceeding 0.6 knots was 2.1% at Station L-2 in the transverse component. Dr. Hires was of the opinion that the data available from two key stations (L-2 and L-4) along the proposed ship track, obtained by measurements at five-minute intervals, were adequate to determine current conditions including current fluctuations, and that it was unlikely that additional current meter stations along the proposed ship track would provide substantially different measures of unpredictable fluctuations (Id. at 19-21, Tr. 1009-11).

115. Dr. Ronald H. Loucks, an expert in oceanography and in dispersion of spilled oil at sea and the individual whose name is appended to the most recent of the current measurement reports referred to in the preceding finding, testified as to the dispersion of spilled oil following a simulated or imaginary spill in Head Harbor Passage (Testimony, NOAA Exh. 50). In making these predictions, he relied principally on the current measurements made by himself and others in 1973 and by Forrester in 1957. Dr. Loucks also testified that he did not think Dr. Hires had adequately represented his (Loucks') work insofar as the magnitude of the current fluctuations were concerned (Tr. 2873-74). His concern appeared to be that Dr. Hires testimony might be misleading. He indicated that Dr. Hires had described the magnitude of the fluctuations as being in the order of 5% to 10% of tidal currents whereas fluctuations of one knot or more had been determined in the Loucks' report at a station where the tidal current was 3.5 knots, making the fluctuation upwards of 30%. Moreover, he stated that the one knot or more current was transverse to the ship channel. As indicated in the preceding finding, what Dr. Hires actually testified was that most of the larger current speed changes were in the range of 0.2 to 0.39 knots or on the order of 10% of measured peak ebb and flood current speeds. Dr. Loucks'

data were to the effect that on 14 of the 153 occasions when the current fluctuation at Station L-2 (transverse current) runs 0.6 knots or greater (2.1% of the five-minute periods in 24 days) the current fluctuation was one knot or greater (Tr. 2897 - 99). He indicated that his concern over Dr. Hires' calculation of the 2.1% was that fluctuations of 0.6 knots or greater could occur daily and not be bunched in any particular period (Tr. 2899 - 2900). Dr. Loucks also expressed concern that his instruments were not equipped to measure surges or current fluctuations of less than five minutes duration (Tr. 2876-78, 2895-96). However, he could only speculate that surges greater than those measured over five minute intervals had occurred, stating that it was conceivable (Tr. 2876), he had used the same instruments in making current measurements where other refineries had been constructed (Canso Strait, Come-by-Change Bay, Tr. 2892-94) and he admitted to not having the background or experience to know whether the pilot of a VLCC would be greatly concerned with current fluctuations of less than five minutes duration (Tr. 2895-7).

116. The Forrester and Loucks' studies* referred to in the preceeding findings appear to be the only current measurements taken within Head Harbor Passage. The Loucks' measurements were taken over longer periods than Forrester's and are presumably more accurate (Tr. 2868). A summary of the Loucks' data (memo, dated September 2, 1976, Index, Item V-II at 6; see also FEIS, Vol. II at III-40), indicates minimum currents within Head Harbor

*Current measurements reported in the Loucks' study appear to have been made by Atlantic Oceanographic Laboratory and EG&G Inc. (FEIS, Appendix D, Vol. III). See however, FEIS, Vol. II, Figure III-16 at III-41, which indicates that only measurements at Station 5 opposite Broad Cove were made by EG&G Inc.

Passage of 1.2 knots and maximum currents of four knots. This provides no support for the often repeated assertion that currents within Head Harbor Passage (the area opposite Broad Cove is considered not to be part of the Passage) may at times attain speeds of five knots. In Dr. Hires' analysis of the Forrester and Loucks studies (finding 112), it was concluded that cross currents during the last hour of the ebb at station F-54 (opposite Western Passage) attained a maximum velocity of approximately one knot and that directions of the flood and ebb at station F-57 (between Campobello and Casco Bay Island) were nearly parallel to the proposed ship track. Nevertheless, the cited memo (Item V-II at 6) appears to be referring to Station L-2 (between East Quoddy Head and Casco Bay Island) when it states that cross-stream currents reach values as high as one knot. The channel at Casco Bay Island is 2,050 feet in width at mean low water according to the FEIS (Vol. II, Table III-9 at III-33), and is one of the areas where cross-currents would seem to be of prime concern. The referenced memorandum appears in part to be a verbatim copy of Canadian Technical Report No. 428 (1974), which incorporates the Loucks' study. It seems reasonable that maximum currents across or perpendicular to the proposed ship track would be experienced at the intersection of Head Harbor and Western Passages. Dr. Hires testified that the only substantial transverse vectors of current velocity occur opposite Western Passage at Stations F-54 and L-4 (Rebuttal Testimony at 20), and, if Dr. Loucks' study supported a finding of a one knot transverse current at Station L-2, it is curious that this matter was not addressed in his extensive testimony on redirect examination.

117. Mr.Charles Yentsch (identified, finding 90) testified without elaboration and without specifying a location that cross stream currents in Head Harbor Passage can be as high as one knot (NOAA Exh. 82 at 12). For this assertion he cited Canadian Technical Report No. 428 which as indicated (finding 115) relies on Dr. Loucks' work or study. In comments on the draft EIS submitted by Fisheries and Environment Canada (FEIS, Vol IV A at 91-12) it is stated that cross currents up to two knots develop at five locations along the proposed ship route: mouth of Head Harbor Passage, Harbour De Lute, Western Passage, Friar Roads and the berthing areas. No data to support this statement are cited. Mr. Virgil Keith (finding 99) went even further, asserting that cross-currents at Eastport were up to three plus knots (NOAA Exh. 33 at III-2; Tr. 2169-75). Mr. Keith cited no data to support the three knot cross-current figure and it appeared to be based on the supposition of a tanker being at 40° to the channel in a five knot current. Mr. Henry Steinorth, a civil engineer and Senior Vice-President of Frederic R. Harris, Inc., testified before the Maine BEP that a significant favorable aspect of Eastport is that there were virtually no cross-currents to contend with in bringing vessels to the proposed sites (Appendix I, Vol. II at 198). It will be recalled that Mr. Steinorth's testimony before the BEP was among the data reviewed by and relied on by the U.S. Coast Guard in concluding that Head Harbor Passage could safely be navigated by tankers of the size contemplated by Pittston (finding 105). It is found that currents perpendicular or across the ship track in Head Harbor Passage at no time exceed one knot.

118. The Eastport Ship Terminal System, Preliminary Analyses and Assessment by the Canadian Coast Guard states that within the confines of the proposed

Eastport ship terminal area, tidal currents of between three and eight knots are generated (NOAA Exh. 35 at 16). Source of the eight knot figure is apparently a 1977 report entitled "Alternative Site Study, Northeast Coast Liquified Natural Gas Conversion Facility", by Resource Planning Associates, Inc. for the Federal Power Commission in connection with a natural gas project proposed by Tenneco Altantic Pipeline Company. This report is not in the record, but is referred to in Mr. Keith's testimony (NOAA Exh. 32 at 14, 15). There is no evidence that the eight knot figure was derived from current meter measurements and no other evidence in the record to substantiate such a current speed. The FEIS (Vol. II at III-40) states that the maximum current at Station 5, opposite Broad Cove, is five knots and that the minimum current speed at that point is 1.8 knots. These figures were derived from measurements made by EG&G Inc. for Frederic R. Harris, Inc. in December 1972 (Geophysical and Drogue Study Current Profile Reports, December 1972) (Item III-2) and February and March 1973 (FEIS, Vol. III at D-5). The March 1973 record of current measurements (Id.) appears to show a single excursion to a maximum of six knots at 26 feet below mean low water. The Maine BEP Order of June 1975 requires that currents on the outboard side of the crude pier at no time exceed one knot.

119. Although opponents of the Pittston project have emphasized the risks associated with tankers in Head Harbor Passage at maximum current speeds, Pittston's plan is that VLCC's will not be transiting Head Harbor Passage in currents which on the average exceed three knots and that such movements will normally be made with currents ranging between zero and two knots (Manuevering VLCC's in Eastport Harbor, Pittston's Proposed Eastport Refinery and Marine

Terminal, Item III-7). The cited document (Info Paper No. 6 R 1, November 12, 1973) reflects that a VLCC, presumably fully loaded, can cover the 6.3 nautical miles between East Quoddy Light and Shackford Head, being brought to a dead stop opposite the crude pier, in 132 minutes, having at no time exceeded a ground speed of six knots or encountered tides in excess of two knots. This does not include time, estimated at 20 minutes, to turn the VLCC so that its bow is to the seaward, or the time, estimated at 15 to 20 minutes, to push the vessel onto the breasting dolphins at the pier. It is anticipated that pushing the VLCC onto the breasting dolphins will be undertaken when currents are 0.5 knots or less in order to minimize forces broadside to the vessel when it is being turned. A table developed from data obtained by EG&G Inc. off of Estes Head shows that minimum time with the current at plus or minus 0.5 knot is 20 minutes and the maximum is 70 minutes and that with the current at plus or minus one knot, minimum time is 50 minutes and maximum time is 120 minutes. This establishes that with proper scheduling there is adequate time to make the described berthing manuevers in currents of plus or minus one knot or less. Berthing should not be confused with mooring, the former means having the vessel abreast of the dolphins at the pier, while the latter means attaching all lines so that the ship is fully secured.

120. The Atlantic Pilotage Authority, Halifax, Nova Scotia, controls the provision for ship pilots on the eastern Canadian Seaboard (Tr. 2557, 2603). Because part of Head Harbor Passage is in Canadian waters and because at the time the number of Americans with experience piloting VLCCs was minimal, the authority was requested by Frederic R. Harris, Inc. to evaluate the feasibility of tankers up to 250,000 DWT navigating the Passage to the proposed terminal, which was then to be located at Deep Cove. The

result of that evaluation was furnished to Frederic R. Harris, Inc. in a letter dated October 27, 1972 (attachment to testimony of Captain William H. Crook, NOAA Exh. 46). Although the letter did not answer specific questions posed in a manner unfavorable to the project, it, nevertheless, rated Eastport three on a scale of zero to ten, with zero being totally unacceptable. The principal reason for the three rating was the lack of subcurrent (beneath the surface) data which was termed vital. Following a meeting in St. John, New Brunswick on February 13, 1973, at which information obtained by EG&G Inc. in November and December 1972 was furnished (Appendix I, Vol. VII at 1548 et seq.) (EG&G current studies were in the Deep Cove and Broad Cove areas and not in Head Harbor Passage), the Atlantic Pilotage Authority wrote a letter, dated March 7, 1973 (Attachment, NOAA Exh. 46). The letter stated that we, the Authority, are of the opinion that VLCC's were too large having regard for the extreme inconsistencies of current both in velocity and direction, to transit or dock in the confined waters of Passamaquoddy Bay and Eastport Maine. It should be noted that the Loucks' current meter measurements were taken in August and September 1973 (into November at Station L-3, Tr. 2888) and were not available at the time the cited opinions were rendered. It should also be noted that the driving force for tidal currents in Head Harbor Passage operates over the whole depth of the water and that there is no reason to believe that these currents vary significantly with depth (Loucks, Tr. 2856-57).

121. The facts stated in the preceding finding provide background for the testimony of retired Canadian ship pilots Captain Alexander M. Huntley (NOAA Exh. 45) and Captain William H. Crook (NOAA Exh. 46). Both men have had extensive experience in piloting large ships including VLCC's, and must be regarded as experts in that regard. Both men reviewed documents concerning

the project (Pittston's application to the State of Maine and supporting documents, testimony of marine experts before the Maine BEP, the FEIS, the Preliminary analysis and Assessment of the Pittston Project by the Canadian Coast Guard (NOAA Exh. 35), and Pittston's response thereto (Item V-20A), Canadian Technical Report No. 428, etc.) and both made brief visits to the Eastport area (Captain Huntley for one day August 27 or 28, 1979, Tr. 2534 and Captain Crook for two days on November 19 and 20, 1979, Tr. 2585) transiting the proposed tanker route from East Quoddy Light to Deep Cove. Both men supported the opinions rendered by the Atlantic Pilotage Authority referred to in the preceding finding that currents in the area made it too hazardous for regular VLCC traffic. It is difficult to determine the extent to which the opinions of Captains Huntley and Crook are based on personal observations, conversations with unnamed local fisherman, mariners etc., the Eastport area's perceived general reputation for having high velocity, unpredictable or inconsistent currents, the prior opinions rendered by the Atlantic Pilotage Authority and the Canadian Coast Guard, and analyses of available scientific data. For example, Captain Huntley states that "These waters [Head Harbor Passage] are known for their upwellings and cross-currents which create strong eddies and whirlpools throughout much of the proposed tanker route, especially where Western Passage meets Head Harbor Passage" (Testimony at 5). Under cross-examination, he stated that comments in his testimony concerning currents at Eastport were based on personal observations (Tr. 2523). Asked specifically the source of the quoted statement, he referred to conversations with various fishermen, etc., described as "local knowledge," his trip and reading the documents (Tr. 2524-26). "Local knowledge" could not have been that of Captain Huntley because his visit on August 28 or 29, 1979, was his first transit of Western and Head Harbor Passages (Tr. 2515). He conceded that the only violent whirlpools experienced on his trip were in Western Passage and that he did not see any whirlpools in Head Harbor Passage (Tr. 2528).

122. Captain Huntley asserted that conversations with persons familiar with the Eastport area and studies by hydrographic experts, Charles Yentsch in particular, had convinced him that sudden, powerful tidal surges were commonplace in the area (Testimony at 8). Mr. Yentsch, whose expertise was in biochemistry, plankton in particular (Tr. 4706-07), did not make any independent measurements or surveys of currents in the Eastport area and his knowledge in that respect was based on Loucks' work and Dr. Hires' interpretation thereof (Tr. 4714). Although Mr. Yentsch's testimony states that the result of [tidal waves being forced through passages of various cross-sections, complicating the interaction between flooding and ebbing tidal waters] is the formation of large eddies and shearing whirlpools which are generated by tidal inflow and exist in the channels, especially Head Harbor Passage (NOAA Exh. 82 at 10), the accompanying table curiously does not show average and maximum tidal velocities for Head Harbor Passage as it does for Western and Letete Passages (Id. at 11). Among Mr. Yentsch's conclusions were that navigational risks are high where velocities are high and unpredictable (Id. at 19). Asked to explain his understanding of unpredictable currents, Mr. Yentsch replied that Dr. Hires' data demonstrated the unpredictablity better than anyone else's (Tr. 4714-15). As we have seen (finding 116), Dr. Hires placed the so-called unpredictable currents in Head Harbor Passage in perspective, finding that fluctuations greater than 0.6 knots (transverse component) occurred 2.1% of the time at Station L-2 and 0.5% of the time at Station L-4. Moreover, Mr. Yentsch was unaware at the time he prepared his written testimony of subsequent (June 1974) current meter and

profile data obtained in the berthing areas by EG&G Inc. (Appendix, Item 12) and prepared his testimony on the assumption that the refinery would be constructed and become operational without further current analyses and studies (Tr. 4706, 4732). It is probable that Captain Huntley's information as to sudden, powerful tidal surges is derived from Canadian Technical Report No. 428, which states "The important characteristic of extreme residual surges is that they are practically unpredictable; therefore, the current may differ from one's expectations as derived from the state of the tide by 1.3 knots at any time" (Item V-11 at 25). The quoted statement applies to residual surges and, in any event, is considered to be mitigated, if not refuted, by Dr. Hires' analyses (finding 116).

123. Captain Crook, identified finding 121, testified that his observations on the second day of his visit to Eastport confirmed what he had read about currents in the region and that these waters were far too hazardous for regular VLCC traffic (NOAA Exh. 46 at 13). Alone among witnesses familiar with or who visited the Eastport area, Captain Crook testified that he saw whirlpools "all over the place", the most violent being between Casco Bay Island and Green Island (Tr. 2576). Taken literally, this testimony would place the whirlpools to the west and north of the proposed ship track. Elaborating on this testimony, Captain Crook stated that the whirlpools extended over a two-mile section of the channel from the northeast end of Casco Bay Island to the entrance to Harbor De Lute, Campobello (Tr. 2576-78, 2590). He estimated the size of a whirlpool encountered in that area by the boat in which he was riding at a hundred feet in diameter. As indicated infra, the overwhelming weight of the evidence is that the only whirlpools of any significance in this area occur on the Western Passage side of the area between Deer and Indian Islands. Captain Huntley on a

one day visit had no difficulty identifying the area where he observed whirlpools as around Dog Island and Deer Island Point (Tr. 2526). He did not see any whirlpools in Head Harbor Passage (Tr. 2528-29). A map (Pittston Exh. 30) appended to the Preliminary Analysis and assessment of the Pittston Project by the Canadian Coast Guard (NOAA Exh. 35) shows whirlpools extending from Western Passage across the proposed ship track in Head Harbor Passage toward Campobello Island. Although the accuracy of the map concerning the location of whirlpools is not supported by an credible evidence in the record, considering the position of the Canadian Coast Guard, it is highly unlikely that the map would have failed to show whirlpools in the area described by Captain Crook if there was any basis therefor. For the reasons stated, the credibility of Captain Crook's testimony in this regard must be seriously questioned and little weight is given thereto. Moreover, Captain Crook's views on the safety of navigation of VLCC's must be regarded as extremely conservative. Although the Atlantic Pilotage Authority considered one mile to be the minimum safe operating visibility for a VLCC in the Eastport area, Captain Crook insisted on five miles as the minimum (Testimony at 13). Furthermore, Captain Crook was unfamiliar with the modern navigational aids proposed for the Pittston project (Tr. 2609-11, 2614-16) and in any event, was unwilling to place confidence in such equipment rather than in his own senses (Tr. 2617-18, 2624). He went so far as to assert that the naked eye had more discrimination than navigational aids (Tr. 2625).

124. Captains George Harris (Rebuttal Testimony, Pittston Exh. 41) and Maynard Morrison (Rebuttal Testimony, Pittston Exh. 42) are fishermen and boatmen who have spent their lives in the Eastport area. Although neither had seen other than a picture of a VLCC, both men are thoroughly familiar with the waters in Head Harbor Passage and in the Eastport area. Both men have taken and operated boats (Harris, 50 footers and Morrison up to 70

footers) in and out of Eastport and Head Harbor Passage hundreds of times over many years (Tr. 833, 850, 873; Pittston Exh. 42 at 1, 4). Captain Harris disputed the impression of the waters in the Eastport area conveyed by the testimony of Captains Crook and Huntley as wild, violent and totally unpredictable. He asserted that his own experience indicated that such was not the case (Rebuttal Testimony at 2). He was of the opinion that current flowing into Head Harbor Passage from Western Passage would have little or no effect on tankers in Head Harbor Passage because the current curved to the northeast around Cherry Island, which is Southeast of Indian Island, rather than continuing southeasterly into Head Harbor Passage (Id. at 3). Accord, Maynard Morrison, Rebuttal at 6. Concerning the upwellings, eddies, and generally turbulent waters described by Captains Crook and Huntley, he asserted that most of these take place around points, shoals, close to shore and in coves, etc. where large tankers would not be. (Id., Tr. 844-46). This testimony was supported by Mr. Morrison, who stated that these phenomena, i.e., back eddies, reversing currents, etc., were simply not found in the middle of the channel (Rebuttal at 6, Tr. 868-69). Messrs. Harris and Morrison were emphatic that Captain Crook could not have seen large whirlpools in the channel between Casco Bay Island and the entrance to Harbor De Lute and that the only whirlpools of any significance were off of Deer Island Point in Western Passage (Tr. 847-50, 863, 868-69, 877-78, 881-82). Both men testified that these whirlpools would not be of any significance to a boat of a 100 feet or more in size (Tr. 848-49, 877-78, 882-83). Mr. Morrison referred to vessels of substantial size, up to 500 ft. in length navigating Head Harbor passage and oil barges towed by a tug on a line of approximately 1200 feet in length, making the turn at Western Passage and proceeding up the St. Croix River or to St. Andrews, New Brunswick, on a regular basis with no apparent difficulties (Rebuttal at 5, Tr. 876, 878-79, see also Appendix I, Vol. XXI at 4531-37). See also the testimony of Captain Robert Peacock, finding 126, infra, who stated that whirlpools in Head Harbor Passage across the proposed tanker track would be highly unlikely to have any impact on the navigation of VLCC's (Tr. 941).

125. Admiral Barrow, identified finding 102, visited Eastport, flying over the area and spending several hours on the waters of Head Harbor Passage and in the proposed berthing areas (Pittston Exh. 18 at 4; Tr. 534, 587). He did not observe any whirlpools in Head Harbor Passage and the only whirlpools he did observe were off of Deer Island Point in Western Passage (Tr. 553, 587-89, 598-99). Virgil Keith also visited, the Eastport area, transiting Head Harbor Passage. Although at one point Mr. Keith appeared to be indicating the channel of Head Harbor Passage opposite Western Passage as the area where he observed whirlpools and another point he stated flatly that the whirlpools were in the middle of the channel, he read from a document called the "U.S. Coast Pilot" which he referred to as "a bible", which placed the whirlpools and eddies in Western Passage off of Deer Point Island as located in the testimony by Captains Harris and Morrison and Admiral Barrow (Tr. 2156-60).

126. Captain Robert Peacock, a lifelong resident of Lubec, Maine, having personal knowledge of the waters in the area, and an individual with considerable experience as mate and captain of tankers in excess of 150,000 DWT, including command of the 392,000 DWT U.S.T. Atlantic, the largest vessel ever to fly the American flag, testified that the problem of bringing VLCC's into Head Harbor Passage was not insurmountable (Pittston Exh. 43 at 1 and 5). He indicated that great care would be required, that the best equipment (navigational aids) should be available and operating limits strictly followed. Elaborating on this testimony, he was of the opinion that shore based radar augmenting radar on the ship, together with

other navigational aids proposed by Pittston (Appendix, Item 10) would make transiting Head Harbor Passage at least as easy as that of Valdez Narrows, Alaska (Id. at 6). He asserted that with departures and arrivals timed for slack water and large tugs in attendance, the currents should have little effect on the operation. He further stated that this type of operation was very common in parts of the world experiencing tidal current problems. In rebuttal testimony, he reiterated the conclusion that passage of VLCC's through Head Harbor Passage to Shackford Head was perfectly feasible and in fact, not as difficult and dangerous as some other ports of the world (Pittston Exh 44 at 3). Under cross-examination, he answered in the affirmative the question of whether he would be willing to bring a VLCC down Head Harbor Passage (Tr. 924-25) and stated "I have taken a ship through the center of the channel (Head Harbor Passage), and I've lived there all my life and been all around the water on boats, from 26 foot to 400 foot, through where they want to build this, or send the ships through, and I've never seen anything that would bother me on anything from a 26 foot on up" (Tr. 924). His subsequent testimony that he would want trial or practice runs with ballasted VLCC's in Head Harbor Passage, prior to construction of the refinery is contradictory and inexplicable (Tr. 956-58, 966).

127. Captain Harry Breitenfeld, an active ship pilot with many years experience in the port of New York, reviewed Canadian Technical Report No. 428, the Preliminary Analysis and Assessment of the Pittston Project by the Canadian Coast Guard (NOAA Exh. 35), Pittston's response thereto (Item V-20A), an applicable chart (Pittston Exh. 1) and pertinent sections of the FEIS, the testimony of Drs. Eda, Hires and Virgil Keith, and that of Captains Crook and Huntley (Rebuttal Testimony, Pittston Exh. 64 at 1-3). Captain Breitenfeld has a summer home near St. Andrews, New Brunswick and some familiarity with waters in the area (Id.at 6). He testified that, as

he understood the proposal, tankers would enter and leave the channel (Head Harbor Passage) so that they encounter currents no greater than two knots and pointed out that it was common practice to navigate ships of VLCC size in two knot currents. He stated that in any passage of over a mile, cross currents of some magnitude would be encountered at some point in almost any port and that pilots and masters learn to compensate for these currents and use them to advantage. Referring to parts of the port of New York, he described restricted channels, cross currents varying from 1.6 knots N.W. to 1.8 knots W.S.W. within a one half mile area, head and following currents of up to two knots at various places and cross currents of approximately one knot at a point south of Goethals Bridge. He testified that the initial passage to the oil terminals off of Bayway (New Jersey) is made at a speed of six to eight knots over the ground and that average speed during this passage, which narrows at one point to 500 feet in width, is at four knots over the ground (Id. at 4, 5). Although these passages are not transited by VLCC's, Captain Breitenfeld described maneuvering a 285,000 ballasted DWT tanker safely into Bayridge Channel (Brooklyn) in following currents of up to two knots without tug assistance. He emphasized the width and depth of the channel at Eastport, the fact that the channel was relatively straight, requiring only a minor course change off of Windmill Point (Campobello) prior to the 90° turn at Estes Head to the berth, the fact that the berthing area was protected from sea state and winds and the low traffic associated with the project (Id. at 6-8). He had reviewed the planned passages, time intervals and speeds for ships at Eastport and found that they compared favorably to what he would recommend. He indicated that adjustments might be made as operational experience was gained but that he would not expect any major changes in that regard or difficulties in operating the port. He flatly disagreed with Captain Crook's (actually Captain Huntley's) opinion that tugs would be ineffective if the tanker were traveling at speeds greater than two knots over the ground, asserting that his experience demonstrated that tugs can be effective at speeds of over four knots over the ground. Under cross-examination, Captain Huntley conceded that there were circumstances under which tugs would be effective if the tanker was traveling at speeds in excess of two knots and that he did not disagree with Captain Breitenfeld in that respect (Tr. 2549-51).

128. Rebuttal testimony to that of Captain Peacock (finding 126) was presented by Captain Ormond Staples, a retired shipmaster with many years experience in coastal and worldwide tanker operation for what is now Exxon Corporation (CLF Exh 4). Captain Staples, who seemed incensed at Captain Peacock's having been made shipmaster at an early age, made several petulant observations concerning Captain Peacock's testimony and pronounced himself impressed with the testimony of Captains Huntley and Crook (Id. at 1-4). Captain Staples agreed that the controlling objection to handling large tankers in the Eastport area was what he referred to as the "current problem". Although he visited the area and reviewed various documents concerning the Pittston project, there is no indication that his knowledge of the currents in the area is as extensive as that of Captain Peacock's. He (Staples) testified that the principal benefit of shore based radar was as an aid in traffic control and alluding to a hypothetical situation where a VLCC in Head Harbor Passage becomes suddenly emerged in a dense fog near Casco Island, encounters an unexpected cross-current and starts to take a sheer, he asserted that the sheer would first be noticed on radar or on the gyro compass, several seconds after it would have become apparent by visual observation in clear weather (Id. at 5). Apart from the fact that the hypothetical is unrealistic, the evidence shows that there are no cross

currents of any significant magnitude in that part of Head Harbor Passage (finding 116) and the likelihood of the suddenly becoming enveloped in a dense fog is seemingly remote, (infra, findings 131-133), Captain Staples' statement ignores the "doppler system" which, as described by Captain Peacock, is a form of sonar enabling almost instantaneous detection of any deviation from the desired ship track (Tr. 901-02, 909, 912-13, 925-27). See Oil Spill Contingency Manual, NOAA, Exh 83. Pittston has stated that "state-of-the-art" navigation aids will be employed. Like Captain Huntley, Captain Staples testified that tug assistance would be largely ineffective at tanker speeds of over two knots (Id. at 6), but retracted that testimony under cross-examination, indicating tugs might be effective at speeds as high as four knots (Tr. 2505-06).

129. Although the validity of comparing the Port of Milford Haven's experience regarding oil spills to those anticipated at Eastport has been sharply attacked, Milford Haven nevertheless, affords a usefull illustration of the conditions under which VLCC's have been safely operated. The channel at Milford Haven provides a minimum depth at low water of 53 to 55 feet and maximum depths at high water of 69 to 79 feet (Rebuttal Testimony of Captain Guilford Dudley, Harbormaster at Milford Haven, Pittston Exh. 34 at 9). It is therefore obvious that VLCC's with drafts of 65 feet or more must coordinate their entrance with the state of the tide. Milford Haven has a minimum width of 850 feet, which may be further reduced if a VLCC is alongside the pier (Id. at 10; Pittston Exhs. 35, 36, and 40). Although maximum currents within the Haven are on the order of 2.12 knots, mostly parallel to the direction of ship traffic, cross currents of up to 2.5 knots are experienced at the entrance to the channel which is 1300 feet in width (Pittston Exh. 34 at 9, 24; Tr. 643, 719). Furthermore, Milford Haven is used by approximately 3,500 tankers per year, of which about 150 or three a week are VLCC's (Pittston Exh. 34 at 9, 24).

130. A probable source of the Eastport area's general reputation for having turbulent and unpredictable waters is the June 1973 "Interim Report Atlantic Coast Deep Water Post Facilities Study" issued by the Corps of Engineers (Appendix, Item 11). This report conveyed results of a study of feasible means of developing facilities to accommodate very large, bulk cargo carriers in the area from Eastport, Maine to Hampton Roads, Virginia. Concerning Eastport, the report states in part: "* * a natural access channel, with a depth averaging 120 feet, is provided by Head Harbor Passage and Friar Roads. However, its approaches are winding; its currents extremely difficult to judge and the area has the highest number of fog days along the coast. * * ." The Canadian Coast Guard was so impressed by these comments concerning Eastport that they are quoted in full twice within the space of 30 pages (NOAA Exh. 35). While the statement concerning fog is accurate (infra, finding 131), no data to support the quoted statement are cited. A map of the Bay of Fundy illustrating the track of a VLCC entering Head Harbor Passage from the Bay of Fundy and proceeding to the berthing area could be described as forming a rough arc with the only sharp turn being at Estes Head to the berthing area (Item V-20A, Exh. 27). If incoming vessels take the track shown in the illustration, and no reason is apparent why they would not, the approaches to Eastport may not properly be characterized as winding. The alleged unpredictability of the currents has been adequately considered (finding 114, supra). It should be noted that ships of the U.S. Fleet, having lengths of up to 624', beams of up to 97' 5" and drafts of up to 32' 4", have called at Eastport during the period 1915 to and including 1963 (Item V-20A, Exh. 15). Although these vessels do not approach the size of a VLCC and are undoubtedly more maneuverable, it seems unlikely that such visits would have been made if the waters in the Eastport area were, in fact, hazardous and unpredictable.

Fog

131. There does not appear to be any dispute that the Eastport area has the highest number of fog days along the east coast of the United States (Record, Item V-20A, Executive Summary and Conclusions, at 6; Rebuttal Testimony of Dean Francis K. Davis, Pittston Exh. 47 at 2-5). The parties are also in agreement and the evidence reflects that the most severe fog conditions occur in the summer months of June, July and August. The fog results from light, southerly winds bringing warm, moist air over the cold water in the Eastport area (FEIS, Vol. II at III - 18 et seq.; Pittston Exh. 47 at 3). As much as 94.75% of all fog approaches Head Harbor Passage from the south having formed or moved into the area from Grand Manan Channel (Tr. 1196; Testimony of Richard Rhine, NOAA Exh. 86 at 3, 4; Rhine Deposition at 6, 7, 42, 43).

132. The concern with regard to fog, is of course, that a VLCC or other tanker might meet the minimum one mile visibility criteria for entry of Head Harbor Passage or departure from its berth and suddenly become enveloped in a dense fog, thereby increasing the risk of a collision, grounding or other accident. Mr. Richard Rhine is a resident of North Lubec, Maine, is confined to a wheel chair and has compiled extensive meteorological data over a 20 year period (Rhine Testimony, NOAA Exh. 86; Deposition). Although Mr. Rhine is not a trained meteorologist, his records appear to have been meticulously kept and there is no reason to question their accuracy as a record of his observations. Using his house in Lubec as a vantage point, Mr. Rhine is able to see Head Harbor Passage up to approximately two thirds of Indian Island, Windmill Point, Welshpool and Friar's Head on Campobello Island, the western shore of Grand Manan approximately 12 miles distant and intermediate points such as Lubec Narrows and West Quoddy Head (Id., Figure 1; Depostion at 5, 7; NOAA Exh. 20). Fog typically moves through Lubec narrows and simultaneously

through a valley on Campobello Island, converging in Friar Roads and then diverging , moving up Head Harbor Passage and into Cobscook Bay on either side of Eastport (Id. at 3, 4, Fig. 2). Summarized, Mr. Rhine's data shows that visibility dropped from five miles to one half mile in 20 minutes or less 402 times in 20 years or just over 20 times a year (Id. at 5). Such a visibility drop can be expected to happen within an hour 58 times a year. Visibility dropped from five miles to one mile in ten minutes on 261 occasions during the 20 year period or an average of 13 times a year, visibility dropped from five miles to one mile in 20 minutes 33 times a year and dropped from five miles to one mile in an hour 108 times a year. For all the times visibility dropped from five miles to one mile, it occurred in less than an hour 58% of the time. As is true of fog development or occurrence in general, rapid fog development most often occurs in summer, visibility dropping from five miles to one mile in 30 minutes during June, July and August on an average of 32 times a year. Concerning fog duration, Mr. Rhine's data indicates that visibility due to fog over the 20 year period was between one and two miles for 907 hours, between one half and one mile for 2,254 hours and between zero and one half mile for 16,183 hours (Id. at 6, Table 5). In terms of averages, visibility due to fog over the mentioned period was one half mile or less on 1,153 days (total 16,183 hours) or slightly over 14 hours per day of occurrence, visibility was one mile on 882 days (total of 2,254 hours) or 2.55 hours per day of occurrence and visibility due to fog was two miles on 336 days (total 907 hours) or 2.69 hours per day of occurrence. Mr. Rhine testified that the likelihood of a typical summer fog developing or its onset was highest in the late afternoon or early morning hours and that an early morning fog typically dissipated or burned off by approximately 10 o'clock in the morning (Deposition at 10).

133. Francis K. Davis, a meteorologist and Dean of the College of Science at Drexel University in Philadelphia, reviewed Mr. Rhine's testimony and records of the Head Harbor Lighthouse at East Quoddy operated by the Canadian Government, records of the lighthouse at West Quoddy operated by the U. S. Coastguard, records of the National Weather Service Cooperative Station in Eastport, and the records of the lighthouse on Dog Island north of Eastport operated on a 24 hour a day basis by George Morrison and family (Rebuttal Testimony, Pittston Exh. 47 at 6, 7). The latter station uses as a visibility marker a point on Cherry Island located one mile to the east and very close to the proposed ship track through Head Harbor Passage. Dean Davis testified that records of fog from the Weather Bureau Station in Eastport over a 66 year period (1885 to 1951) showed that the average number of days at Eastport with visibility less than one quarter of a mile is 58 and that these conditions prevail on 30 days in the summer (33% of the time) and on five days in the winter (5% of the time (Id. at 7)). He further testified that 75% of fog occurrences began during hours of darkness, that more than half of the poor visibility hours occurred at night (this was true during the summer months as well as at other times of the year), that in practically every case where fog occurrence developed during the day, the winds were light (5 to 10 knots) with a southerly component and that only twice during the year (1976) did poor visibility due to fog persist through two consecutive days. Dean Davis cited with approval data in the FEIS (Vol. II, Figure III-32 at III-121) indicating that visibility in the Eastport area is likely to be two miles or greater 80% of the time and two miles or greater 90% of the time during daylight hours. He criticized Mr. Rhine's use of a single observation point (actually one direction) asserting that it was not possible to determine if fog developed rapidly from such data and testified that, in any event, the formation and movement of this kind of fog (radiation advective) is so well

known and observed that routine meteorological forecasting procedures could just about eliminate the possibility of a tanker moving down Head Harbor Passage when the fog was moving in (Id. at 2-4; Tr. 1193-95, 1210 -11). Elaborating on this testimony, he asserted that the reliability of Weather Bureau forecasts for one or two hour periods in advance was nearly 100%. Equipment needed for such forecasts include a synoptic weather map, a map which will give the air mass distribution, pressure gradients which enable a forecast of how the pressure systems are going to move, measurements of temperature or dew point or humidity in the air, sea surface temperatures and a wind forecast to ascertain which way the wind will move (Tr. 1214-15, 1216-17).

Wind

134. Prevailing winds in the Eastport area are westerly (FEIS, Vol. II at III-113). During the period November to March winds blow from the west to north direction and from April to October southwesterly winds predominate. Mr. Rhine, identified finding 134, testified that the Eastport area is prone to very high winds at frequent intervals from most any direction and that high winds are most likely in spring, fall and winter (Testimony at 7). Although Head Harbor Passage and Cobscook Bay are protected somewhat from open seas by Campobello Island, he stated that the combination of strong winds and high tides create some very rough water in these areas, especially when the wind is out of the southeast or northeast. He indicated that most of the area's worst storms come from either the southeast or northeast (Id.at 8). Table 7 included with Mr. Rhine's testimony shows that wind velocities greater than 35 mph occurred 448 times over the 16 year period 1959 to 1974 inclusive or an average of approximately 28 times a year. Table 8 shows that in nine of the 16 years from 1959 to 1974 winds of 70 mph were recorded, with the highest being 85 mph. Winds of these velocities always occurred

during storms. Under cross-examination, Mr. Rhine disclaimed any intent of comparing Eastport to other areas so as to conclude that Eastport had higher velocity and more frequent winds than other areas along the coast (Deposition at 34, 35).

135. Dean Francis Davis (finding 133) testified that there was nothing unusual about winds in the Eastport area as compared to other areas along the East, Gulf, Pacific and Alaskan Coasts (Pittston Exh. 47 at 9). He cited a Weather Bureau publication "Climatography of the U.S." applicable to Eastport covering a 67-year period ending in 1952 which stated "Days with winds of 32 mph or more average 19 a year nearly all in winter." Citing official records for Eastport covering a period of 79 years, he asserted that the fastest mile ever recorded was 83 mph in December 1917 (Id. at 11). He compared the fastest mile for various months in Eastport, 47 mph in July to 83 mph in December, to that in Portland, Maine which showed the fastest mile ranging from 44 mph in July to 76 mph in March. He stated that these wind speeds were roughly comparable. He also cited records of highest wind speeds in Norfolk, Virginia, stating that the range was from 48 mph to 78 mph. He testified that return frequencies of high winds had been developed by the American Standards Institute for use as a guide for design loads and that these showed that a wind of 80 mph could be expected at Eastport once every 50 years and that the same return frequency could be expected along the coast of Maine, eastern Massachusetts and through New York and Philadelphia. He indicated that even higher wind speeds could be expected from the coast of North Carolina southward and along the Gulf Coast from Florida through Texas (Id. at 12). Dean Davis further testified that the average annual wind speed in Eastport is 10.7 mph with monthly means varying from 7.4 mph in August to 13.5 mph in

January. He referred to a detailed analysis of the wind structure available from the National Climatic Center for Portland, Maine, which shows that for all directions and all stability classes, wind speeds greater than 21 knots occur less than one percent of the time. He asserted that periods of highest winds result from migrating low pressure systems, could be forecast well in advance and that speed of wind was not a special weather risk in Eastport nor peculiar to that area (Id. at 14, 15). It will be recalled that Captain Breitenfeld, finding 127, testified that the proposed berthing areas were protected from sea state and winds.

Duration of Effects of Oil Spills

136. Effects of oil spills primarily as related to impacts on whales or their food supply were discussed in findings 76-96, supra. This section will deal primarily with the evidence as to the duration of effects of oil spills or otherwise stated, the period of recovery from an oil spill. In this connection, it should be noted that Pittston has not contended and the evidence would not support a finding that no adverse environmental effects result from oil spills. Mr. Robert Clark (finding 93) testified that the magnitude and permanency of damage resulting from an oil spill is a function of (i) the chemical composition and physical properties of the spilled petroleum, (ii) the quantity of the petroleum and duration of the spill, (iii) seasonable oceanographic, and meteorological conditions, (iv) nature of the exposed ecosystem, (v) habitat type and substrate, (vi) geographic location, and (vii) type of spill cleanup employed (Testimony, NOAA Exh. 66 at 3). He was of the opinion that a major oil spill would have serious long-term effects on the ecosystem of the Quoddy Region and that chronic low-level discharges have the potential for causing other long-term disruptions of sensitive marine communities. In subsequent testimony, he asserted that the Quoddy Region marine environment, with its rich and diverse biota is a unique biological regime which may well be irreversibly jeopardized by a major oil spill or by smaller chronic discharges (Id. at 5). He stated that a major oil spill would seriously disrupt a unique ecosystem, perhaps to the extent that parts of it would be permanently altered (Id. at 6).

He indicated that various parts of the impacted area would likely return to stable ecosystem conditions over the course of some unpredictable period of time, possibly decades if the oil impregnated soft substrates, but that stability did not necessarily mean a return to the same conditions that prevailed prior to the pollution incident. Elaborating on this testimony under cross-examination, he indicated that elimination of one unique organism from an area, regardless how small, was sufficient to constitute permanent or irreversible jeopardy or damage in his view (Tr. 3437, 3451, 3463-64). He conceded, however, that there was no scientific data to establish that any species had been completely and permanently eliminated from any area as a result of even the most massive oil spill (Tr. 3465). Dr. Page emphasized this point, asserting that if ecosystems were permanently altered as a result of an oil spill, then areas where natural oil seeps occurred would be biological deserts but that such was not the case (Testimony at 15).

137. Notwithstanding his concern about irreversible jeopardy and permanent alteration of an ecosystem as a result of oil spills, Mr. Clark testified that recovery from the effects of an oil spill started immediately after a spill (Tr. 3450, 3456, 3496). This results from the fact that the oil immediately undergoes weathering processes which he listed as spreading to form slicks, evaporation of volatile components, dissolution of soluble compounds into the seawater beneath the slick, emulsification of fine particles of petroleum into the water column, sorption of petroleum with waterborne particles, compaction of the oil into tar balls, modification of petroleum mixtures by ingestion and excretion of bacteria and large life forms

and photochemical modification (Testimony at 8). Although he stated that neither a single rate nor a mathematical model for the rate of petroleum biodegradation in the marine environment can be given, microbial degradation of oil is undoubtedly the most important process involved in weathering and eventual disappearance of petroleum from the marine environment (Id. at 12; Tr. 3479). See also Petroleum in the Marine Environment (NOAA Exh. 18). He further stated that the most that can be said is that some microorganisms capable of oxidizing chemicals in petroleum have been found in virtually all parts of the marine environment examined.

138. Dr. Edward Gilfillan (finding 27) testified that there was little doubt that a large oil spill in the Eastport area would cause harm to the environment (Rebuttal Testimony, Pittston Exh. 50 at 1). He asserted, however, that in the event of even a large oil spill, not all of the area within the impact zone would be uniformly oiled and that some areas would be heavily oiled, others less so and other areas within the impact zone would not be oiled at all (Id. at 2). Moreover, because of varying degrees of weathering the oil that comes ashore would have different chemical compositions and the different habitat types in the Eastport area (approximately 50 different habitat types described by Dr. Larson, infra, finding 148) would have their own characteristic rate of recovery which depended to a large extent on the physical and chemical environments of these habitats. Dr. Gilfillan confirmed Mr. Clark's testimony (finding 137) that once oil stopped leaking from whatever source, recovery of the impact zone begins (Id. at 3). Dr. Gilfillan testified that the rate of recovery of an

environment was proportional to the rate of removal of oil, that oil could be physically removed by wave action or by the efforts of cleanup forces or it could be removed through the processes of solution and evaporation. He indicated that once cleanup had been carried out, the most important route by which oil was removed from the environment was bacterial action and that in order for bacterial degradation to proceed at a high rate, a source of oxygen and nutrients, such as nitrogen and phosphorus was required.

139. Describing various areas and their rates of self-cleaning, Dr. Gilfillan stated that high energy shores (rocky shores exposed to wind and waves) self-cleaned fairly rapidly, citing an exposed rocky shore in France which was essentially cleaned within a year after the Amoco Cadiz spill (Rebuttal at 3). He indicated that unconsolidated sediments with plenty of water percolation or a large degree of oxygen availability will be cleaned up fairly rapidly by bacterial action and that oil persists for long periods of time only in low energy areas where there is little or no water percolation in the sediments (Id. at 3, 4). Applying these criteria to the Eastport area, he made some general, worstcase (heavy oiling with toxic oils) predictions for recovery times, emphasizing that times cited were virtually complete recovery (Id. at 6,7). He asserted that rocky shores can be expected to be largely clean in a year or so, that substantial recovery should occur within one year and complete recovery within four years. Beaches will clean up at widely varying rates depending on grain size and wave exposure. He cited the Tamano oil spill in Portland, Maine in 1972, where two heavily oiled, exposed beaches were clean in three to six weeks and where Tamano oil could not be identified past four years. He also

cited a 1974 crude oil spill on Deer Island, New Brunswick where hydrocarbon analyses conducted on beach sediments in 1979 failed to reveal any traces of crude oil. Based on these precedents, he indicated that a conservative recovery time for beaches in Cobscook Bay would be from less than a year to a maximum of four years.

140. It is generally agreed that marshes, especially salt marshes, require the longest time to recover from the effects of an oil spill and are the most vulnerable to oil. Dr. Gilfillan stated that most studies that have been done on the persistence of oil in mud flats had been done in conjunction with oiled marsh areas, but that oil in muddy environments could be expected to persist for some three to eight years (Pittston Exh. 50 at 7,8). He stated that ten or more years may be required for recovery of a severely oiled marsh. As support for these assertions, he referred to the Tamano oil spill (mentioned in the preceding finding) where after four or five years oil could only be detected in two small areas totalling less than one acre; the Searsport, Maine pipeline break at Long Cove in 1971 where 200 acres were originally impacted and where there had been 17 spills since 1971, but even so it was clear that oil was weathering normally except in a refractory area of about two acres; and the Northern Gulf spill in 1963, which oiled forty miles of the coast of Mucongus Bay, north of Boothebay Harbor, and where, after 15 years, only a few hundred square feet in two isolated pockets remain impacted.

141. Dr. Gilfillan described the impact of an oil spill and the various steps or progression of the area impacted as it recovered (Rebuttal Testimony at 4). He indicated that in every environment all or nearly all of pre-existing plants and animals may be killed, but that as oil

levels decrease, species of animals or plants which are very resistant to physical stress will begin to repopulate the area. These animals which are very resistant to environmental stress and have very high reproductive rates are commonly referred to as "opportunistic animals." Opportunistic animals, while resistant to changes in the physical environment, are not very good at resisting competition by other species of animals. A physically controlled environment is one in which the number and species of animals found therein is determined by its physical characteristics. A biologically controlled environment is one in which the number and kind of animals and plants found therein are determined primarily by the interaction or competition between these species of animals and plants. As oil degrades or is otherwise removed from an oiled area, the area progresses from being a physically controlled environment, in which there are characteristically low numbers of species in large numbers, through an intermediate period where there are both opportunistic species which originally colonized the area and species which are characteristic of the area (Id. at 4,5). As more and more of the species characteristic of an environment return following an oiling, these species overcome the opportunistic species and the community of animals and plants found in the environment returns to its original state. When each of the originally occurring species reappears in an environment which has been oiled depends upon the tolerance of that species to oil.

142. Dr. Gilfillan testified that the extent to which a fishery as a whole will be harmed by an oil spill is dependent upon two factors: (1) the

proportion of the total spawning area covered by the oil slicks and (2) the proportion of the total spawning period that the slick is in the spawning area (Rebuttal at 13). He indicated that to the extent either of these proportions is small the effects of an oil spill on recruitment of young fish would also be small. He further indicated that whatever the effects of an oil spill on the recruitment of fish stocks were they are a one-time event and subsequent years' recruitment would not be affected, unless bottom sediments were contaminated (Id. at 14). Citing experience with flat fish in France following the Amoco Cadiz spill in 1978 which indicated that interference with recruitment of such fish in that area appeared to be confined to the year 1978, Dr. Gilfillan indicated that to the extent oil was incorporated in bottom sediments in Cobscook Bay, flat fish in the area may be similarly effected, but that the fishery for flat fish in Cobscook Bay was not extensive (Id. at 15, 16). Dr. Gilfillan also referred to the short period (approximately three months) the fisheries for lobsters and crabs were closed following the Amoco Cadiz wreck, asserting that from that experience it was possible to conclude that the effects of even a serious oil spill in Cobscook Bay on the lobster fisheries would be confined to the period in which there was oil floating on the water and that this would cause an interruption only because of possible fouling of lobster gear (Id. at 16, 17). He stated, however, that the lobster fishery in Cobscook Bay might be effected if the oil spill occurred at the particular time lobster larvae were near the surface of the water. He further testified that the soft shell clam industry of Cobscook Bay was the fishery most at risk from the effects of oil spills and that the duration of this effect would be a function of the residence time of oil in the sediment in which the clams live. He stated that in the case of the Tamano spill, referred to in finding 139, many of the areas were clean within two years and that significant effects on the clam fishery did not persist past four years. Summarizing, Dr. Gilfillan asserted that the recovery time for oiled clam flats in Maine could vary from two years or less in exposed areas, to about four years in more protected areas to a worst case of ten years under conditions existing at Searsport (Id. at 18). Referring specifically to Cobscook Bay, he stated that the clam fishery could be effected by a significant oil spill for from two years or less to as long as ten years in isolated areas, but that he would expect that even in the event of a major spill most clamming areas would be recovered prior to ten years.

143. Dr. Vandermeulen (finding 83) testified that all spills studied to date have demonstrated that soft sediments of shoreline and bottom retain oil the longest, in some cases in excess of 15 years (Testimony, NOAA Exh. 68 at 14). This testimony was sharply disputed by Dr. Page, who asserted that this idea is totally contrary to published fact and his experience with oil spill studies (Rebuttal Testimony at 7). Dr. Page testified that because of the highly hydrated nature of soft sediments they were resistant to oil penetration. Dr. Vandermeulen seemed to agree, in part, stating that in his opinion oil does not tend to sink too deeply in river mudflats and that perhaps only the top centimeter or so is ~~contaminat~~ed because the material is so

heavily packed that the oil has difficulty penetrating it (Tr. 3820-21). Moreover, soft intertidal sediments generally exhibit the highest degree of microbial activity and degrade oil more rapidly than clay-gravel type beach sediments. One of the reasons for the rapid degradation of petroleum in such sediments is that the sediments offer a habitat for polychaete worms which are able to tolerate relatively high residues of petroleum concentrations and perform the crucial function of turning over and burrowing into the sediments to enable microbial action to oxidize petroleum residues (Id. at 7; Dr. Gilfillan, Rebuttal at 11; Gordon et al. Influence of Arenicola Marina on Weathering of Sediment-Bound Oil, Appendix, Item 24 at 591 et seq.) Rough estimates of the amount of oil degraded by microbial action following the Amoco Cadiz spill were on the order of 10,000 tons in two weeks (Tr. 3779-80; Pittston Exh. 87 at 2).

144. As an example of an oil spill where the ecosystem took many years to return to stability, Mr. Clark cited the Tampico spill below Baja, California (Mexico), asserting that the cove inshore from the spill did not reach ecological stability until ten years later (Testimony at 17). The Tampico, which was carrying a cargo of 60,000 barrels of diesel fuel, was grounded and wrecked in the spring of 1957 in such a way that the hull of the vessel extended across a small cove (Tampico, A study of Destruction and Restoration by Dr. Wheeler North, NOAA Exh. 66). No efforts at cleanup were undertaken. While the cited study of the Tampico spill states that only a few of the animal species in the cove or area effected by the spill survived, it also states that the unsightly and poisonous conditions resulting from oil spillage lasted about three

months and that by summer, the little cove was again fresh and clean. The study was apparently written in 1967, ten years after the wreck, and, although stating the author's belief that the area was still not the same as it was before the wreck, it provides little or no support for Mr. Clark's assertion that the area did not return to stability until ten years later. Under cross-examination, Mr. Clark testified that recovery started very rapidly and that the Tampico was an excellent example of an area's recovery from the effects of an oil spill (Tr. 3441-43). Dr. Page (finding 17) cited Dr. North's study of the Tampico spill, supra, as an example of a rapid recovery of three years of an area from an oil spill (Pittston Exh. 46 at 14-15).

145. The Metula was a tanker that ran aground in the Straits of Magellan at the southern tip of South America in August of 1974, spilling 5,500 tons of crude oil (Tr. 3552; Microbial Ecology in the Straits of Magellan, J. Fish Res. Board Can. Vol. 35 (1978), Appendix, Item 24 at 573 et seq.) No cleanup operations were undertaken. Studies of the area more than two years after the spill indicated that effects of the oil were still detectable and that microbial degradation, weathering, and mechanical action of waves and surf were slowly removing the residual oil (Id. at 579). The study concluded that complete removal of the last traces of the Metula spill would not occur for years and perhaps decades. In February 1970, the Liberian Tanker Arrow with a cargo of 108,000 barrels of Bunker C fuel oil ran aground in Chedabucto Bay, Nova Scotia, spilling approximately two-thirds of her cargo and oiling approximately one-half of the 600 kilometer shoreline (Oil Residues in Chedabucto Bay, Appendix, Item 24 at 528 et seq.) An extensive field survey and chemical analysis of sediment samples (collected in July of 1976) for aliphatic and polycyclic aromatic hydrocarbons identified only

a few locations where arrow Bunker C remained in the intertidal and sublittoral sediments. Certain areas of the upper intertidal zones of Rabbit, Crichton and Durrell Islands remained covered with an oil and sediment mixture of a pavement like consistency. Human cleanup efforts effected less than ten percent of the shoreline impacted by the spill (Tr. 3830). Hydrocarbon concentrations in the sublittoral sediments were below those found toxic to benthic organisms. An estimation of the amount of Arrow Bunker C remaining in Chedabucto Bay was not possible due to patchy destribution, evidence of more recent oil spills and absence of adequate control sites. Nevertheless, the conclusion of a separate study (Distribution and Abundance of Hydrocarbon-Utilizing Bacteria in Sediments of Chedabucto Bay, Nova Scotia, in 1976, J. Fish Res. Board Can., Vol. 35, 1978, Appendix Item 24 at 581 et seq.) based on analyses of the presence of hydrocarbon utilizing microorganisms, whose numbers increase as oil is introduced into the environment and decrease as the metabolically usable hydrocarbon fractions decrease, was that most of hydrocarbons degradable by microorganisms had largely disappeared 18 months after the spill and that Chedabucto Bay was then (1976) relatively oil free.

146. Messrs. Clark and Vandermuelen (findings 83 & 96) cited the Metula and Arrow spills discussed in the previous finding as examples of what might happen if an oil spill occurred in Eastport. However, recovery from the effects of an oil spill is dependent in part upon cleanup efforts, no cleanup efforts were undertaken following the Metula spill and, as pointed out by Dr. Page, in only a few isolated spots is there visible evidence of oil remaining from the Arrow spill out of an original

estimated 600 kilometers of impacted shoreline (Pittston Exh. 46 at 17). See also Stewart and Marks: Hydrocarbon Utilizing Bacteria in Chedabucto Bay, Appendix 24 at 583 (conclusion that Chedabucto Bay now relatively free of oil). Moreover, Drs. Page and Gilfillan pointed out that the Metula and Arrow spills occurred in colder climates than at Eastport and that accordingly, productivity and biological activity would be much less (Pittston Exhs. 46 and 50 at 16, 17 and 22, respectively). While there is evidence that average winter temperatures in Cobscook Bay may be lower than in the vicinity of the Metula spill, the crucial question is the length of the winter season (Tr. 1303-05). Dr. Gilfillan testified that winter lasted much longer in the Straits of Magellan and in Chedabucto Bay than in Maine (Tr. 1305). See also Dr. Page at Tr. 1145-49 (physiological processes much slower in Chedabucto Bay due to colder environment). As proof of the fact that the climate was more harsh and the growing season shorter in Chedabucto Bay, he cited soft-shell clams which may reach a length of two inches in five to eight years in Cobscook Bay and require 17 to 22 years to reach the same length in Chedabucto Bay (Tr. 1306-09).

147. Studies undertaken in Milford Haven 15 years after it commenced operation as a substantial oil port reached the conclusion that there were no overall ecological changes which could be attributed to the oil industry (Ecological Changes in Milford Haven During its History as an Oil Port, Pittston Exh. 37 at 65). This was attributed at least in part to an efficient harbor administration, cooperation of the oil companies and a well organized clean-up system. Another study, The Application of the Milford Haven Experience for New Oil Terminals (Pittston Exh. 38), pointed out that in addition to the human factors listed above the

minimal damage inflicted on Milford Haven by the oil industry could be attributable to extensive tidal flushing, a relatively small number of muddy shores--the shores of Milford Haven being predominantly rocky and a small number of oil susceptible birds in the port (Id. at 77,78).

148. As indicated (finding 140) marsh areas are considered the most susceptible to damage from oiling and take the longest time to recover therefrom. However, there is evidence that this may not always be the case as a study of a 1976 oil spill in marsh areas of the Chesapeake Bay of Virginia indicated the populations of mussels and oysters were not effected, that the population of a snail was significantly reduced but appeared to be recovering well and that a dominant marsh actually showed increased productivity measured by standing crop, increased density, decreased mean height and increased flowering success (Effects Of The Chesapeake Bay Oil Spill On Salt Marshes Of The Bay, Pittston Exh. 77). Increased productivity of marsh grass was attributed in part to its dormant stage at the time of the spill, cutting of the grass during cleanup efforts, relative non-toxicity of the oil and a comparatively high energy system, which reduced the residence time of the oil. Dr. Peter F. Larson, Senior Research Scientist at Bigelow Laboratory, West Boothebay Harbor, Maine, testified that salt marshes were considered the most biologically productive areas on the east coast of the United States (Tr. 3095). Dr. Larsen cited data from the Maine Department of Fisheries and Wildlife to the effect that there were 278 acres of marshland in the Cobscook Bay area (Tr. 3098-99; Testimony, NOAA Exh. 56 at 6). He indicated, however, that in his opinion marshland areas were underestimated by one-half because only areas of five acres or more were included in the Maine data. Under cross-examination, he conceded that he had no knowledge as to the actual extent of the areas under five acres and that it was merely his impression that these areas would equal

at least 278 acres (Tr. 3099, 3100). It is noted that the 278 acre figure for salt marsh area in the inner Quoddy Region is accepted by Dr. Vaugn Anthony, an expert witness for NOAA (NOAA Exh. 47 at 61). Although it is not clear that the Cobscook Bay area referred to by Dr. Larsen is the same as the area referred to by Dr. Vandermeulen, Dr. Vandermeulen estimated that salt marshes constituted approximately .5% of the shoreline of the Quoddy Region (Testimony at 12). Dr. Vandermeulen estimated that mud flats constituted approximately ten percent of the Region's shoreline at low tide (Id. at 15).

149. The Literature Review of the Marine Environmental Data for Eastport, Maine (June 1973) prepared by the Research Institute of the Gulf of Maine (TRIGOM) lists six subsystems present in the Quoddy Region: (1) tidal mud and sand flats, (2) subtidal bottom-based communities, (3) salt marshes, (4) high velocity channels, (5) plankton-based communities and (6) rocky shorelines, headlands and rock outcroppings. Dr. Larsen, identified in the preceding finding, listed 50 intertidal habitats in the Cobscook Bay area (Testimony at 37, 38). However, he made no attempt to defend the 50-habitat figure, indicating that 10 to 20 distinct habitat types would probably be more accurate (Tr. 3103-04). He asserted that this would be based on the animals living there, but made no effort to identify the distinct habitats he considered to be present.

150. The dozen salt marshes of five acreas or more constituting the 278 acres of salt marshes in the Cobscook Bay area are listed in the TRIGOM report at 84. One of these marshes, Northwest Bailey's Mistake, fronts on the Grand Manan Channel while two others Northwest Quoddy Head and

South Woodward Point front on Quoddy Roads between Washington County, Maine and Campobello Island (Map, Pittston Exh 75). Boyden Stream Marsh (Little River) outlets into Passamaquoddy Bay and the cited map does not show Nat Smith Marsh or Hardscrabble River, North of Meadow. The Hardscrabble River (Pembroke area) is shown on the map, Pittston Exh. 46. The balance of the marshes listed in the TRIGOM report are clearly within the Cobscook Bay area. Dr. Larsen attempted to identify other marsh areas with which he was familiar. He referred to Hebon Cove (not identified on Pittston Exh. 75) to an area behind Hallowell Island and to an area at the base of Whiting Bay (Tr. 3106-07). He asserted that there were a number of other marsh areas.

151. Based on data supplied by the Maine Department of Inland Fisheries and Game, the TRIGOM report states that there are 9,300 acres of mud and sand flats in the Eastport area (Id. at 52). Slightly over 6,000 acres of this total are indicated to be mudflats, defined as an unvegetated intertidal flat exposed at each low tide, in Cobscook Bay (Id. at 83).

Areas Impacted by an Oil Spill

152. The spread of a hypothetical 13,000,000 gallon oil spill occurring 2.5 miles off of the Northeast Coast of Campobello Island was discussed in connection with the effects of such a spill on the food supply of whales (finding 97). Dr. Loucks, identified in finding 117, estimated the spread of spilled oil from hypothetical spills of 50,000 tons each occurring in the northern part of Head Harbor Passage at low water and off of Estes Head one hour before high water (Testimony, NOAA Exh. 50 at 3). Hourly charts of tidal currents prepared by Forrester (1959)

were used to estimate the drift of an oil patch from a given location (Id. at 5). Maps were prepared for each hour in the tide-cycle to form a time sequence. Fifty thousand tons were selected as the size of the hypothetical spill because over the 12-hour time scale surface tension for such a spill would continue uninterrupted (Id. at 6). He indicated that for a smaller spill of 1,000 gallons, surface tension spreading would cease after approximately six hours.

153. Dr. Loucks' hourly estimates of a 50,000-ton oil spill imagined to occur at low water near Casco Bay Island at the entrance to Head Harbor Passage are shown on Figures 7-18 of the attachment to his Testimony (NOAA Exh. 50). This shows that at low water plus three hours the spill has spread beyond Indian Island toward Eastport and Friar Roads covering approximately 60% of the entrance to Western Passage (Id., Fig. 10). At high water minus two hours, the spill encompasses Friar Roads and has proceeded beyond Eastport, Deer Island Point and to Kendall Head, Quoddy in Western Passage (Fig. 11). At high water the spill substantially covers Western Passage, Head Harbor Passage including Harbor De Lute, Campobello and substantially covers the area between Seward Neck and Broad Cove (Moose Island), the entrance to Cobscook Bay (Fig. 13). At high water plus three hours the oil has receded from Western Passage and the entrance to Cobscook Bay, remaining on the shores, proceeded to cover Johnson Bay and through Lubec Narrows into the Lubec Channel, spread beyond East Quoddy Head and to Scott Head, Campobello Island (Fig. 16). At the completion of the cycle (low water minus one hour), the oil has receded further from Western Passage and the entrance to Cobscook Bay, has extended further into Lubec Narrows

and has extended approximately one-third of the distance down the east side of Campobello Island (Figure 18).

154. Figures 19 though 31 represent Dr. Loucks' hourly estimates of the spread of a 50,000-ton oil spill hypothetically occuring off Estes Head one hour before high water. At high water plus two hours the oil has surrounded Treat Island in Friar Roads, spread over Johnson Bay and started into Lubec Narrows (Figure 22). At low water minus two hours the oil has receded from the westerly side at Treat Island, spread into Lubec Channel and up Head Harbor Passage as far as the entrance to Harbor De Lute, Campobello Island (Figure 24). At low water, the oil has advanced further up the shoreline of Seward Neck toward Cobscook Bay, occupied approximately three-quarters of Lubec Channel, spread over Friar Roads and up Head Harbor Passage as far as East Quoddy Head, hewing to the Campobello Island side of the Passage (Figure 26). At low water plus three hours the oil has receded from the Lubec Channel, extended up Seward Neck into Cobscook Bay, spread over approximately four-fifths of Western Passage and occupied the area between Campobello and Deer Islands to a point just north of Indian Island and impacted approximately one-third of the shoreline on the eastern side of Campobello (Figure 29). At high water minus one hour the oil has receded from the Lubec Channel, spread over the major portion of Cobscook Bay, extended over Western Passage and into Passamaquoddy Bay and receded somewhat from Head Harbor Passage north of Indian Island (Figure 31).

155. Dr. Loucks' overall conclusion was that dispersion of spilled oil would be rapid and extensive in Head Harbor Passage and that the risk

of contamination seems to be general rather than being concentrated in a few collector-sites (Attachment to NOAA Exh. 50 at 64). He further concluded that all the waters and the shores of Head Harbor Passage would be vulnerable within 12 hours of a spill and that waters and shores of Passamaquoddy Bay, Campobello and Grand Manan would be vulnerable to contamination within a week. Waters and shores of the Bay of Fundy and the Gulf of Maine would be vulnerable to contamination in longer periods of time (Id.). Dr. Loucks' conclusions as to the spread of oil assumed that no clean-up efforts were effected and that there were no restraints on the spread of oil other than the land bodies (Tr. 2847). Although he denied that his conclusions assumed an instantaneous release of 50,000 tons of oil, asserting that a continual hemorrhaging was envisioned (Tr. 2847), no release time was mentioned and it would seem to be obvious that the rate of spread would be effected by the rate of release. Dr. Loucks also made no allowance for evaporation, assuming that would be minimal in a 12-hour period even though his conclusions were based on a data base taken in the summer and made no estimate of the amount of oil trapped in estuaries or shoreline areas (Tr. 2848-49, 2851, 2853). He also considered that tidal drift would be the dominant mode or driver for the spread of oil within Head Harbor Passage and thus his conclusions made no allowance for the effects of wind (Tr. 2860-61, 2867). He contended that wind would only be a dominant factor if the oil reached Passamaquoddy or Cobscook Bays.

Alleged Uniqueness of Quoddy Region

156. Opponents of the Pittston project have emphased the uniqueness of the Quoddy Region, arguing that such an area should not be exposed to the risks of oil spills which will be engendered by the project. The FEIS (Vol. II at III-71) concluded that if uniqueness is to be considered as the presence of species or habitat types which are found absolutely nowhere else, then the Cobscook Bay area could not be considered unique. The FEIS further concluded that all species found in the Cobscook Bay area are thought to occur in other habitats along the Coast of Maine and that no evidence has been found to indicate that species are present which would be eliminated as the result of an oil spill.

157. In an effort to rebut the conclusions of the FEIS, Dr. Peter Larsen (finding 148) testified that eastern Maine and the Quoddy Region, especially Head Harbor Passage and the Cobscook Bay areas, were unique in terms of benthic invertebrates to such a degree that no one could objectively argue otherwise (Testimony, NOAA Exh 56 at 11, 12). He conceded, however, that subjectivity or bias would always be present and that the data were not as complete as he would like. He asserted that the western Atlantic boreal zone extended from Cape Code to southern Labrador and in the United States extended only from northern Massachusetts, New Hampshire and Maine (Id. at 12, 13). He cited data indicating that the total number of benthic invertebrate species found in Maine is 1,339 (Id. at 14). He cited other data indicating that the distribution of many species were disjunct and discontinuous, and that based on water temperature and faunal composition the boreal region of northern New England was divided into two regions, the area to

the north characterized by cold summer surface water temperatures and the area to the south having areas of warm water with pockets of warm temperate species. The dividing line between these areas was Penobscot Bay, with the area from east of Mt. Desert Rock to Passamaquoddy Bay being characterized as subarctic (Id. at 14, 15). Dr. Larsen testified that this was the only area of its type south of Labrador and was unique in the 48 contiguous states. He further testified that if eastern Maine and the Quoddy Region were unique in terms of water temperature the uniqueness should be manifested in the fauna.

158. Dr. Larsen divided the coast into eight regions: southern Maine south of Cape Elizabeth, the six regions utilized by the U.S. Fish and Wildlife Service (Eastport being in Region 6, Machias-Passamaquoddy) and Passamaquoddy (Canada) (Testimony at 15). Table 2 reflects that Region I (Casco Bay) has a total of 804 species, Region 5 (Mount Desert) has a total of 722 species, Region 6 a total of 705 species and Passamaquoddy a total of 836 benthic invertebrate species (Id. at 19). The cited Table also lists the number of unique species as 92 for Region I, 95 for Region 5 and 70 for Region 6. Dr. Larsen acknowledged that Region 6 was larger than the Quoddy Region and much larger than Cobscook Bay (Tr. 3122). He attempted to explain the lower number of species shown for Region 6 by the assertion that it was the most poorly sampled region on the Maine coast, that Region I included deep water samples not included in other regions and that both Regions I and 5 included species of bryozoans which were not sampled in the other regions (Testimony at 18-21; Tr. 3124-26). He testified that there was

no question in his mind that if Region 6 were systematically sampled, as have the regions further south, it would clearly be established as the richest area on the east coast of the United States north of the tropics (Testimony at 21). By his own characterization, this was argument and he further argued that the numbers of species for Region I were inflated by offshore species, that Region 5 contains 36 species of unique bryozoans which probably occur elsewhere and that in all likelihood, Region 6 has the highest numbers of unique species as well as the richest fauna (Id.). He acknowledged that the Sheepscot Estuary (Region 2) has a deep slit, which lets in deep, cool water and the same kind of constant environment as Cobscook Bay (Tr. 3130). The substance of Dr. Larsen's testimony is that present data does not establish that the Quoddy Region is unique in terms of diversity of invertebrate species but in his opinion further studies would establish that as a fact. It is of interest that a table in the FEIS (Table III-25 at III-85) showing the distribution of marine and invertebrate species reported since 1940 for 11 regions along the Coast of Maine (Region 9 representing eastern Washington County) and reportedly based on Perkins and Larson data for 1975 shows 359 species for Region 9 and 539 for Region 5 (Boothbay Harbor, Lincoln County).

159. Dr. Larsen also contended that eastern Maine and the Quoddy Region were unique because species found intertidally there were only found subtidally elsewhere (Testimony at 21, 22; Tr. 3134-35). He testified that data for the State of Maine showed that 99 species can be found intertidally in Region 6, or at least east of Mt. Desert, which can be found only subtidally in other regions (Testimony at 22, Table 3). He acknowledged,

however, that "east of Mt. Desert" included part of Region 5 and all of Region 6 and that there were similarities between the Coast of Maine in the vicinity of Mt. Desert and the coast in the Eastport area (Tr. 3136-3139). The significance of this is, of course, that even the tremendous impact of an oil spill on Cobscook Bay would not effect a similar area or system at Mt. Desert, for example. He also acknwledged that there were species found intertidally in some areas and not in Cobscook Bay (Tr. 3139).

160. Concerning density of species and mean numbers of species, Dr. Larsen's data does not show Cobscook Bay to be the most productive in the State of Maine or in the world (Testimony, Table 4 at 42). The cited table shows that the Sheepscot River Estuary and Casco Bay are the most productive in terms of mean numbers or density of species. He acknowledged that Cobscook Bay was not unique in terms of total numbers of benthic invertebrates and that productivity of Cobscook Bay in relation to other Maine estuaries and other temperate estuaries in the world could properly be termed "relatively high" (Tr. 3140). He contended, however, that Cobscook Bay was unique in terms of individual species and their abundance. Nevertheless, Table 4 shows the Sheepscot River Estuary having 77 as mean number of species as compared to 50 for Cobscook Bay and Dr. Larsen acknowledged that data for out-of-state and out-of-county areas were not available (Tr. 3141).

161. Dr. Gilfillan testified that the Eastport area is unique only because a great many species of animals happen to occur there together (Rebuttal Testimony, Pittston Exh. 50 at 23). He asserted that all of

these animals were in fact found elsewhere and that the reason for the diversity in the Eastport area was because the environment was more predictable than in other areas of Maine (Id.). He further testified that this occurrence of high species diversity in more predictable environs was by no means a unique process and was by no means limited to the Eastport area. In answer to a question as to whether there were species in the Quoddy Region which did not occur anywhere else in the world, Dr. Larsen referred to second hand information that there were at least a hundred macrobenthic species which occurred only in that region of the mouth of the Bay of Fundy (Tr. 3189). The mouth of the Bay of Fundy is hardly restricted to the Quoddy Region and Dr. Larsen acknowledged that his source, a Dr. Bausfield, utilized different terminology in describing areas.

162. Dr. Larsen also considered Cobscook Bay to be unique because of what he termed "giantism," the large sizes obtained by some benthic invertebrate species (Testimony at 26; Tr. 3158). He mentioned starfish, brittlestars, tunicates and sea urchins as among species that may attain two or three times their normal size. He testified that the cause of the giantism has not been determined. He acknowledged that he had heard of giantism among benthic invertebrates in the Antarctic and among oyster drills on the eastern shore of Virginia and that he had not done any studies looking for giantism elsewhere than the Cobscook Bay area (Tr. 3158-60). Paradoxically he testified that he would consider metabolic activity to be higher in Chedabucto Bay than in Eastport (Tr. 3179).

163. Dr. Vaugn Anthony of the National Marine Fisheries Service, Woods Hole, Massachusetts, and an expert in the population dynamics of Northwest

Atlantic commercial species, testified that the Quoddy Region was unique because it supported the only known near-shore population of redfish in the North Atlantic and because of the regular presence of swarms of euphausids which attract cetaceans, herring, and other species, close to shore (Testimony, NOAA Exh. 48; Tr. 2747-48).

164. Dr. Larsen referred to shore and coastal birds which depended upon benthic invertebrate prey for their diet (NOAA Exh. 56 at 10). He referred in particular to shore birds such as semipalmated sandpipers and semipalmated plovers which in certain seasons congregate on the large intertidal flats of the Quoddy Region to feed. He testified that the birds increase their weight by 50 to 100% in two to four weeks feeding on intertidal invertebrates such as amphipods (Id.). These amphipods reportedly occur only in the northern Gulf of Maine and Bay of Fundy on this side of the Atlantic (Tr. 3150). Dr. Larsen indicated that the birds pass through the Bay of Fundy-Quoddy Regions in their seasonal migrations, that they are exhausted when they reach that area and that an oil spill which wiped out the amphipods would be devastating to the birds (Tr. 3149-52). He acknowledged that he was not an expert in this regard, that he was relying on information and opinions from others and that there were oligochaete worms and Baltic clams that made up a small percentage of the diets of the semipalmated plovers and sandpipers. Although he asserted that the portion of his testimony concerning birds was included to show the special nature of communities in the Cobscook Bay area, he also stated that his purpose was merely to show how benthic invertebrates are linked

to higher trophic groups (Tr. 3148). Dr. Larsen also referred to other shorebirds, gulls and ducks which feed on intertidal and shallow water invertebrate fauna such as Baltic clams, oligochaete worms, mussels and crabs (Testimony at 10).

165. Mr. Ralph Andrews, a wildlife biologist for the Fish and Wildlife Service, identified water and shorebird species in the immediate vicinity of the proposed Pittston project and in adjacent coastal waters through which tankers would pass (Testimony, DOI Exh 30). He also identified specific areas of particular importance to the birds. The "study area" utilized by Mr. Andrews is larger than the Quoddy Region described herein and includes the area from Maces Bay, New Brunswick to Machias Bay, Maine and the Grand Manan Archipelago (Id., Fig. 1). He grouped waterbirds and shorebirds (broadly defined to include all species that feed in the marine aquatic and intertidal zones) of regular occurrence in the study area into six categories: (1) gulls, terns and cormorants, (2) shorebirds (including phalaropes), (3) waterfowl (including loons and grebes), (4) alcids, stormpetrels and associated seabirds, (5) wading birds and (6) hawks and eagles. Of these he considered birds that spend most of their time feeding on the water or diving for their food would be most vulnerable to oil spills and these included loons, grebes, diving ducks such as scoters and eiders and possibly birds in large concentrations such as alcids (seabirds) which consists of groups including puffins, dovekies, razorbills and murres (Tr. 4542, 4561). Because some of the birds are migratory and others move in and out of the area at specific times of the year for breeding, nesting and other reasons, not all birds common to the

area would be present at any particular time and thus at risk from an oil spill (Tr. 4560-61). Mr. Andrews acknowledged that not all birds in the study area would be at risk should the refinery be constructed and that the survival of any species referred to in his testimony would not be jeopardized by the refinery (Tr. 4546-48, 4578). He also acknowledged that he knew of no reports of permanent or lasting damage to bird populations as a result of oil spills (Tr. 4563).

166. Effects of oil on eagles, eagle eggs and the food supply of eagles have been alluded to above (findings 23-28). Mr. Peter H. Albers of the U. S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland, submitted testimony on the effects of crude oil and refined oil products on birds and the hazards to birds posed by potential oil discharges from the operation of the proposed Pittston refinery (DOI Exh 33). He testified that avian mortality from oiling as a result of oil spills was well documented and that sea ducks (e.g., scoters and eiders), alcids (puffins, murres and auks) and penguins were the most vulnerable species to surface oil (Id. at 4). This is because they spend so much time on or near the water and because they often form large concentrations in offshore areas heavily used by ships. Gulls, terns, and shorebirds are less vulnerable because they spend less time in contact with the water. Populations of long-lived species with low reproductive potential might be seriously depressed by a single large oil spill because of the time required to replace losses. Mr. Albers testified that factors such as time of year, time of day, tidal state and weather were important factors in determining what species of bird would be

effected by an oil spill and how severely (Id.). Mr. Albers indicated that attempts to clean and rehabilitate oiled birds had faired poorly in the past but were improving and that the success rate for a well run rehabilitation center should be about 60% (Id. at 5).

167. Oil causes death in birds by disrupting the feather structure and causing feathers to mat together, thus destroying the insulation and buoyancy qualities of the feathers so that birds may die of exposure or drowning (Albers, Testimony at 4). Birds may also ingest oil directly by preening, drinking, or eating food covered with oil or indirectly when consuming food that contains oil or fractions of oil (Id. at 7). Necropsies of birds killed in oil spills have revealed some general pathological effects of direct ingestion of oil which include lipid pneumonia, gastrointestinal irritation, fatty livers, enlarged adrenal glands and kidney, and pancreas damage which can lead to other complications such as dehydration, starvation, shock and reduced disease resistance. In general short-term ingestion of small amounts of oil may cause detectable changes in avian physiology and behavior (Id. at 8). While it is true that oil may penetrate sand and gravel beaches and sediments of intertidal areas and thus be released slowly into the environment (Id. at 9), laboratory experiments wherein mallard ducks were fed oil for periods exceeding 50 days, the ducks exhibiting impaired reproduction, do not seem realistic when compared to what might happen as a result of an actual oil spill. The magnitude or consequences of oil ingestion from prey items in the wild are unknown (Id.). Studies using artificially or naturally incubated eggs of ducks, gulls, herons, etc. have shown that a single application of 1-20 microliters

(5 microliters equals a small drop) of several crude and refined oils will significantly reduce hatchability of eggs (Id. at 10). Bird embryos are most sensitive to petroleum during the first ten days of incubation. Oil can be transferred to eggs from the plummage and feet of birds (Id. at 10, 11). No. 2 fuel oil weathered for two weeks and Prudhoe Bay crude oil weathered for three weeks were less toxic to bird embryos than unweathered samples of these oils.

168. The largest bird mortality from oiling in the Eastport area would most likely occur during the period August through April, as except for offshore islands, the area is less important for reproduction than for migration and wintering (Albers, Testimony at 5). Migrating species that use the area heavily during late summer, fall or spring include blackducks, American brant (geese), scoter ducks, northern phalaropes, sandpipers, semipalmated plover, black-bellied plover and Bonaparte's gulls. Common wintering species include blackducks, scoter ducks, common eiders, goldeneye, bufflehead and old-sqaw ducks, great comorants, horned grebe, several alcids, herring gulls, black-legged kittiwakes and northern fulmar (Id. at 6). Sea ducks, alcids, comorants and loons would be most severely affected by an oil spill followed by diving ducks, grebes and geese. More migrating northern phalaropes visit Eastport and vicinity than any other area in North America and because of their habit of feeding and resting on open water, they would be seriously threatened by a large spill. Migrating shorebirds that roost on intertidal flats would be vulnerable to a night oil spill or a night movement of previously spilled oil. According to Mr. Albers, No. 2 fuel oil, a product of the refinery, poses the greatest oiling

threat, followed by incoming Saudia Arabian crude and No. 5 fuel oil, also a product of the refinery (Id. at 7). This was based on spreading, solubility and toxic characteristics.

169. Mr. Albers testified that chronic discharges of small quantities of oil from local inhabitants and the refinery would probably result in the ingestion of some oil by birds all during the year (Id. at 10). He indicated that birds foraging in Broad Cove would get the greatest chronic exposure to petroleum and cited testimony (see, e.g., Ralph Andrews, Figure 7) to the effect that Broad Cove was an important feeding site for shorebirds.

Value of Resources at Risk

170. The FEIS (Vol. II at III-87) recognizes that invertebrate species found in the Quoddy Region have substantial commercial value. Only species of commercial interest in Washington County, Maine and Charlotte County, New Brunswick are listed and these include lobster, soft-shelled clam, shrimp, scallop, periwinkle, blue mussel and worms. Although 1975 landings and dollar values (Table III-27 at III-91) show that lobster was the most important species for Washington County (1,910,000 lbs. valued at $3,192,000), the FEIS states that soft-shelled claims (2,675,000 lbs. valued at $2,411,000) were the most important species for the Eastport-Passamaquoddy area. Invertebrate landings for Washington County in 1975 totaled 5,345,000 lbs. valued at $6,711,000 (FEIS, Table III-27). Invertebrate landings for Charlotte County, New Brunswick for 1975 (doesn't include mussels and worms) totaled 1,509,000 lbs. valued at $1,603,000 (Id. Table III-29). Dr. Vaughn Anthony (finding 163)

calculated total Washington County invertebrate landings for 1978 as 5,789,633 lbs. valued at $8,302,357 (NOAA Exh 47, Tables 4 and 5). He also showed Charlotte County, New Brunswick invertebrate landings as totaling 1,677,900 lbs. valued at $2,365,000 (Id., Table 7).

171. Table III-31 at III-98 of the FEIS shows 1975 groundfish landings in Washington County totaling 257,000 lbs. valued at $40,000. Groundfish include cod, haddock, cusk, eel, dab (plaice), hake, pollock, halibut, winter flounder and witch founder (gray sole). Ground fish landings for Charlotte County, New Brunswick in 1975 totaled 2,942,000 lbs. valued at $302,000 (Id., Table III-32). Dr. Anthony reports Washington County groundfish landings (only cod, haddock and pollack) for 1978 as totaling 1,088,780 lbs. valued at $169,530 (Testimony at 54-56). Charlotte County, New Brunswick groundfish landings for 1978 are reported as 770,000 kilograms valued at $360,000 (Id., Table 6).

172. The FEIS states that herring are the single most important fishery in the Passamaquoddy Region (Vol. II at III-100). Herring landings for Washington County in 1975 totalled 6,596,870 lbs. valued at $293,717 (Id. at III-102). Herring landings for Charlotte County, New Brunswick, in 1975 were 131,965,000 lbs. valued at $3,383,000 (Table III-34 at III-103). Dr. Anthony shows 1978 sea herring landings in Washington County to be 14,726,874 lbs. valued at $822, 400 (Anthony Testimony, Tables 2 and 3). This is out of total finfish landings in 1978 in Washington County of 15,538,132 lbs. valued at $972,319 (Id.). Dr. Anthony also shows 1978 herring landings for Charlotte County, New Brunswick of 131,744,000 lbs. valued at $8,777,000 (Table 8). Dr. Anthony shows total finfish landings for

New Brunswick of 133,442,000 lbs. valued at $9,137,000 (Tables 9 & 10). It is noted that 1975 landings, shown by Dr. Anthony for Washington and New Brunswick Counties do not agree with those shown in the FEIS. Dr. Anthony (Table 11) shows total 1978 landings of finfish and shellfish for Washington and New Brunswick Counties of 156,600,000 lbs. valued at $20,807,000.

173. Dr. Anthony testified that landings and landed values reported in his tables were minimum estimates because the data included only commercial landings collected at major ports (NOAA Exh 47 at 15). He stated that recreational landings were not included in his data, that some dealers handling fish and shellfish were not contacted by data collectors and he referred to the belief of NMFS port agents that on the average about 75% of the landings were reported from the 15 ports (Maine) they visited (Id. at 15, 16). He also indicated that fish caught in one area may be landed in another (Id. at 17, 18; Tr. 2670-71). While he included a factor of 2.9 to account for finfish caught off of Washington County (NOAA Statistical Area 511, Pittston Exh 77) which were landed elsewhere, he did not include a similar factor for finfish landed in Washington County but caught elsewhere because of the belief that there was little or no market for such fish in Washington County and thus no reason or advantage for bringing fish caught in other areas into Washington County (Testimony at 18; Tr. 2673-74). He acknowledged, however, that there were a limited number of fish processing plants in the County (Tr. 2675-76). Notwithstanding his use of a factor 2.9 to account for finfish caught in Statistical Area 511 (roughly Washington County) but landed elsewhere, he increased Washington County finfish landings by a factor 1.54 for such reason in Table 9. He testified that

the 1.54 factor was based on an analysis of reported catches in Statistical Area 511 and monthly fish landed data as reported by the State of Maine (Tr. 2676-78). While he acknowledged that the figures were subject to error and that faith could not be placed in particular numbers, he insisted that the figures were approximately correct and showed trends over time. As a generalization, Dr. Anthony's figures on landed quantities (pounds or metric tons) of marine products (Tables 1 thru 10) show a general upward trend during the period 1969 through 1978 (Testimony at 8; Tr. 2679). It is clear, however, that the dramatic increases in landed values are due primarily to price increases in an inflationary economy (Testimony at 9-11; Pittston Exhs 72, 73, 74).

174. Dr. Anthony testified that the landed value of marine resources at risk should the Pittston refinery be constructed underestimated the actual value and that landed value should be increased to account for values added by handling, processing, etc. (Testimony at 15). In the case of herring, he asserted that landed value should be increased by 25 to account for the value, price or income from dockside to the sardine can on the grocer's shelf. He acknowledged that this was a rough calculation based on an assumed shelf price for a can of sardines and that this added value would not be confined to Washington County (Tr. 2696-98). He stated that his testimony dealt with landed value because added value was difficult to obtain (Tr. 2693-94). Dr. Anthony referred to sport and recreational fishing for mackeral and salmon. He placed a value of $500 on each salmon caught because he considered salmon fishing to be very expensive and this was the value to the economy (Tr. 2638, 2695-96). Data on commercial catches of mackeral since

1972 and recreational catches of mackeral are not available. Dulse, Irish Moss and Rockweed production and landed values are shown in Table 31. Charlotte County production of these plants totaled 95,000 lbs. in 1978 valued at $83,000. Although Dr. Anthony referred to interest in aquaculture activities in the Cobscook-Passamaquoddy Bay area by both Canadian and American agencies and the great economic potential for such activities in that area (Testimony at 58, 59), he made no attempt to place a value on aquaculture.

175. James Kirkley, an economist/econometrician and an expert witness for NOAA, estimated that the aggregate economic impact from commercial fisheries for Washington County, Maine and Charlotte County, New Brunswick was approximately $60,000,000 (NOAA Exh 54 at ii, iii). This figure was derived by applying a multiplier of 2.96 to the expressed or landed value of commercially reported landings. He maintained that this figure was very conservative in that it did not include income to the wholesale sector except for herring, estimated impact from subsistence and recreational activities and non-quantifiable aesthetic values such as those attributable to marine mammals (Id. at iii). He also maintained that the use of the 2.96 multiplier was very conservative, citing the Corps of Engineers' use of a multiplier of up to 22 when estimating the impact of marine resources on all economic sectors.

176. Mr. Kirkley estimated potential impacts of an oil spill on revenues and harvests for the years 1980 to and including 1990 (Testimony at iv, Tables 37 thru 60). Analyses of U. S. Fisheries were confined to catches within three miles of the shore of Washington County. Potential losses were assumed to be the result of mortality, tainting, fouled gear and

consumer resistance. His calculations assumed losses of the entire harvest for one year because that was the only data available (Tr. 2959-61). In the case of invertebrate stocks, he estimated recovery times from an oil spill. His estimated impacts did not consider the potential for fishermen to redirect harvesting activities to other species, changes in price levels from reduced availability of stocks, possibility of fishermen taking or harvesting portions of stocks during recovery periods, potential permanent reductions in harvesting and employment due to short-term loss in income, i.e., small fishermen going out of business, consumer response to product contamination or the impacts on the economic value to area residents predicated on the quality of life resulting from commercial fishing activities (Testimony at iv, v). He estimated the value of saltwater recreational fisheries (based on expenditures) in Washington County at $504,532.

177. Mr. Kirkley recognized that landed catch data had to be viewed with caution because the data did not necessarily indicate where the resource was taken (Tr. 2946-48). However, he did not make any adjustments to account for resources taken off of Washington County (Statistical Area 511) and landed elsewhere as Dr. Anthony had done (finding 167) or vice versa (Tr. 2948-2953). There are also substantial discrepancies in the data on landed quantities. For example, quantities of sea herring landed in Washington County in 1978 are given as 14,534,000 lbs. (Testimony, Table 6 at 15, Table 16 at 41). In other portions of his testimony, herring landings for Eastern Maine are stated to be 12,804 or 12,805 metric tons, almost twice the quantity given in Table 6 (Id. at 18, 19, Table 10 at 29). Eastern Maine is considered synonymous with Washington County (Tr. 3014). Mr. Kirkley was unable to explain this large discrepancy (Tr. 2974-78; 3053-55).

178. In calculating potential losses to the harvesting sector for each of the years 1980 to 1990, Mr. Kirkley used a minimum harvest level as observed in reported catches in Eastern Maine for the years 1951 to 1978, a five-year average catch, projected losses based on the 1978 catch and estimated annual losses based on a time series model (Testimony at 27, 28). The five-year average catch for herring is shown as 15,199,506 lbs. (Table 10), even though other data, i.e., Table 2, show the largest herring catch during the period 1969 to 1978 inclusive was 14,726,874 lbs. in 1978. Table 10 shows the 1978 herring catch as 27,809,460 lbs. His calculations assume a steadily rising landed price for herring of $.07 a lb. in 1980 increasing to $.12 per pound in 1990. As indicated, supra, (finding 176), his calculations assumed the loss of the entire catch for the year under consideration.

179. Mr. Kirkley also listed caveats in considering his estimates or projections of losses for the years 1980 to 1990 (Testimony at 62, 63). Possibly changes in prices resulting from a shift in demand or supply are ignored, prices were assumed to be set outside of Washington County and not effected by changes in local supply, redirection of effort by fishermen to other species or stocks were not considered and information on market distribution, sector employment and market prices were either unknown or uncertain (Id.; Tr. 2982-85).

180. Mr. Kirkley also used a multiplier based on Southern New England to calculate loss of income flow in Washington County, i.e., to support industry, families, etc., from the loss of fishery-resources (Testimony at 30; Tr. 3011-12, 3030). This multiplier is the 2.96 referred to in finding 175 and assumes that

one dollar of landed value for lobsters and one dollar of landed value for clams are identical as far as the economy is concerned (Tr. 3030, 3059). The cited document (Economic Impact of Marine Oriented Activities-A Study of the Southern New England Marine Region, NELF Exh 4A) defines the Southern New England Marine Region as consisting of all of Rhode Island (parts of Connecticut and Massachusetts (Id. at 1). The area consists of 3,178 square miles with a population of 1,654,562 people, while Washington County, Maine is approximately the same size (2900 square miles), but had a population of only 29,800 in 1970 (FEIS, Vol. II at III-12, 13; Tr. 3061). Because of these and other differences between the Southern New England Marine Region and Washington County, Mr. Kirkley acknowledged that the 2.96 multiplier must be applied to Washington County with caution and that certain assumptions regarding production mixes, technology, etc., were required in order for the multiplier or production coefficient to have validity (Tr. 3062-65).

181. It is inaccurate to assume that the entire fisheries of the Quoddy Region or the Bay of Fundy will be placed at risk by construction and operation of the refinery. There is no evidence of the loss of an entire year's recruitment or class of pelagic or other fish stocks from even the most massive oil spill. Moreover, the oil industry and the fishing industry have coexisted and indeed, thrived in the Gulf of Mexico, the North Sea and elsewhere (Pittston Exh 58 at 6; Appendix, Item 18A at 88-90).

Oil Discharges and Pittston's Oil Spill Containment and Recovery Plan

182. The FEIS (Vol. II at VI-28) states that combined flows, i.e., ballast water, stormwater runoff and process wastewater from the refinery would total approximately 4.4 million gallons a day, which at the permitted maximum concentration of 15 mg/l would amount to approximately 550 pounds or 92 gallons of oil and grease per day discharged in the immediate vicinity of the refinery. It is indicated that dispersion through the diffuser outfall would minimize the visual impact of this quantity of oil and grease and that concentrations in the vicinity of the diffuser should be near or below the threshold at which animals and plants may be effected. The FEIS states that sediments in the immediate area of the diffuser will lose the potential for supporting benthic life, but that it was expected that the loss of organisms in the immediate vicinity of the discharges would have insignificant effects on the ecosystem (Id. at VI-29). Although Dr. Gaskin asserted (NOAA Exh 71 at 53) that once a source of contamination, the refinery was established in the Bay of Fundy, it would almost certainly involve a net accumulation [of oil] from year to year, this was refuted by Dr. Gilfillan who testified that Dr. Gaskin's statement ignored the fact that petroleum compounds were readily metabolized by bacteria and was not based on published data (Pittston Exh 50 at 31, 32).

183. Another source of oil discharged to the environment is spills during routine transfer operations at the crude and product piers. The FEIS estimated these at 20 to 86 barrels per year (Vol. II at VI-29-32). The former amount (20 barrels) was asserted to be 0.00002 percent of all oil handled and ten times less than Portland, Maine, New England's largest oil port,

which is considered to be well managed and to have an excellent record. This estimate was essentially based on Milford Haven, U.K., which is considered similar to Eastport in many respects but handles 3,500 vessels a year as compared to Eastport's anticipated 500 to 750. The tankers will be surrounded by booms during transfer operations and substantially all of this oil should be contained and removed (Id.). Mr. Albers agreed with the assessment that Pittston's containment and clean-up plans appeared adequate to remove most of this oil (DOI Exh 30 at 2). Accord, EPA, Oil and Hazardous Spill Section, Statement on the Proposed Refinery Terminal, Eastport, Maine, dated September 7, 1976, Item V-12, at 2.

184. While noting that some tanker spill analyses define a large spill as over 1,000 barrels, the FEIS defined a severe incident as one where the oil spill exceeds 700 barrels (Vol. II at VI-29). Evidence with regard to the probability of a catastrophic spill (50,000 long tons or more) is covered above (findings 93 to 103). The Pittston Oil Spill Contingency Manual for the proposed refinery envisages that should an oil spill occur in transit, the source of the oil would be removed, the spilled oil would be contained and diverted, protective equipment would be deployed in sensitive areas and clean-up activities would follow (NOAA Exh 83 and Item V-IIA at 22). Specifically, the manual states that should a spill occur in transit from a loaded tanker compartment, the tanker would be stopped in the channel with tug assistance, spill emergency signals would be sounded, and the tanker crew would take immediate action to transfer oil to shipboard slop tanks, other cargo tanks where space exists or water ballast tanks if

feasible. In addition, cargo would be pumped to barges or tankers if available at the terminal (Id.). The tugs, motor boats and a vacuum barge would form the nucleus of equipment for containing and recovering oil in the channel from any source. The tugs and barge would be equipped with a supply of booms most appropriate for channel work. Booms would be used to contain and divert the oil to quiescent areas, which would be determined by dye tests during the construction phase (Id.). Location of these areas would be incorporated into the final operational plan, quantities of boom would be stored at or near these areas for quick response and buoyed anchor points would be located for boom fastening.

185. Pittston's Oil Spill Contingency Manual envisaged that permanent folding booms would be installed to protect lobster pounds on Deer Island (Id. at 22). Pound operators would be instructed in procedures for deploying the booms and in the event of an oil spill alert the booms would be deployed. Pittston personnel would deploy the booms if a pound operator could not be reached. Portable booms to be deployed by members of the Pittston oil response team would be used to protect lobster pounds on Campobello and at Leonardville Harbor, Deer Island.

186. Pittston's Oil Spill Contingency Manual also provided for the installation of permanent booms in a folded position, the booms to be deployed in the event of an oil spill, in Passamaquoddy Bay at Western Passage and in Cobscook Bay (Id. at 22, Figure 10). The booms across Western Passage would run from Indian Island to Deer Island to Moose Island (Eastport) at approximately Dog Island. The booms to prevent oil from entering Cobscook Bay would run from approximately Comstock Point, Seward Neck to a point above Deep Cove, Moose Island and from Shackford

Head to Birch Point and also from Shackford Head to Gove Point, Seward Neck. Mr. John Conlon, Chief of the Oil and Hazardous Substance Spill Section for EPA's Region I, testified that because of currents it would be very difficult to deploy booms in this manner and that in his opinion, booms so deployed would not be very useful (Tr. 4882-86). Accord, Marc Guerin, Director of Maine's Division of Oil Conveyance Services (the Division is responsible for enforcing pollution control laws and regulations and assuring that oil spills are properly cleaned up) (Tr. 2805, 2810-11 and Testimony of Dr. Roy W. Hann, NOAA Exh 91 at 21-24).

187. Booms are usually ineffective in containing oil at current speeds in excess of 1.5 to 2 knots (Guerin Testimony at 6, Tr. 2825-27; Hann Testimony at 18; Captain Dudley, Tr. 627-28). The Pittston Oil Spill Contingency Manual states that boom containment is effective without skimmers in currents of two knots parallel to the boom surface and one knot perpendicular to the surface (Id. at 9). Dr. Hann detailed additional difficulties with diversionary booms, namely that diverted oil must be promptly removed or it will escape either through entrainment or current direction changes, booms which are not continuously tended will generally fail either because of flotsam or tidal changes and irregularities at the shore end of booms leave gaps which allows oil to escape and oil shores (Testimony at 19). Other impediments to deploying and effectively utilizing booms in the Eastport area alluded to by Dr. Hann included wind, tides, extremes in temperature and lack of good visibility. Dr. Hann was of the opinion that lobster pounds could only be protected by extensive permanently constructed facilities and that ad hoc booming to

protect clamming flats was doomed to failure because of inadequate time to deploy the booms before impact, most areas being impacted within one tidal cycle (Id. at 22).

188. Oil removal equipment to be employed by Pittston includes 24-foot motor boats with gasoline powered fire pumps, positive displacement rotary pumps, portable diesel generators, portable vacuum skimmers, an 8,000-10,000 barrel slop barge, portable hose and oil skimming tugs (NOAA Exh 83 at 13). Absorbent booms, pillows and sweeps may be used to clean up oil outside of the booms. Pittston's Oil Spill Contingency Manual also refers to the use of dispersants if approved by EPA or other authority and herding agents to concentrate the oil. For oil reaching the shoreline vacuum trucks would be employed if accessible by road and natural and man-made absorbents would be used (Id. at 23). Although disposal of oil soaked absorbents and debris has been a serious problem, Mr. Guerin was of the opinion facilities being developed by the State of Maine would resolve this problem by the time the refinery is operational (Tr. 2786-88). Absorbents, foam and other supplies will be stockpiled at the refinery and a listing of additional equipment and supplies and procedures for obtaining same will be included in the final contingency plan. Although Messrs. Guerin, Conlon (finding 186) and Hann were critical of the Oil Spill Contingency Manual, characterizing it as inadequate in many respects, the manual is preliminary and Mr. Guerin acknowledged that his Division had authority under Maine law and regulations to require a revised oil spill contingency plan, to impose additional construction, pre-operational and operational conditions on the project and to require Pittston to maintain specified equipment

and supplies at the refinery for use in cleaning up oil spills (Tr. 2827-28).

189. Mr. Guerin testified that in instances of significant or major oil spills (defined as anywhere from 250,000 to millions of gallons) the recovery rate was seldom over 20% (Tr. 2781, 2791, 2794, 2804, 2814). Accord, Dr. Hann, Testimony at 24-31. Mr. Guerin also testified that a spill of 250,000 gallons or more offshore could not be contained in the Eastport area (Tr. 2784-85, 2803, 2812, 2814). He acknowledged, however, that this was not confined to the Eastport area but would be true anywhere along the Coast of Maine and probably anywhere in the world (2784-85, 2803, 2814, 2829).

Need for Refinery

190. The FEIS justified the need for the refinery by citing Federal policy to encourage the construction of refining capacity within the U.S. to meet domestic needs for reasons of national security (Vol. II at IV-1-5). It stated that by 1973 product imports totaled three million barrels per day or 17% of total requirements. While some domestic refinery capacity has been added since 1973, product imports exceeded 2.5 million barrels a day during the first four months of 1977 and more domestic refinery capacity was assertedly needed to back out imported products and take care of anticipated future growth in demand (Id.). The FEIS cited the serious problems created by U.S. dependence on foreign crude and asserted that over dependence on foreign refineries would be equally dangerous. Petroleum products were estimated to supply approximately 42% of U. S. energy requirements by 1985 (Id. at IV-2). The most

serious deficit of refining capacity is on the east coast (having approximately 30% of requirements) and there is no refining capacity in New England.

191. Citing data (The United States Refining Policy In a Changing World Oil Environment, Comptroller General Report To The Congress, June 29, 1979 and Trends In Refinery Capacity and Utilization DOE/RA-0010(78), (September 1978) Campobello Attachments 1 and 2) to the effect that the U.S. refining capacity exceeds domestic oil production and that there is surplus refining capacity not only in the Caribbean but also in Europe, opponents of the Pittston project contend that need for the refinery has not been demonstrated. They also cite the President's policy that imports of foreign oil into the United States not exceed 1977 levels (8.6 million barrels a day) and therefore assert that in the absence of an unlikely substantial increase in domestic oil production, the increases in petroleum consumption projected by the FEIS cannot take place. This, of course, is intended to bolster the contention that there is no need for the refinery. However, Dr. J. Lisle Reed, Director of the Office of Oil and Natural Gas in the Resources Application Section of the Department of Energy, testified that the United States needed additional refining capacity even if petroleum consumption was held at present levels (Tr. 4634-40).

192. Dr. Reed, testified that because of the increasing use of unleaded gasoline, demand for unleaded gasoline was very close to the U.S. refinery capacity to produce such gasoline (Rebuttal Testimony, EPA Exh 7 at 2; Tr. 4611-12). Refineries in the Caribbean and in Europe

do not have the capability to supply significant amounts of unleaded gasoline to the U.S. Contemplated output for the proposed Pittston refinery will be 41% low sulphur heating fuel oil, 34% low sulphur heating oil and 22% unleaded gasoline (Kaulakis, Pittston Exh 58 at 12). This product mix corresponds closely to consumption in the Northeastern U.S. (Id.) Normal output for a refinery of the size contemplated would be 40 to 45% gasoline and Dr. Reed acknowledged that if the main objective was production of gasoline the proposed Pittston refinery probably would not be constructed (Tr. 4610). However, U.S. refinery capability to process sour crudes (defined as crudes having more than 0.5% sulphur content by weight) is 46% of capacity and Dr. Reed testified to be in balance because of declining availability of sweet crudes, 65% of domestic refinery capacity should be devoted to sour crudes (Testimony at 5, 6). The Pittston refinery would be a substantial step in that direction (Id. at 2).

193. Dr. Reed emphatically confirmed the statement in the FEIS (finding 190) that it was Federal policy to encourage construction of refining capacity within the U.S. to meet domestic needs (Tr. 4616). He asserted that this was for national security and balance of payments reasons (Tr. 4617). While in line with the Comptroller General Report referred to supra (finding 191) substantial time was spent in cross-examination of Dr. Reed as to the wisdom of this policy, amounts actually contributed to balance of payments and the domestic economy, whether it wouldn't be cheaper to convert surplus refining capacity in the Caribbean to unleaded gasoline production, and whether United States' requirements

could not be assured in time of shortage or crisis through regulation of American oil companies with international operations to prevent diversions (Tr. 4617-28), the essential point of U.S. policy not to rely on product imports is an established fact. In this connection, Mr. Kaulakis and Dr. Reed emphasized that if the refinery were built, it would be more likely to be able to obtain crude oil in the event of an embargo or other shortage (Tr. 1809-10, 4624, 4646-48).

Economic Benefits of the Refinery

194. The FEIS compared Eastport with alternate refinery sites in the Middle Atlantic States and on the Gulf Coast, using the same size refinery, processing the same crude oil, making the same mix of products and supplying the same market (Vol. II at IV-14, 15). Eastport had $.37 a barrel advantage over the Gulf Coast and $.58 advantage over the Middle Atlantic States. The advantage of the Eastport location was due principally to lower transportation costs of delivering crude in VLCC's. Mr. Kaulakis estimated benefits from delivery of crude in VLCC's and from movement of product short distances in medium size vessels at $1.00 a barrel (Rebuttal at 15; Tr. 1854-56). He acknowledged that this figure could move up or down based on tanker rates which depended on conditions at the time. Mr. Kaulakis also estimated balance of payments benefits to the U.S. at $3.00 a barrel, which he indicated was the cost of refining (Rebuttal at 15; Tr. 1859, 1861). He acknowledged that to the extent other smaller, inefficient refineries were shut down, balance of payments benefits might have to be reduced.

195. As indicated in finding 29, construction of the refinery is expected to create 1,000 jobs during the first year, 2,500 jobs during the second year and 1,000 jobs during the third and final year of construction. Permanent jobs at the refinery will be 300 with another 200 jobs created by individuals or firms performing services on a contract basis (Tr. 1835-36). Utilizing a conservative multiplier of 1.25 for retail, service and other support activities associated with the creation of 500 jobs in the area would result in a minimum of 700 jobs in the Eastport area in addition to those created by the refinery (Tr. 5004-05).

196. Data in the FEIS reflects that Washington County had a population of 45,232 in 1900, which had declined to 29,859 in 1970 and increased to 31,737 in 1973. Similarly, Eastport had a population of 5,311 in 1900, a population of 1,989 in 1970 and a population of 2,103 in 1973 (Vol. II at III-16). The FEIS also reflects that there is a shortage of year-round jobs in Washington County that much of the employment is seasonal in nature, that Washington County had an unemployment rate of 13.6 percent in 1975 and is regarded as the poorest County in Maine (Id. at III-15-17). Additionally, per capita income for Eastport in 1972 was 14 percent below the County level, 30 percent below the State level and 45 percent below the national average.

Alternatives to Pittston Project

197. The FEIS stated that EPA action on the Pittston permit application was limited to granting, denying or granting the application with conditions (Vol. II at V-1). It was pointed out that action on the permit application must relate to the project as conditionally approved by the Maine BEP. The FEIS limited consideration of alternative sites for a refinery and marine terminal to those in the State of Maine. Other sites considered were Machias, Penobscot/Blue Hill and Portland (FEIS, Vol. I at 35, Vol. II at V-3 et seq.). EPA concluded that none of these sites was preferable or superior from an environmental stand point to Eastport (Vol. II at V-10). The FEIS also analyzed the alternative of a monomooring or monobuoy (singlepoint mooring or SPM) system in the Grand Manan Channel off of Lubec, Maine. EPA concluded that because of locational constraints in the Eastport area such a system would not significantly reduce overall environmental impacts associated with the project (Id. at V-15).

198. Although opponents of the Pittston project have attacked the FEIS consideration of alternatives as inadequate and based on an erroneous interpretation of EPA's NEPA obligations (Position Statement on Siting an Oil Refinery by the Pittston Company in Eastport, Maine, dated November 16, 1978, Item VIII-48 at 46), they have presented no probative evidence to contradict EPA's conclusion that other sites in the State of Maine are not environmentally preferable to Eastport. NOAA does refer to a study conducted by an interagency task force chaired by the Corps of Engineers in connection with the Final Supplement to the EIS concerning the Hampton Roads Energy Company's proposal to build a

refinery in Portsmouth, Virginia (Appendix, Item 25). The cited study, conducted for the purpose of evaluating alternative locations to the Portsmouth, Virginia site, evaluated Eastport and Portland/Sanford in Maine as well as sites in other states and gave Eastport unacceptable ratings as to risks or impacts on endangered or threatened species, terrestrial species and waterfowl, aquatic species and commercial and sport fisheries (Id. at 1-91). However, the study recognizes that the amount of information available on each site varied widely, that comparisons were valid only in relation to the HRECO's Portsmouth, Virginia site and that a decision to eliminate any particular site from consideration as a site for a refinery and marine terminal would necessarily be based on a full NEPA review (Id. at 1-9, 1-90). Moreover, in preparing the EIS for the Pittston project, EPA used "worst case analyses," a factor not applied to other sites with the exception of the Portsmouth site. It should also be noted that the matrix, developed to graphically present evaluation of key descriptors for alternative sites, does not allow comparing the relative significance of one descriptor with another and that the Supplemental EIS specifically states that attempting to rank sites using the matrix is not a valid procedure (Id. at 1-90). That there was no intent to rank sites was subsequently confirmed by the Corps of Engineers task force leader (Memorandum for the Record, dated May 29, 1979, by Major Joseph S. LeGath, Pittston Exh. 114). In taking final action on the HRECO permit application and accompanying EIS, the Office of the Secretary of the Army determined that there were gross inconsistencies in the way information was translated into the matrix and that the matrix was invalid as a decisional guide (Pittston Exh 57, Attachment 3 at 80).

199. The FEIS lists the reasons Pittston considered Eastport a preferred location as: (1) a very deep, naturally sheltered harbor, with excellent channel approaches as regards its width, depth, straightness, and length; (2) a logistically excellent location in relation to water distances to foreign crude supply points as well as to product markets, and the size of tankers that can be accommodated; (3) a location on the U.S. mainland with attendant stability and production geared to supply U.S. markets; (4) a receptive local community and (5) an adequate site which has been acquired or is under binding options (Vol. II at V-3). It was concluded that only sites in Maine met the requirement for deep water ports close to shore, capable of accommodating VLCC's and that a discussion of alternatives to Eastport should include sites meeting some of the basic business criteria necessary for Pittston to proceed with the project (Id.). In comparing Machias with Eastport, the FEIS stated that these sites were in the same air quality control region, that Machias had no industrial development nor unique sources of air pollution and that the air quality at Eastport and Machias should be approximately the same (Id. at V-5). Regarding water quality, land and sea uses, harbor traffic, terrestrial, aquatic flora and fauna, and socio-economic considerations, the FEIS determined that Eastport and Machias were similar and that impacts of the refinery at these two locations would be essentially the same. It was also determined that the risk of oil spills at Machias using VLCC's would be slightly greater than at Eastport because of exposure to wind and weather from the Bay of Fundy (Id. at V-9).

200. The FEIS stated that there were more point sources which contribute air pollution in the Penobscot/Blue Hill area than at Eastport and that the effect of the refinery on air quality could not be quantified because existing monitoring data may not accurately reflect emissions from existing sources due to prevailing winds and relatively large distances (Id. at V-7). Impacts on water quality at Penobscot/Blue Hill were considered to be essentially the same. Regarding land and sea uses it was pointed out that Penobscot/Blue Hill area had pockets of industrial growth, a population density more nearly equivalent to that of the larger towns and that tourism, and related land uses were more important than at Eastport or Machias (Id. at V-8). It was also noted that Acadia National Park was located in the middle of the area, that the area attracted many summer residents and that both commercial and pleasure boat traffic was greater than at Eastport. The FEIS states that the Penobscot/Blue Hill area is the center of Maine's lobster, clam and fish industry, and that the tanker approach is approximately 30 miles long and between numerous islands thus possibly exposing the tankers to a greater possibility of mishap close to inhabited areas and commercially important fishing grounds. Aesthetic impact of the refinery in Eastport was determined to be less than in Machias or Penobscot/Blue Hill area because the topography of Moose Island enabled the refinery to be largely sheltered from inhabited areas.

201. Portland is more heavily industrialized and densely populated than Eastport, Machias or Penobscot/Blue Hill. Portland is in violation of oxidant standards, has violated sulphur dioxide standards in the past and is approaching the standards for particulate emissions (FEIS, Vol. II at V-6-7). Water quality impacts from the refinery at Portland would

not be substantially different than from the other Maine sites discussed above. Commercial and pleasure boat traffic at Portland is the heaviest on the Maine Coast (Id. at V-8). Because Portland is an industrialized area, noise and aesthetic impacts of the refinery would be less than at the other sites. While Casco Bay and its environs are important areas for lobsters, clams and various fish, Portland has substantially less flora and fauna than Eastport, Machias or Penobscot/Blue Hill. Pittston determined that Portland was not an acceptable site because water depth was limited to tankers of 90,000 DWT, there was not enough land near the waterfront for a refinery or marine terminal, the refinery would have to be located approximately 30 miles from the waterfront and the difficulties in piping crude oil and fuel oils for those distances as well as obtaining the necessary right-of-way (Tr. 4924-26).

202. In a report prepared for Pittston by Frederic R. Harris, Inc. it was determined that it was technically feasible to construct a monobuoy in the Grand Manan Channel off of Lubec, Maine (Monobuoy Delivery Systems Including a Monobuoy Design For the Pittston Project (March 11, 1975), Appendix, Item 15; Pittston Exh 57 at 21, 22). As already noted (finding 192), EPA concluded that because of location constraints in the Eastport area such a system would not significantly reduce overall environmental impacts associated with the proposed refinery and marine terminal. One reason for this conclusion was that in order to keep the monobuoy in U.S. waters in the Grand Manan Channel, it could not be located far enough from shore to make it unlikely that spilled oil would

impact the shore (Tr. 5134). The site selected by Frederic R. Harris is 1.5 miles off the U.S. mainland. With regard to such a system in Machias Bay the FEIS concluded that it would be merely transferring the hazard to an equally ecologically sensitive area (Vol. II at V-15). Mr. Kaulakis testified that where a sheltered harbor, good depths of water and moderate ship traffic density exist, a fixed pier system was the inevitable choice (Pittston Exh 57 at 24). He asserted that the fixed pier in such situations provides for the greatest security, safety and convenience for operations and maintenance and for the best possible surveillance and control essential to minimize the risk of oil spills and other accidents that could be dangerous to both personnel and the surrounding community. The FEIS also concluded that because of exposure to the open ocean, an SPM system in Luske Sound (Portland) would be subject to a greater risk of an oil spill than a fixed-pier at Eastport (Vol. II at V-9). This would have required extensive dredging of rock and resulted in a narrow channel with turns in an area close to significant marsh resources (Tr. 5168-69). A monobuoy system is impractical for product and product would still have to be shipped from the refinery in tankers (Tr. 1898).

203. NOAA presented evidence for the purpose of establishing that a SPM constructed 50 miles off of the coast of New Jersey would be an economically feasible project (Testimony of Robert A. Mondor, NOAA

Exh 80; A Proposed New Jersey Offshore Terminal Versus The Existing Crude Oil Delivery Practice Within Delaware Bay, NOAA Exh 81). The offshore facility would consist of three SPM's connected to a pumping platform 50 miles off of Atlantic City, New Jersey in 130 feet of water. It would be used to deliver crude oil from BLM Lease Sale Nos. 40 and 49 and to unload crude oil tankers which normally proceed up the Delaware River to individual refineries. The capacity of the system would be 1.041 mm million barrels per day of existing capacity plus 250,000 BPD of additional capacity, the latter equivalent to the capacity of the proposed Pittston refinery at Eastport. Despite capital costs estimated at 630 million dollars and operating costs estimated at 40 million dollars a year, it was concluded that savings from use of VLCC's and removal of the necessity for lightering would deliver crude oil at a minimum of $.20 a barrel less than the existing system. This system would eliminate the necessity for tanker deliveries to individual refineries and over 25 years would reduce oil spills by one-third or roughly two million gallons of oil. However, this study omits land use regulations and environmental attitudes as selection criteria based on the expectation these constraints may be lifted or modified in the near future (NOAA Exh 81 at IV-6-7). Mr. Mondor acknowledged that this assumption was not based on knowledge of actual or anticipated legislation (Tr. 4331). He also acknowledged that no detailed engineering had been done and that there was nothing in the report (NOAA Exh 81) that compared the proposed system with Pittston's project from an economic standpoint (Tr. 4333, 4337). The proposed pipeline would go ashore at approximately

Atlantic City, New Jersey and cross the southern portion of the State (NOAA Exh 81, Fig IV-3 at IV-5). Mr. Mondor acknowledged that rights-of-way were presumed to be available but that detailed studies in that regard had not been performed (Tr. 4346). The study made no allowance for the fact that New Jersey is in a non-attainment area under the Clean Air Act (Tr. 4348).

Maine BEP Conditions As Part of Section 401 Certification

204. On September 2, 1977, the Acting Commissioner of the Maine Department of Natural Resources, Henry E. Warren, issued a certification pursuant to Sec. 401(a)(1) of the CWA that the discharge proposed in the permit (FEIS, Vol. III, Appendix A at A-13 et seq.) to be issued to the Pittston Company would comply with the applicable provisions of Sections 301, 302, 306 and 307 of the CWA (Item VII-17). The certification also provided that the described discharge will not lower the quality of the receiving waters below the minimum requirements of their classification and will satisfy appropriate requirements of Maine law. The certification made no mention of the conditions under which the Maine BEP had approved the Pittston project (BEP Findings of Fact and Order, dated March 12, 1975, as amended June 4, 1975, Item VII-2) and in fact was completely silent as to the existence of the BEP order and conditions. Nevertheless, the proposed permit states at 13 (FEIS, Vol. III at A-25): "As part of its certification for this permit, the Maine Board of Environmental Protection has required compliance with the conditions set forth in its Order No. 29-1466-29210 of March 12, 1975, as amended on June 4, 1975.

In accordance with Section 401(d) of the Act, those conditions set forth in the Board's Order as amended which are now required to assure compliance with Sections 301, 302, 306 and 307 are hereby made part of this permit." Pittston has contested the finding that the conditions of the Maine BEP order were a part of the Sec. 401 certification.

205. The State of Maine issued a license authorizing Pittston to discharge treated wastewaters from a refinery complex in Eastport on June 8, 1977 (License No. 1468, Item VII-12). The license was issued based on BEP findings and conclusions to the effect that:

> "A. The proposed discharge so licensed, by itself, or in combination with other discharges, will not lower the quality of the receiving waters below the minimum requirements of their classification.
>
> "B. The proposed discharge, as licensed, will receive the best practical treatment.
>
> "Therefore, the Board grants the application of the Pittston Company to discharge treated refinery process wastewaters to Tidewaters of Eastport, Class SA."

The license was specifically made subject to General and Special Conditions attached. These conditions made no reference to the BEP order referred to in the preceding finding.

206. A letter from the Maine DEP to Mr. Tom Doane, EPA in Boston, dated June 15, 1977, encloses a copy of the license mentioned in finding 205 and states that this license was approved by the BEP at their regular meeting on June 8, 1977 (Item VII-13). The letter further states:

> "The Board indicated that they would consider certification of the Federal National Pollution Discharge Elimination System permit for the Pittston refinery if the Environmental Protection Agency alters the terms and conditions of the permit to include provisions of the State of Maine waste

"discharge license. I believe it is the Board's intent that the effluent parameters on pages 3-A through 3-G of the State Waste Discharge License replace those on the Federal Permit only where those parameters are lower than the permit."

207. Mr. Henry E. Warren, Commissioner of the Maine BEP, submitted testimony which incorporated by reference a letter to EPA, dated June 21, 1979, signed by Mr. Warren (CLF Exh 15). Although acknowledging that the certification itself contained no express conditions and that there was no other document in the Department's files confirming or denying that the certification was intended to be granted only upon condition that the terms of the BEP order be incorporated into the permit, the letter refers to four draft NPDES permits, copies attached, the last three of which recite in substantially identical language that "the Maine BEP has required compliance with the conditions set forth in its Order No. 29-1466-29210 of March 12, 1975 and amended June 4, 1975." The letter concludes that the Sec. 401 certification is impliedly dependent upon compliance with the BEP order and conditions and argues that as a matter of law these conditions constitute more stringent state limitations under Sec. 301(b)(1)(C) of the CWA and thus appropriate conditions to the certification. The draft permits are undated except the final one (Attachment I) which states "Final Draft Permit For State Certification (Date 8/19/77)," and Mr. Warren's letter makes no reference to the DEP letter quoted in finding 206. Mr. Warren's testimony was admitted over Pittston's objection and Pittston has renewed its objections on brief and filed a motion to strike.

Dr. White

Page	Line	
27	10	insert "Q" at beginning of sentence
28	11	"data" for "date"
35	18	"Whitetailed Sea Eagles" for "Whitetail Seagulls"
36	2	same
44	17	"nest" for "next"
44	18	"in" for first "it"
50	3	"peregrin" for "perregrin"
51	20	"Marsh" for "March"
52	19	"volume" for "volumen"
57	2	"Q" for "A" at beginning of sentence
57	13	"Postupolsky" for "Polstapolski"
58	15	"Sea Eagles" for "Seagulls"
70	23	"peregrin" for "perregrin"
71	20	same
72	24	same
73	17	same
75	25	same
76	24	same
77	7	same
79	3	same
86	20	"moved" for "made"
90	11 - 12	"Feeding Whitetailed Sea Eagles" for "feeding Whitetail seagulls"
95	8	"refinery" for "find"
97	11	".7" for "27"

Dr. Dunstan

Page	Line	
104	11	"Dunstan" for "Dunstant"
115	9	"Besnard" for "Bezner"
128	5	"one" for "on"
134	6	"Dorceas" for "Dorcas"
134	16	"Broad Cove" for "Broad Cover"

Dr. Winn

160	24	"Indies" for "India"
182	9	"cetaceans" for "sightations"
191	1	"Jeffrey's" for "aoffrey" and "Stellwagen" for "Stelwigin"
205	7	"Cetaceans" for "sightations"
228	15	"enter bay" for "her babes"
261	5	insert "not" after would
289	16	"omitted" for "admitted"
300	17 & 19	"Mr. Hayes" for "Mr. Silverman"
309	9, 10 & 23	"grey" for "gray"
319	24	"Loucks" for "Loux"
322	16 & 18	"grey" for "gray"
323	4, 5, 7 & 13	"grey" for "gray"

Dr. Filby

327	23	"atypical" for "typical"
328	8	"VIII-4" for "8-4"
330	2	same
336	5	"Libyan" for "Bolivian"

Dr. Filby continued

Page	Line	
340	4	"flame" for "camera"
341	5	insert "were" after "they"
344	23	"Sjostrand" for "Yostrand"
347	1	"thermal neutron" for "thermoneutron"
350	13	"phenyl" for "fennel"
350	24	"phenyl" for "fennel"
355	11	"asphaltines" for "asphaltenes"
358	23	"numerator" for "enumerator"
362	10	"Oman" for "Oldman"
366	12	"Bowen" for "Balen"
366	15	"Wedespohl" for "Vederpal"
368	21	"Oman" for "Oldman"
369	5	same
369	11	"over" for "out of"
369	19	"Oman" for "Oldman"
371	2	same
374	2	"VIII-4" for "8-4"
379	23	"fast" for "first"
384	4	"VIII-4" for "8-4"
387	18	"Cymeric" for "kumeric"
390	18	"personal" for "person"

Dr. Friend

421	2	"wet" for "what"
474	19	"Appendices" for "Hennessey's

Irving Cohen

Page	Line	
481	13	"Copeland" for "Cokeland"
486	20	"detected" for "directed"
490	4	"Kraft" for "Cracked"
494	23 & 24	"CRSTER" for "Crester"
494	23	"PAL" for "Powell"
505	12	"Q" for "A"
505	13	"A" for "Q"
		Admiral Barrow
528	25	"and" for "in"
529	1 & 2	Capitalize "Intergovernmental Maritime Consultative Organization"
538	23	"VI-8" for "6-8" and "and thus" for "unless"
543	13	"could" for "couldn't"
544	15	"Moran" for "Iran"
558	19	"Rhine" for "Ryan"
571	23	"attacked" for "attached"
577	11	"conditions" for "contentions"
589	23	"Fugaro" for "Figuero"
590	7	same
596	17, 22 & 23	"Fugaro" for "Figuero"
597	9	"Ashok Kalelkar" for "Eschak Gallagher"
601	15	"145,000" for "145"
		Captain Dudley
619	12 & 13	capitalize "Harbor Docks and Piers Clauses Act"
632	3	"fixed" for "six"
639	2	"fog" for "cloud"

<u>Captain Dudley</u> continued

Page	Line	
639	19	"Rhine" for "Ryan"
657	16	"from shore" for "for sure"
658	7	"collisions" for "conditions"
663	6	"Jenny" for "Denny"
666	7	"Mersey" for "mersia"
672	15	insert "million" after "28.2"
679	18	"Maine" for "May"
682	14	"Dopler" for "Dockler"
684	14	"Scappa" for "Scapper"
684	24 & 25	"Conservancy Board" for "Conservance aboard"
688	3	"bear" for "far"
688	12	"towing" for "turring"
689	10	"rock" for "raw"
692	2	"backed" for "banked"
701	13 & 14	"balk" for "walk"
710	4	"St. Ann's" for "Sedan's"
711	11	"Mill Bay" for "Middlebury"
713	4	"fore" for "far"
713	19	"formidable cost" for "formative house"
714	4	"forward" for "for it"
715	13	"Curijic" for "Kunjek"
718	16	"Patience" for "Paysons"
719	21	"neap" for "leap"
720	6	"neap" for "neat"
720	11	"annum" for "datum"

Captain Dudley continued

Page	Line	
734	12	"port" for "court"
734	17	"Decca" for "Decker"
736	2	"console" for "counsel"
		Professor Senders
751	15	"the display" for "way"
774	1	"ridden" for "written"
788	13	"Chandler" for "Chadler"
793	2	"admit" for "damit"
801	4	"not" for "now"
803	9	"loaded" for "latent"
815	17	"4-4" for "444"
817	5	"4-5" for "45"
817	20	"4-6" for "46"
819	9	"4-8" for "48"
821	11	"3a & 3b" for "3A and 3B"
821	12	"3b" for "3B"
826	24	"Diedonne" for "Diadome"
827	19	insert "not" after "does"
		George Harris
840	4	"Crook" for "Cook"
841	25	"Alister" for "Alistair"
842	2	"Guilford" for "Gilford"
845	22	"bitty" for "itty"
850	6	"charge" for "chart"

Maynard Morrison

Page	Line	
858	1	"herring" for "heron"
859	9	"Irving" for "Ervin"
860	9	"Shackford" for "Shcokford"
871	18	"Buckman" for "Bucknam"
878	9 & 10	"Dog" for "Dug"
878	21	delete "Q"
878	22	"Erving" for "Ervin"
879	6 & 7	"Navy" for "Maybe"
		Captain Peacock
945	2	"Huntley" for Huntly"
949	12	"Europort" for "Europe Port"
965	20 & 22	"sea" for "C"
		Dr. Hires
1000	10	"statistical" for "statistic"
		Dr. Page
1014	25	"Schwartz" for "Schwarts"
1015	2	"Haines" for "Haynes"
1019	2	"Skillins" for "Skillance"
1019	4	"confluence" for "influence"
1024	17	"Skillins" for "Skillance"
1028	3	same
1035	11	delete "$ sign" before "200,000"

Dr. Page continued

Page	Line	
1045	23	"Marchand" for "Marchant"
1046	12 & 16	same
1047	10	same
1052	5	"carbocyclic" for "carboxylic"
1063	3	"quantified" for "clarified"
1066	2	"implied" for "supplied"
1074	2	insert "to predict" after "impossible"
1078	9	"Torrey" for "Tori"
1078	18	"sandworms" & "bloodworms" for "sandworks" & "mudworks"
1082	16	"Quoddy" for "Quadron"
1082	22	"flora" for "fluor"
1099	6	"elements" for "evidence"
1099	22	"planet" for "plant"
1107	11	"A." for "Q."
1108	10	insert "he is" after "maintaining"
1116	3	insert "that English sole held in" before "oil"
1116	9	"sole" for "soil"
1128	9	"biomass" for "biomask"
1128	25	"pristane" for "pristine"
1129	1 & 3	same
1135	19	"No data" for "No doubt it"
1139	17	"fraction" for "factor"
1144	14	"soil" for "salt"

Dr. Page continued

Page	Line	
1152	23	"A." for "Q."
1154	3, 6, 7, 14 & 18	"mousse" for "moose"
1155	3, 9, 10, 14, 17, 19 & 25	same
1156	2 & 6	same
		Dean Davis
1175	8	"Mondor" for "Mandore"
1180	20	insert "days with" before "winds"
1181	20	"though he" for "through here"
1194	2	insert "not" after "I'm"
1212	8	"amended" for "ammended"
1212	12	"summer" for "similar"
1214	1	"forecastable" for "for pastable"
		Dr. Gilfillan
1234	18	"dispersants" for "disburses"
1235	1	"dispersant" for "disbursement"
1235	4	same
1238	18	"optimums" for "optimode"
1239	21	"ubiquitous" for "biquadrous"
1251	18	"to .17" for "2.17"
1261	20	"senescense" for "synessence"
1261	21	same
1265	14	"touting" for "toting"
1267	18	insert "can" after "anybody"

Dr. Gilfillan continued

Page	Line	
1272	20	"touting" for "toting"
1277	19	"bound" for "bond"
12B7	23	"Joseph Geraci" for Jerasey Torasion"
1288	1	"Geraci" for "Torasion"
1288	10 & 18	"Geraci" for "Torasion"
1288	11	"Cetaceans" for "sitations"
1289	13	"Cetaceans" for "setations"
1289	17	"Geraci" for "Torasion"
1289	22	"Cetaceans" for "setations"
1290	3	"Geraci" for "Torasion"
1290	16	"Winn's" for "wind"
1290	23	"Cetaceans" for "setations"
1291	13	same
1291	15	"Katona" for "Catona"
1292	5	"Katona" for "Catona"
1292	20	same
1295	6	same
1295	12	same
1299	25	"bight" for "bite"
1300	7	same
1306	23	"Scarratt" for "Scaris"
1311	17	"yentsch" for "yanch"
1312	25	"Guerin" for "Garvey"
1313	2	"Monobuoy" for "Molaboy"

Dr. Gilfillan continued

Page	Line	
1313	11	"aromatic" for "aeromatic"
1313	21	"dispersants" for "disbursements"
1313	25	same
1324	3 & 7	"dispersants" for "disbursements"
1324	17	"micelle" for "my cell"
1324	24	"dispersants" for "disbursements"
1326	1	"Aber Benoit," "Aber Vrach" for "Arbor Benoire," "Arber's Rock"
1327	21	same
1333	21	"bait" for "bay"
1339	5	"anthropomorphism" for "answer for morphism"
1356	19	"disperses" for "disburses"
1364	17	"Grassle" for "Grasley"
1366	23	"dispersants" for "disbursements"
1367	2, 6, 12 & 15	same
1367	17	"rule" for "role"
1367	19	"dispersed" for "disbursed"
1367	23	"dispersant" for "disbursants"
1368	9 & 12	same
1371	23	same
1372	6	same
		Dr. Eda
1388	21 & 25	"Bick" for "Bik"
1394	1	"Guilford" for "Gilford"
1394	19	"How do you define" for "Where do you find"

Dr. Eda continued

Page	Line	
1403	7	"they" for "I"
1403	19	"4-5" for "45"
1405	15	same
1410	9	"Bick" for "Bik"
1411	8	"Maine" for "main"
1411	12	"Maine" for "main"
1413	15	"Western Passage" for "western passes"
1417	10	"ballast" for "burst"
1418	10 & 14	"4-6" for "46"
1420	6	"Milford Haven" for "Middle Hold Heaven"
1420	6 & 7	same
1420	11, 12, 14 & 15	"Milford Haven" for "Middle Hold Heaven"
1420	23	same
1422	4	same
1423	23	"Bick" for "Bik"
1425	14	"to them" for "it in"
1430	2	"Bick" for "Bik"
1439	18	"graff" for "graft"
1469	6	"Bick" for "Bik"
1472	6	insert "agree" after "would"
1475	2	"Bick" for "Bik"
1476	22	"Kill Van Kull" for "Kilvert Cove"
1476	24	same
1477	3	same
1477	16	same

Dr. Eda continued

Page	Line	
1477	23	"Milford Haven" for "Middle Hold Heaven"
1480	1	"Bick" for "Bik"
1480	5	same
1483	21	"Milford Haven" for "Middle Hold Heaven"
1483	23	same
		Frank Gramlich
1524	14	insert "a good" before "sign"
1546	8	"kill" for "use"
1547	1	"dispersion" for "disbursion"
1549	25	"Royston" for "Royce and"
1554	2	"Goldeneyes" for "Golden Eagles"
1556	11	"Patuxent" for "toxin"
1556	25	"Boyden" for "Bowdoin"
1557	1	"Denneys" for "Dennies"
1561	18	"Machias" and "Denneys" for "Mechias" and "Dennies"
1564	11	"Lawson" for "Larson"
1574	20	"Denneys" for "Dennies"
1585	18	"intake" for "intact"
1585	21	"Gramlich" for "Gremlich"
1586	24 & 25	"dispersed" for "disbursed"
1588	5	"Breton" for "Brenton"
1592	12	"deleterious" for "dilatorious"
1619	8	"emigration" for "immigration"

Frank Gramlich continued

Page	Line	
1624	2	"are vast" for "fast"
1645	5	"Black Duck" for "Black Diet"
1652	19	"parents" for "parts"
1664	24	"waives" for "weighs"
		Mr. Kaulakis
1720	1	"Act" for "active"
1724	7	"Bick" for "Bik"
1724	11	"Bick" for "Bik"
1739	16	"150,000" for "250,000"
1744	5	"VIII-42" for "8-42"
1755	5	"Manan" for "Manon"
1762	23	"vociferous" for "duciferous"
1765	9	"oblique" for "blike"
1769	17	capitalize "Metropolitan"
1771	10	"hut" for "hot"
1780	10	"Calais" for "Calis"
1780	18	"Calais" for "Calis"
1796	20	"relevant" for "irrelevant"
1806	19	"refinery policy" for "marital refinery"
1818	6	"Qaddafi" for "Gnafi"
1819	16	"with" for "was"
1824	18	"capability" for "keepability"
1830	13	"Gramlich" for "Gramlin"
1845	15	"area" for "are"
1866	22	"refining" for "referring"

Mr. Kaulakis continued

Page	Line	
1868	22	"is" for second "it"
1884	18	insert "Q" and (interrupting) before "that"
1889	12	"is" for "of"
1898	21	"at" for "a" before "Grand Manan"
1906	1	"Kemeny" for "Comody"
1909	6	insert "too" before "little"
1909	8 & 14	"A" for "Q"
1913	13	insert "a' after "to" change "disclaim" to "disclaimer" and insert "of" after "disclaimer"
1923	6	"fit" for "filt"
1933	11	insert "get" after "could"
1937	14	insert "out" after "brought"
1968	24	"9.5" for "915"
1971	7	delete "when"
1993	7	"adds" for "one"
1998	7	"and" for "in"
1998	9	"substances" for "settisters"
1998	16	delete comma after "absorption" insert "and" after "spectroscopy"
1998	20 & 21	insert "state of the art" at beginning of line, delete "basis relied on, were established in most trace metals" and insert "for establishing most trace metal levels for"
2007	18	"Terris" for "Terrace"
		Dr. Stewart
2045	24	"port" for "quart"

Virgil Keith

Page	Line	
2084	20	"err" for "air" twice
2086	20	"Hayes" for "Hill"
2089	5	"A" for "Q"
2100	4	"Chandler" for "Chadler"
2108	10	"piloting" for "plotting"
2157	12	"Cobscook" for "Cook"
2210	19, 20, 22	"SPM" for "SBM"
2211	2, 16	same
2212	5	same
2213	3, 4, 7, 10	same
2233	15	"swept" for "sweat"
2234	14	"tankers" for "anchors"
2251	21	insert neither after Mr. Hill
2251	22	"circuity" for "security"
2257	6	"swept" for "sweat"
2270	23	"Breitenfeld" for "Breckenfeld"
2338	11, 14, 16	"Gotas" for "Godis"
2354	2	"Waterborne Commerce" for "waterborne corners"
2443	7	Insert "Q"
2452	2	"HRECO" for "TRECO"
		Captain Huntley
2524	1	"Scarrate" for "Scairt"
		Captain Crook
2586	15	"Light" for "Lake" twice

Dr. Anthony

Page	Line	
2652	4	"Field" for "Fuel"
2677	20	"Washington" for "Lawson"
2699	6	"IGNAF" for "IGNAV"
2713	18	same
		Marc Guerin
2798	20 & 22	"Honn" for "Hohn"
2799	21	same
2800	2 & 20	same
2801	8	same
2802	19	same
2803	1	same
2803	25	"mousse" for "moose"
2810	2	"Honn" for "Hohn"
2812	8	same
		Dr. Loucks
2856	3	"moored" for "lured"
2867	23	delete "Q"
2871	25	"moored" for "lured"
2872	9	same
		James Kirkley
2933	6, 7, 19	"Hodgins" for "Hodgekins"
2965	5	"from reduced" for "reduce them to"
2985	22 & 23	"resulting" and "unemployment" for "result in employment"

James Kirkley continued

Page	Line	
2985	23	"in" for "and"
2986	10	"were" for "we are"
2987	21	"fin" for "thin"
3030	19	insert "true" after be
3052	17	"A" for "Q"
3062	21	"brush" for "rush"
		Dr. Larsen
3089	6	"physical" for "fiscal"
3106	12	"Hallowell" for "Hellowell"
3155	21	"boreal" for "oil"
3179	19	"A" for "Q"
3188	9	delete the 2nd "not"
		Dr. Sherman
3199	10	"residence" for "resident's"
3214	5	"euphausids" for "ufousits"
3223	21, 22, 24 & 25	"plaice" for "place"
3238	2	"euphausids" for "ufousits"
3258	12	"530" for "53"
		Dr. Malins
3309	10	"phenols" for "fanols"
3312	6	"1059" for "985"
3319	11	"Varousi" for "Beransi" and "she" for "he"
3320	2	"1069" for "995"
3321	22	"1094-95" for "1020"

Dr. Geraci

Page	Line	
3385	1	"breathing" for "breeding"
		Robert Clark
3429	18	"Keith" for "Keeth"
3432	17	"A" for "Q"
3435	16	"except" for "expect"
3476	6	"Brest" for "breast"
3492	14	"towed" for "toad"
3501	14	"bigger" for "bitter"
3501	21	"dispersants" for "disbursents"
		Dr. Vandermeulen
3531	17	"Fong" for "Fond"
3533	11	"burrowed" for "buried"
3552	8	"Colwell" for "Caldwell"
3557	14	"residence" for "residents"
3559	14	same
3560	7 & 14	same
3794	11	"recruitment" for "recoupment"
3832	12	"Honn" for "Hohn"
3845	23	"weirs" for "wrers"
		Dr. Gaskin
3918	13	"cut" for "gut"
3921	12	"degrade" for "grade"
3928	12	"Lepreu" for "Lapro"
3950	6, 7, 16	"DeLute" for "Dolute'
3951	11	same

Dr. William Aron

Page	Line	
4058	23	"Mount Desert Rock" for "mountain dispersed rock"
4067	15	"Tellico" for "Talco"
4125	11	same
		Dr. Katona
4162	11	"Bluenose Ferry" for "bluenose"
4194	23	"whales can" for "whale skin"
		Dr. Parsons
4231	7	"quahogs" for "cohogs"
		Dr. Haines
4251	20	"Altshuller" for "Altshur"
4254	4	"Acidification" for "Certification"
4276	6	"Umsaskis" for "Cumsasgus"
4308	15	"DOI" for "DOA"
4317	15	"leaching" for "lacking"
4317	16	"potassium" for "ptassium"
		Robert Mondor
4328	15	"Sea Dock" for "C Dock"
4335	12	same
4341	18	same
4351	23	"Mr. Chandler" for "Mr. Bick"
		Captain Charter
4383	15	"Haruzo" for "Hirazo"
4403	7	"Loucks" for "Laux"
4440	15	"Hickey" for "Hicki"

Captain Charter continued

Page	Line	
4441	21	"Hickey" for "Hicki"
4449	19, 20, 25	same
4450	2	same
4453	12	same
		Ralph Andrews
4531	16	"Census" for "synthesis"
4542	18	"dovekies" for "dovekeys"
4542	19	"murre" for "mers"
4562	20 & 21	"dovekies" for "dovekeys"
		Dr. Reed
4607	5 & 17	"Costle" for "Costal"
4609	3	"EIS" for "DIS"
4625	2	"companies" for "countries"
4629	13	"Beaufort" for "Bowford"
4631	21	"Costle" for "Costal"
4658	13	"A" for "Q"
		Charles Yentsch
4694	5 & 10	"Mr. Bick" for "Mr. Terris"
4707	14	"Bight" for "By"
4709	6	"shoally" for "shore"
		Valentine Descamps
4746	17	"Gaussian" for "galcian"
4754	3	"Meddybemps" for "Medibens"
4781	11	"Gaussian" for "gaseon"

Page	Line	
		John Conlon
4828	4 & 12	"Hann" for "Haan"
		Mr. Kaulakis
4922	8	"repeat" for "proceed"
4926	1	"pump" for "bump"
4937	20	"barging" for "embarging"
4939	14	"saline" for "sal"
4945	17	"Lorenville" for "Lawnville"
4948	20	"Canadian" for first "American"
5006	18	"ship" for "shop"
5009	25	capitalize "Research Triangle Park"
		Wallace Stickney
5065	18	"Keith's" for "Keefe's"
5085	1 & 4	"fog" for "for"
5102	9	"foreclose" for "perclose"
5163	15	"WAPORA" for "Reopora"
5188	24	"Wolves" for "Wools"
5207	19	"EPA" for "UPA"
5240	4, 6, 23	"Eda" for "Ada"
5240	19	"H" for "Age"
5241	2, 9, 12, 21, 23, & 25	"Eda" for "Ada"
5242	2	same

Index of Exhibits

Pittston

Exh 32	In evidence at 605 in lieu of 606

NOAA

Exhs 47 & 48	Dr. Vaughn Anthony
Exh 80	Testimony of Robert A Mondor identified 4322, in evidence 4323

DOI

Exh 31	Corrections to Testimony of Ralph Andrews
Exh 32	Letter dtd 1/2/80 to Mr. Owen from William C. Townsend
Exh 33	Statement of Peter Albers w/attachments
Exh 34	Letter from Regional Director FWS to William Adams, dtd 11/9/79, w/attachments
Exh 35	Letter to ALJ from Counsel, dtd 1/15/79, w/attachments

NELF

Exh 4A	Economic Impact of Marine Oriented Activities--A Study of The Southern New England Marine Region identified 4322, in evidence 4323
Exh 5	Identified 4767 in lieu of 4810