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Deep Seabed Mining

Final Environmental Impact Statement on Issuing an
Exploration License to Ocean Minerals Company



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
November 1994

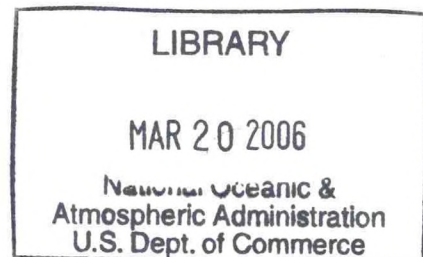
Deep Seabed Mining

Final Environmental Impact Statement

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Prepared by:
Office of Ocean and Coastal Resource Management
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1305 East-West Highway
Silver Spring, MD 20910

November 1994



U.S. DEPARTMENT OF COMMERCE
Ronald H. Brown, Secretary

National Oceanic and Atmospheric Administration
D. James Baker, Under Secretary for Oceans and Atmosphere

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DESIGNATION: Final Environmental Impact Statement (FEIS)

TITLE: Deep Seabed Mining Exploration License

ABSTRACT: This FEIS is prepared pursuant to the Deep Seabed Hard Mineral Resources Act (P.L. 96-283, "The Act") and the National Environmental Policy Act of 1969 (NEPA) to assess the impacts of issuing a deep seabed mining exploration license to Ocean Minerals Company (OMCO). Exploration by OMCO will be authorized by license from the National Oceanic and Atmospheric Administration (NOAA) for ten years in the Pacific Ocean equatorial high seas, roughly between Central America and Hawaii, for the area known as USA-4 that was previously licensed to the Kennecott Consortium. OMCO proposes to monitor the development of exploration and mining system equipment and technologies; use existing mineral deposit data to resolve the remaining unknown factors affecting permit area delineation; perform environmental analysis using existing data; and, conduct ongoing re-evaluations of commercial viability for development. OMCO's license activities will provide the necessary resource, technological, and economic information for OMCO to be in position at the end of the license period to apply for a commercial recovery permit, should economic conditions warrant it. Ultimately this will reduce dependence on foreign land-based mining, and will provide a reliable source for the nationally strategic metals of cobalt, nickel, manganese, and copper.

OMCO's exploration data were collected prior to issuance of the original license for USA-4 to the Kennecott Consortium in 1984.

No further at-sea activities are planned and there will be no significant adverse environmental effects associated with the license.

No onshore activities or equipment tests are authorized by issuance of the exploration license.

LEAD AGENCY: U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Office of Ocean and Coastal Resource Management

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COMMENTS: The final of this environmental impact statement was filed with
EPA on November 4, 1994.

ERRATA SHEET FOR OCEAN MINERALS COMPANY

1. p.5 - substitute new page showing changes in Ocean Mining Associates (OMA) consortium.
2. p.43, 2nd paragraph, line 8 - add "The permit was valid for five years and expired on October 5, 1989".
3. p.44, after 1st sentence - add "However, as mentioned by EPA in its comments on the DEIS, if OMCO proposes to conduct at-sea activities, a new NPDES permit must be issued".
4. p.67, 2nd paragraph, line 6 - "970.901(b)" should read "971.801".
5. p.68, line 5 - "is" should read "it".
6. p.70, 3rd paragraph, line 2 - "unreasonable" should read "unreasonably".
7. p.70, last paragraph, 4th sentence - insert "issued under 46 CFR subchapter I".
8. p.70, last paragraph, last sentence - insert "must be inspected under 33 CFR 140.101 and".
9. p.71, 4th paragraph, line 3 - "970.1105" should read "971.1005".
10. p.72, line 5 - "970.901" should read "971.801".
11. p.73, line 7 - "Convention" should read "convention".

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EXECUTIVE SUMMARY

The National Oceanic and Atmospheric Administration (NOAA) has prepared this environmental impact statement (EIS) pursuant to Section 109(d) of the Deep Seabed Hard Mineral Resources Act ("the Act"), NOAA regulations implementing the Act (15 CFR Part 970, Deep Seabed Mining Regulations for Exploration Licenses) and Section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA). The Act authorizes the Administrator to issue licenses for exploration and permits for commercial recovery of manganese nodules in the deep seabed, subject to appropriate terms, conditions, and restrictions (TCRs).

NOAA proposes to issue an exploration license subject to TCRs (15 CFR 970.500) for a period of ten years to conduct license activities as set forth in an application for a deep seabed mining license submitted to NOAA by Ocean Minerals Company (OMCO) for the area known as USA-4 that was previously licensed to the Kennecott Consortium. This EIS assesses the potential environmental impacts of the activities proposed in the application and of alternatives to issuance of the license.

OMCO's proposed activities as set forth in its exploration plan are designed to use existing mineral deposit data to resolve the remaining unknown factors affecting permit area delineation; to perform environmental analysis of existing data; and, to conduct ongoing re-evaluations of commercial development. No further at-sea activities are planned and there will not be any significant adverse effects associated with the license. Although these activities have no potential for significant environmental impact and would not normally require preparation of an EIS, Section 109(d) of the Act nonetheless requires that NOAA prepare this EIS to assess the impacts of issuing any license.

NOAA's environmentally preferred alternative is to issue, rather than delay or deny issuing, the license in order to provide a better understanding of the environmental impacts and commercial potential of deep seabed mining through a continued analysis of the existing environmental and resource data in USA-4.

No onshore processing activities are proposed in OMCO's application.

Based on the foregoing analysis and information, NOAA has tentatively determined that the license activities proposed in OMCO's application cannot reasonably be expected to result in a significant adverse effect on the quality of the environment (15 CFR 970.506). This determination is necessary before NOAA may issue a license for deep seabed mining exploration activities.

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I. Introduction

I.A. Purpose and Need for Action

The National Oceanic and Atmospheric Administration (NOAA), in consultation with the U.S. Environmental Protection Agency (EPA), the Secretary of State, and the Secretary of the Department in which the Coast Guard is operating, has prepared this final site-specific environmental impact statement (EIS) pursuant to Section 109(d) of the Deep Seabed Hard Mineral Resources Act (P.L. 96-283, hereinafter the Act) and 102(2)(c) of the National Environmental Policy Act (NEPA). This site-specific EIS assesses the potential environmental impacts of the activities proposed in the application of OCEAN MINERALS COMPANY (OMCO) for issuance of an exploration license under the Act for the area known as USA-4 that was previously licensed to the Kennecott Consortium. The EIS does not assess the impacts associated with at-sea mining equipment tests. Such tests will be prohibited under the license until NOAA has prepared a supplemental site-specific EIS, incorporating additional environmental and technological data submitted by the consortium to NOAA, and NOAA has modified OMCO's license to authorize tests in accordance with appropriate terms, conditions and restrictions.

This site-specific EIS will:

- 1) describe the area in the eastern North Pacific Ocean that OMCO has applied for;
- 2) describe the type of activities that will be conducted under the exploration license; and
- 3) assess the environmental impacts expected to be associated with these license activities.

This EIS fulfills the requirement of Section 109(d) of the Act to prepare an

EIS prior to issuing an exploration license.

In September 1981 NOAA published a Deep Seabed Mining Final Programmatic Environmental Impact Statement (PEIS) that described the results of the Deep Ocean Mining Environmental Study (DOMES), a five-year project designed to examine potential effects from nodule mining, and assessed the foreseeable environmental impacts from the exploration for manganese nodules under a license and the commercial recovery of the nodules under a permit.

In 1982, NOAA received initial applications for exploration licenses from four U.S.-member deep seabed mining consortia (Table 1) - Ocean Minerals Company (OMCO); Ocean Management, Inc. (OMI); Ocean Mining Associates (OMA); and, the Kennecott Consortium (KCON). NOAA prepared draft and final site-specific environmental impact statements that assessed the potential environmental impacts of the site delineation and other exploration activities proposed in the applications. The EISs did not assess the impacts associated with at-sea mining equipment tests. Such tests are prohibited under the license until NOAA has prepared a supplemental site-specific EIS, incorporating additional environmental and technological data submitted by the consortium to NOAA, and NOAA has modified a license to authorize tests in accordance with appropriate terms, conditions and restrictions. In August 1984, licenses were issued to OMCO (USA-1), OMI (USA-2), and OMA (USA-3). In October 1984, a license was issued to KCON (USA-4). All four licensees have been authorized since then to conduct exploration activities in their respective areas for the 10 year duration of the license.

In 1988, NOAA designated an area within the license areas of OMA, OMCO, and KCON as a Provisional Interim Preservational Reference Area (PIPRA) (53 FR 224, November 21, 1988). The PIPRA will be unaffected by mining activities and will serve as a

TABLE 1. Deep seabed mining consortia involving United States firms and parent companies, including dates of consortia formation, as set forth in applications filed with NOAA in February 1982, and subsequently amended, showing NOAA license identification.

	USA-1	USA-2	USA-3	USA-4
Nation	Ocean Minerals Company (OMCO) (11/77)	Ocean Management Inc. (OMI) (5/75)	Ocean Mining Associates (OMA) (10/74)	*Kennecott Consortium (KCON) (1/74)
United States	Cyprus Minerals Co. (Cyprus Mining Co.) 50% Lockheed Missiles & Space Co., Inc. (Lockheed Corp.) 37.528% Lockheed Systems, Co., Inc. (Lockheed Corp.) 12.472%	Schlumberger Technology Corp. 24.67%	Essex Minerals Co. (USX Corp.) 33 1/3% Sun Ocean Ventures Inc. (Sun Co.) 33 1/3%	Kennecott Utah Copper Corp. (a U.S. Corporation owned by R.T.Z.) 52%
Belgium			Union Seas, Inc. a U.S. Corporation (Union Miniere) 33 1/3%	
Canada		INCO, Ltd. 25.11%		Noranda Exploration, Inc., a U.S. Corporation 12% (Noranda Mines Ltd.)
Japan		Deep Ocean Mining Co., Ltd. (DOMCO-19 Japanese Companies) 25.11%		Mitsubishi Corp. 12%
United Kingdom				R.T.Z. Deep Sea Mining Enterprises, Ltd. (Rio Tinto-Zinc) 12% Consolidated Gold Fields, PC 12%
West Germany		AMR 25.11% (Preussag A.G., Salzgitter A.G., Metallgesellschaft A.G.)		

*License Surrendered May 21, 1993

July 1994

control area for measuring environmental impact.

In 1989, NOAA prepared an environmental assessment (EA) on the realignment of U.S. license areas resulting from international conflict resolution and changes in licensees' exploration plans.

In 1991, NOAA approved modification of exploration plans and extensions of the license periods for OMI, OMA and OMCO from 1994 until 1999 (56 FR 37344, August 6, 1991 for OMI and OMA; 56 FR 63716, December 5, 1991 for OMCO).

On May 21, 1993, NOAA received formal notification of surrender from Kennecott Consortium of its license area USA-4 (58 FR 33933, June 22, 1993).

In accordance with the intent of the Council on Environmental Quality's (CEQ) NEPA regulations, this EIS focuses solely on the specific major action, i.e., the issuance of a site-specific exploration license to OMCO. Because there are no new environmental issues being presented that could change any analysis or conclusions in the original license EIS's, this EIS "tiers" off the broader PEIS, the site-specific license EIS's and the environmental assessment by summarizing their analyses and incorporating the major discussions by reference, then covering issues specific to this license application.

II. ALTERNATIVES9



II. Alternatives

The alternatives available to NOAA involving the issuance of an exploration license were discussed in detail in Section II of each license EIS. Since there are no new major issues or additional analysis involving alternatives, that discussion is being incorporated by reference and will only be briefly summarized and updated with respect to the OMCO application here.

The three alternatives to issuing an exploration license were:

- 1) issue the license (the proposed action)
- 2) delay issuing the license
- 3) deny issuance of the license

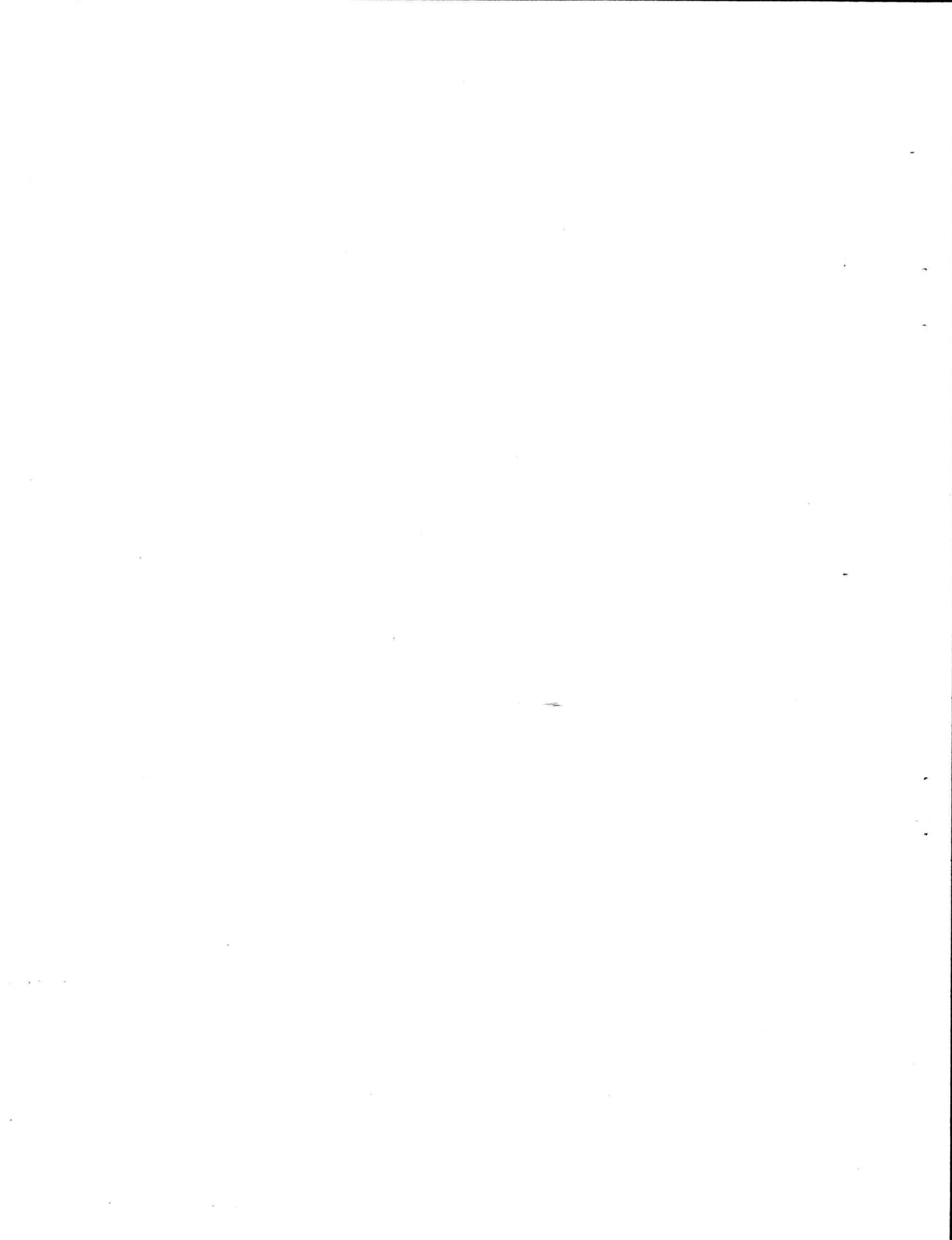
NOAA's preferred alternative was to issue the license subject to final terms, conditions, and restrictions. The Act (105 (a)) required NOAA to determine, before each license could be issued, that the license activities could not reasonably be expected to result in a significant adverse effect on the quality of the environment. NOAA's PEIS had determined that the initial license phase activities, including at-sea mining tests, have no potential for causing significant environmental impacts. The analysis and information in the license EISs supported the determination. The activities planned by OMCO as described in its present application also are of the type with no potential for significant environmental impact.

Issuance of the license could have been delayed until a better understanding of the environmental effects was developed through NOAA research or monitoring of at-sea equipment tests. A delay, however, would have been a disadvantage to U.S. applicants who required site tenure in order to proceed with the expense of exploration. A delay also could have delayed the acquisition of additional environmental data needed for predicting mining

impacts. A delay with respect to the present OMCO license application could affect the retention of the USA-4 site with a U.S. consortium.

Denying the issuance of licenses would have delayed the development of the seabed mining industry, would not have been environmentally advantageous because it would prevent or delay the development of a better understanding of environmental effects, and would continue to require reliance on land-based mining and increased dependence on foreign sources of strategic metals. This alternative also would have been inconsistent with two of the purposes of the Act, i.e., to establish an interim program to regulate deep seabed mining by U.S. citizens, and to encourage the development of technology necessary to recover seabed minerals. Denying issuance of a license to OMCO would leave this once U.S. site open for claim by a foreign entity under the proposed Law of the Sea Treaty and thus deny OMCO the opportunity for site tenure in an area that it has established a priority of right to under U.S. law by conducting extensive exploration activities.

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III. Affected Environment

NOAA's Programmatic Environmental Impact Statement (PEIS) and each license site-specific environmental impact statement provided a description of the environment between the Clarion and Clipperton fracture zones (CCFZ) where all U.S. license areas are situated. NOAA's Deep Ocean Mining Environmental Study (DOMES) was a five-year (1975-1980) research effort designed to provide a data base that would allow the assessment and prediction of the environmental impacts of manganese nodule recovery operations. It established environmental baselines at three sites chosen as representative of the range of selected environmental parameters likely to be encountered in the main area of commercial interest within the CCFZ (Figure 1). The DOMES baseline data and the data submitted by each applicant for a license formed the basis for the description of the environment of all license areas.

The majority of the consortia-submitted data were submitted by OMCO in 1982 in its application for license area USA-1. These data also include data collected by OMCO during previous exploration in the USA-4 area. Because an EIS has been completed and a license previously issued to KCON for the USA-4 area, these data and the environmental description are still applicable. New data are also included from the results of several NOAA-funded research projects, including the multi-year Benthic Impact Experiment (BIE). The BIE is an international cooperative research project begun in 1991 in the Provisional Interim Preservational Reference Area (PIPRA) which is designed to assess the environmental impact of mining on organisms living on and in the seafloor. Because USA-4 is close to DOMES Site C, most of the characteristics of both the upper and lower water columns fall within the ranges observed in the DOMES program.

Figure 2 shows the area of USA-4 and its relation to the other NOAA and foreign

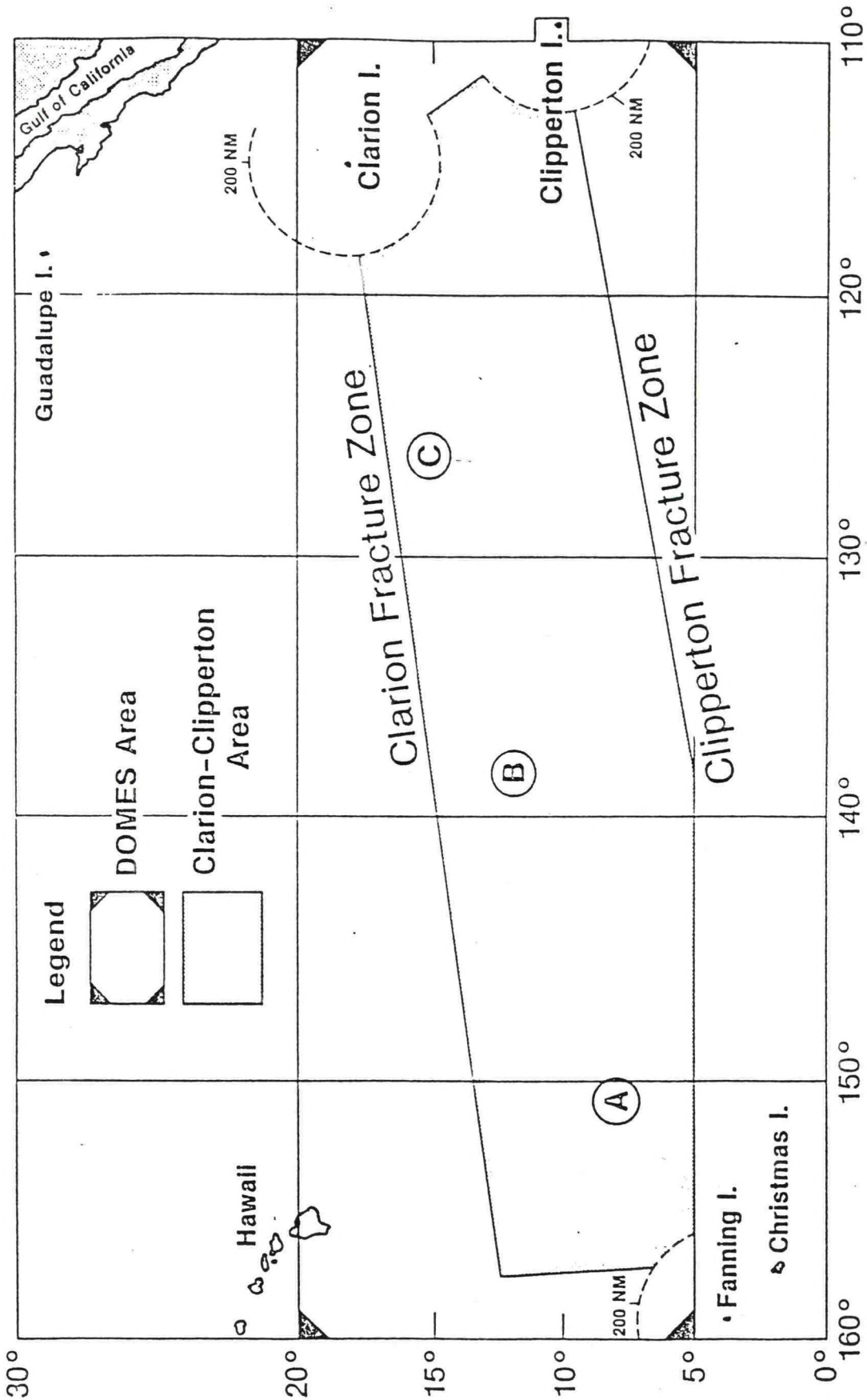
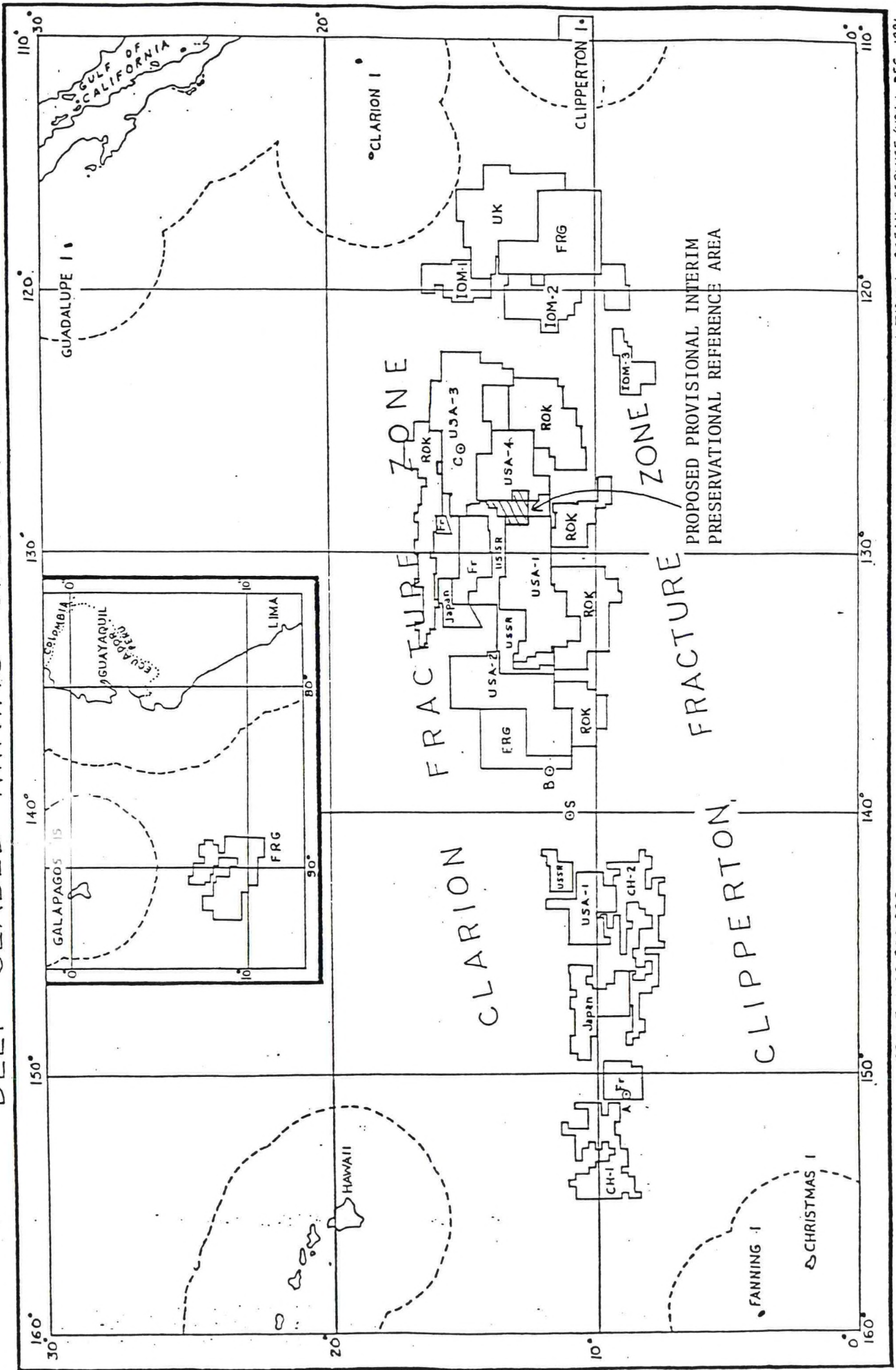


Figure 1. Clarion-Clipperton Fracture Zone Area With DOMES Sites A, B, and C.

DEEP SEABED MINING OPERATING AREAS



license areas, including OMCO's USA-1 and the PIPRA. USA-4 encompasses an area of 65,000 km².

A brief description of this area will be presented, including the new data. For a complete description of the environmental parameters characterizing the area of USA-4, including original detailed data presented as figures and tables, the reader is referred to Section II.A. of the PEIS and Section III. and Appendix 7 of the license EIS's.

III.A. Upper Water Column and Atmosphere

The Clarion-Clipperton area is under the influence of the Northeast Tradewinds for most of the year. Eastern Pacific tropical storms and cyclones are most frequent in late summer and early fall.

Oceanroutes, Inc. assembled detailed weather and seastate statistics for OMCO for three sites within the Clarion-Clipperton zone which are representative of OMCO's application area. Each of these three sites - designated I, II, and III - is at a location close to DOMES Sites C, B, and A, respectively. Table 2 shows a summary of the annual statistics characterizing the wind and the sea and swell conditions for the three sites. The predominant wind and sea direction at site I, the nearest to USA-4, is north-northeast to east.

Surface currents in the eastern tropical Pacific (Figure 3), from north to south, are the westward-flowing North Equatorial Current, the eastward-flowing North Equatorial Countercurrent, and the westward-flowing South Equatorial Current. These currents are relatively shallow (500 m or less) and vary markedly in speed with depth, location, and season.

Surface current measurements taken during DOMES at Site C, the site nearest to USA-4, located in the westward-flowing North Equatorial Current, showed a previously undetected subsurface current flowing in the opposite direction to the surface flow. The

TABLE 2.

PREDOMINANT ANNUAL ENVIRONMENTAL CONDITIONS
AT THREE SITES ACROSS CLARION-CLIPPERTON AREA

(Appendix E, OMCO license application, 1993)

	SITE I		SITE II		SITE III	
WIND DIRECTION	NNE-E	81%	E-NE	88%	E-NE	87%
SPEED	0-10m/s	97%	0-10m/s	96%	0-10m/s	98%
SEA DIRECTION	NNE-E	84%	E-NE	89%	E-NE	88%
HEIGHT	0.5-1.5m	94%	0.5-1.5m	92%	0.5-1.5m	90%
SWELL STATE	Calm	54%	Calm	53%	Calm	66%
DIRECTION	NW	24%	NW	20%	NW-NNW	20%
HEIGHT	0.5-1.5m	43%	0.5-1.5m	45%	0.5-1.5m	32%
PERIOD	13-15s	21%	13-15s	19%	13-15s	15%

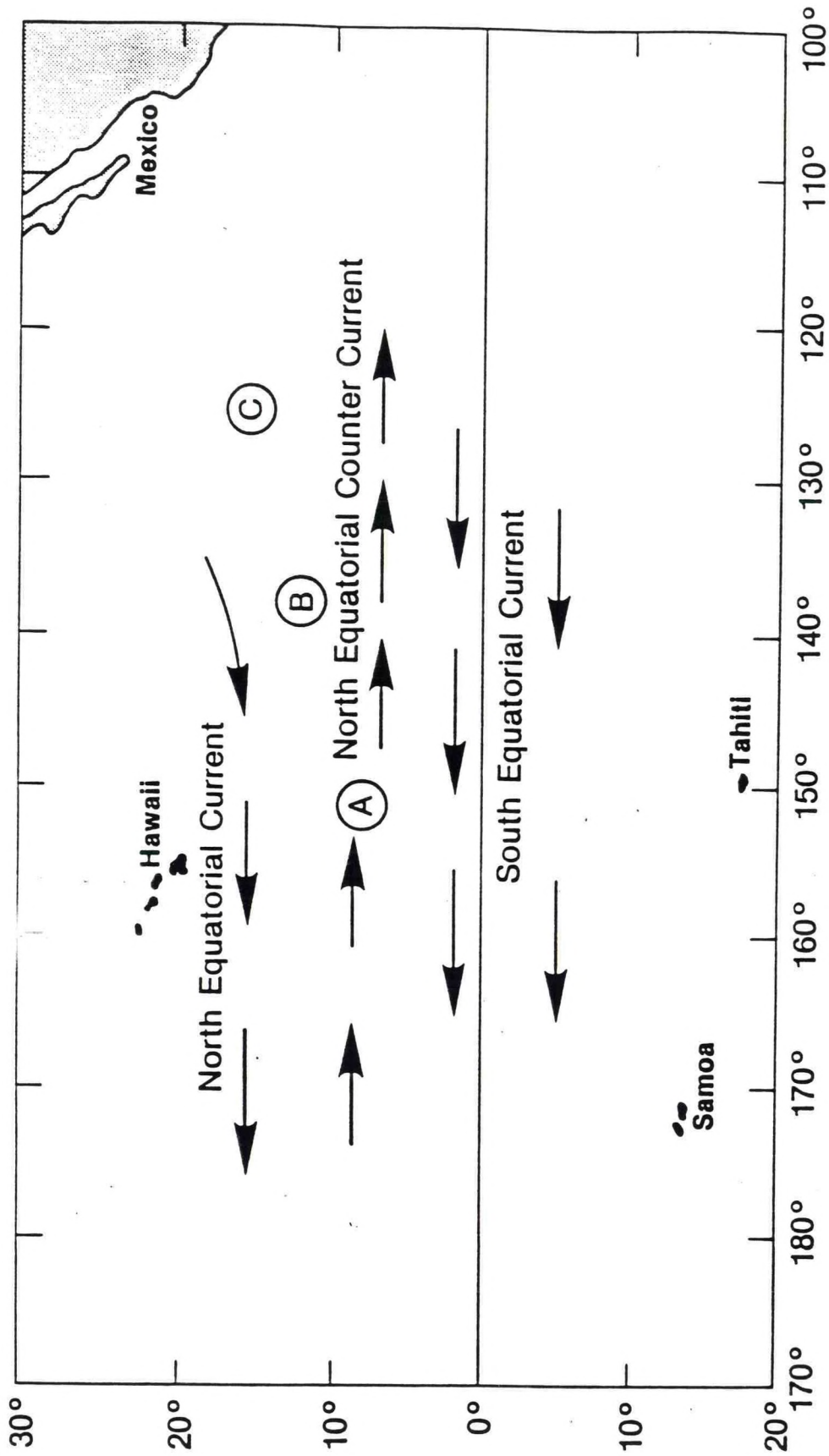


Figure 3. General surface circulation scheme in the Eastern Tropical Pacific, with DOMES site stations A, B, C (Ozturgut *et al.*, 1978).

current at 20 m was westward at 17 cm/s; however, the mean current at 200 m and 300 m was toward the east at about 6 cm/s.

The thermal structure of this area of the tropical Pacific Ocean is characterized by a well-defined surface mixed layer overlaying a strong permanent thermocline. Temperature decreases with depth, reaching about 4.5°C at 1000 m, and exhibits very small seasonal changes. The mean mixed layer depth measured at all stations during DOMES was 36 ± 32 m during the summer and 55 ± 18 m during the winter. The thermocline extended to a depth of 150 ± 31 m in summer and to 130 ± 18 m in winter. Data collected by OMCO during exploration cruises show the average mixed layer depth to be 35 ± 10 m during April and 45 ± 15 m in September.

The salinity in the surface mixed layer varies very little seasonally with a mean value of 34.3 ‰ for summer and winter. The dissolved oxygen concentrations in the mixed layer are near saturation. During DOMES, oxygen concentrations just below the mixed layer were above saturation (400 - 500 ug-at/l) in certain locations because the bulk of the phytoplankton were located at these depths. An oxygen minimum zone, with concentrations as low as 1 ug-at/l, was found between 300 m and 500 m depth.

OMCO used free-floating sediment traps to collect particulate matter from the upper water column. Particles from these traps were analyzed for organic carbon and nitrogen and for Mn, Zn, Cu, Cd, Ni, Fe, and Al (See Appendix 7, OMCO License EIS).

Nutrient concentrations in the mixed layer are low because of uptake by phytoplankton and because the thermocline inhibits vertical nutrient transport. OMCO collected and analyzed seawater samples for inorganic nutrients and for dissolved trace metal concentrations and particulate trace metal content (See Appendix 7, OMCO License EIS).

The average surface chlorophyll *a* value of 0.12 mg/m³ measured at the

DOMES sites is typical of the low values for phytoplankton standing crop in subtropical ocean waters. The average daily primary production for summer and winter was 133 ± 62 mg C/m²/day.

Standing stocks of micronekton, zooplankton, and neuston, as measured during DOMES, varied seasonally from 3 to 8 g/m² with the higher values typical during the winter. Macrozooplankton were found in highest concentrations in the upper 150 m. The lowest concentrations were found in the oxygen minimum zone and below 900 m.

OMCO used bongo net and neuston samplers to study zooplankton and ichthyoplankton distributions. Of the 22 invertebrate zooplankton taxa identified, copepods, chaetognaths, euphausiids, siphonophores, larvaceans, and amphipods were numerically dominant within the upper 100 m. A total of 59 taxa were identified among more than 45,000 captured fish larvae. Few species of commercial importance were found. Coryphaena sp. (Mahi mahi or dolphin) were found only in the upper 25 m and comprised 0.01% of the total abundance in that depth interval. Scombridae (tuna) were found throughout the upper 100 m, but comprised only 0.09% of the total ichthyoplankton.

In order to supplement the few existing reliable published reports on the abundance of midwater fish, OMCO submitted fish caught in their free-fall grab samplers to the University of California, Santa Barbara, for identification. All fish were represented by the orders Anguilliformes, Salmoniformes, Myctophiformes, Gadiformes, Beryciformes, and Perciformes. Based on over 4,000 grab samples, each sampling about 0.1 m² area, OMCO collected 7.2 fish/100 m².

III.B. Lower Water Column and Seafloor

Near-bottom current measurements made at Site C during DOMES fluctuated both in average speed and direction. Currents from July to early November (1977) were

northwest with a maximum speed of 8.8 cm/s recorded 30 m from the bottom. From November to December 1977 the direction was almost south with a maximum speed of 6.3 cm/s at 200 m from the bottom.

Current measurements in the lower 300 m of the water column made by KCON in license area USA-4 over a period of ten days showed speeds ranging from 25 to 39 cm/s. Current directions varied from south to east. Two other KCON current measurements (direction only) over a 24 hour period produced currents fluctuating between west and south direction (at 13°36'N, 126°05'W) and between west and north (at 13°41'N, 126°09'W).

Current meter data were collected in the PIPRA during the BIE. The current meter was located 5 m above the seafloor at a depth of 4797 m (approximately 13°N, 128°22'W) from October 3, 1989 to June 28, 1991. The mean current velocity was 3.23 cm/s, with a prevailing direction from the north to northeast. A maximum velocity of 13.4 cm/s was recorded. The currents were observed to periodically reverse direction in an unpredictable manner.

Bottom waters are well oxygenated but show a significant decrease in concentration from west to east across the Clarion-Clipperton area. Water depth increases from east to west across the area. Mean depths in USA-4 vary from 4000 m in the east to 4600 m in the west. The topography consists of rolling abyssal hills and valleys with a north-south orientation and an average relief of 200 m. Abyssal hills with a relief of 600 m and steep rock scarps with relief of tens of meters are also occasionally found. The sediment consists of a stiff silicious clay.

During DOMES, benthic organisms were surveyed by photography and sampled with box cores, free-fall baited traps, and bongo net tows. The near-bottom macrozooplankton population, comprised mainly of crustaceans, was very low, with fewer

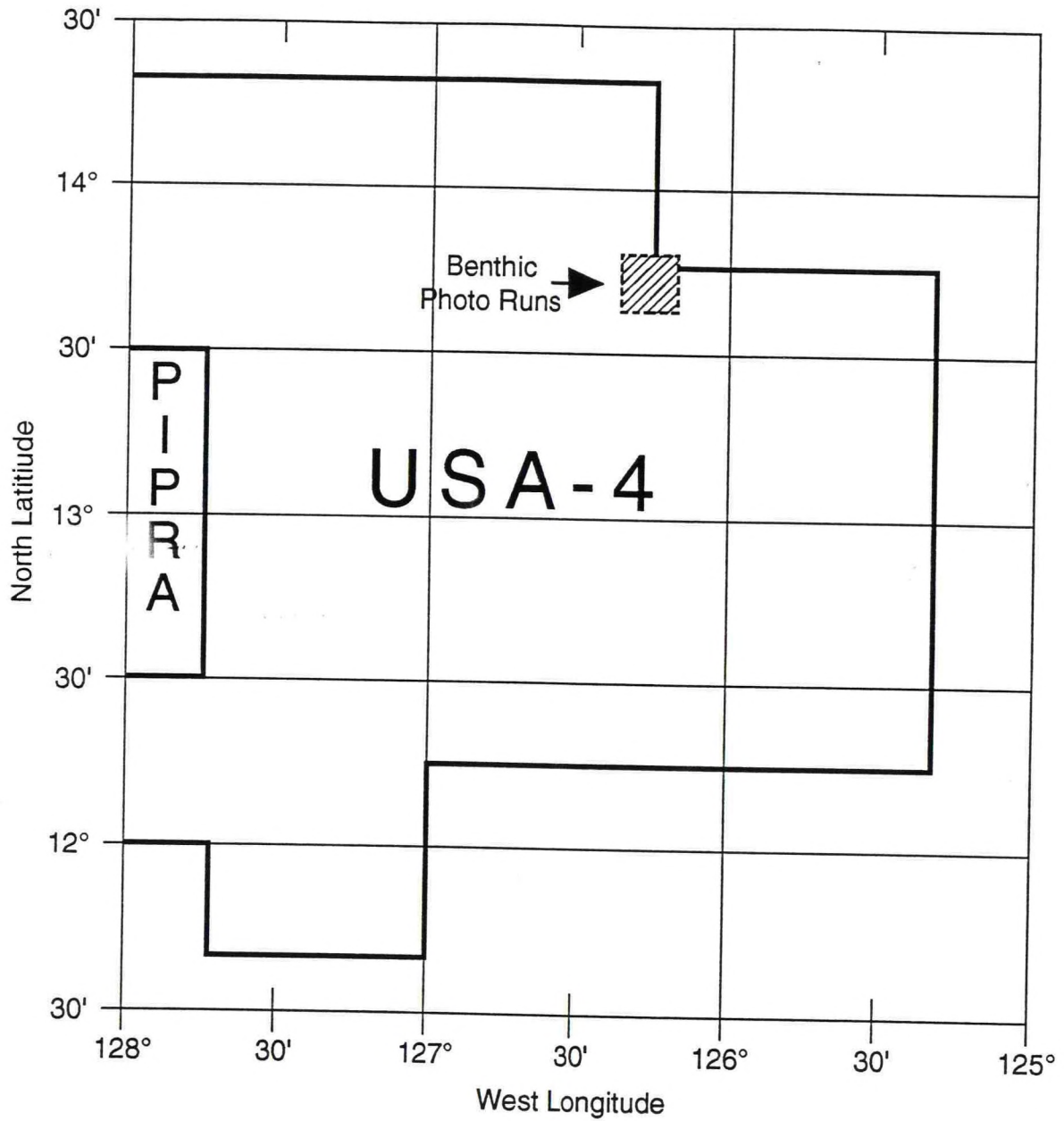
than five individuals caught per sample in net tows. Bottom scavengers found in the baited traps included two families of fish (rat-tails and liparids) and large numbers of amphipods (about 50,000 individuals in the 73 samples obtained). Photographic surveys showed that at least 90 percent of the larger, observable epibenthic organisms were sea stars, brittle stars, sea anemones, sea cucumbers, and sponges. Analysis of the box cores revealed that 40 percent of the organisms collected were polychaete worms (underestimated due to sampling problems), 19 percent were tanaids, and 11 percent were isopods. The majority of the remaining organisms were sponges, bryozoans, gastropods, sea cucumbers, sea urchins, bivalves, sea anemones, brittle stars, brachiopods, and miscellaneous non-polychaete worms.

OMCO used 35mm photographs and basket samplers to determine benthic populations at many sites during exploration cruises. Figure 4 shows the location of camera deployments at one site within USA-4. Twelve camera runs containing more than 3000 photographs were analyzed. Numbers of individuals per 100 m² are shown in Tables 3A and 3B. Sea urchins, anemones, and brittle stars were numerically dominant. Sea urchins were numerically dominant in photos taken during DOMES at Site C. The specific types of organisms observed in the camera runs and their numerical abundances are shown in Figure 5.

Echinoderms comprised 38 of the 50 species of large invertebrates collected with basket samplers by OMCO. Mollusks, crustaceans, and cnidarians comprised the remainder of the organisms collected in this manner.

Pawson (1988) in his analysis of 7,000 previously unanalyzed photographs taken by OMCO in its license area (USA-1) adjoining USA-4, found sea anemones to be the numerically dominant megafauna present. They comprised more than 50% of the total megafauna observed.

Analysis of videotapes taken by Ocean Mining Associates in USA-4 showed



**Figure 4. Location Map – OMCO Benthic Megafauna Data in USA-4
(OMCO License Application, 1993)**

Table 3A

**Benthic Megafauna Observations in USA-4
(OMCO License Application, 1993)**

Megafauna Category (27,013 m ² , 2,699 photos)	Number Observed	Number per 100 m ²
total number observed	2,744	10.158
brittle stars (ophiomusium)	499	1.847
sea urchins	934	3.458
fish	31	0.115
Total holothurians	373	1.381
unknown holothurian	22	0.081
pseudostichopus	30	0.111
mesothuria	14	0.052
psychropotes	11	0.041
psychropotes verrucosa	1	0.004
enypniastes	42	0.155
oneirophanta	26	0.096
"droopy" oneirophanta	75	0.278
deima	9	0.033
amperima A	2	0.007
amperima B	9	0.033
amperima C	7	0.026
amperima D	0	0.000
synallactes	53	0.196
benthodytes	58	0.215
"flowermouth"	13	0.048
holothurian B	1	0.004

Table 3B

**Benthic Megafauna Observations in USA-4
(OMCO License Application, 1993)**

Megafauna Category (27,013 m ² , 2,699 photos)	Number Observed	Number per 100 m ²
Unknown crustacean	4	0.015
coelenterata (unk)	2	0.007
sea anemone	435	1.610
sea pen; sea fan	29	0.107
jelly fish	5	0.019
stalked solitary ascidian	1	0.004
mollusca	1	0.004
porifera	24	0.089
glass sponge	83	0.307
stalked crinoid	91	0.337
unstaked crinoid (10 arm)	129	0.478
brisingia	7	0.026
hymenaster	7	0.026
psilaster-dyaster	7	0.026
shrimp	12	0.044
octopus	4	0.015
isopoda	3	0.011
asteroid (other than above)	17	0.063
unknown animal	37	0.137
bristle worm	2	0.007
lobster-like crab (Galathea)	4	0.015
chiton	1	0.004
man-made debris	2	0.007

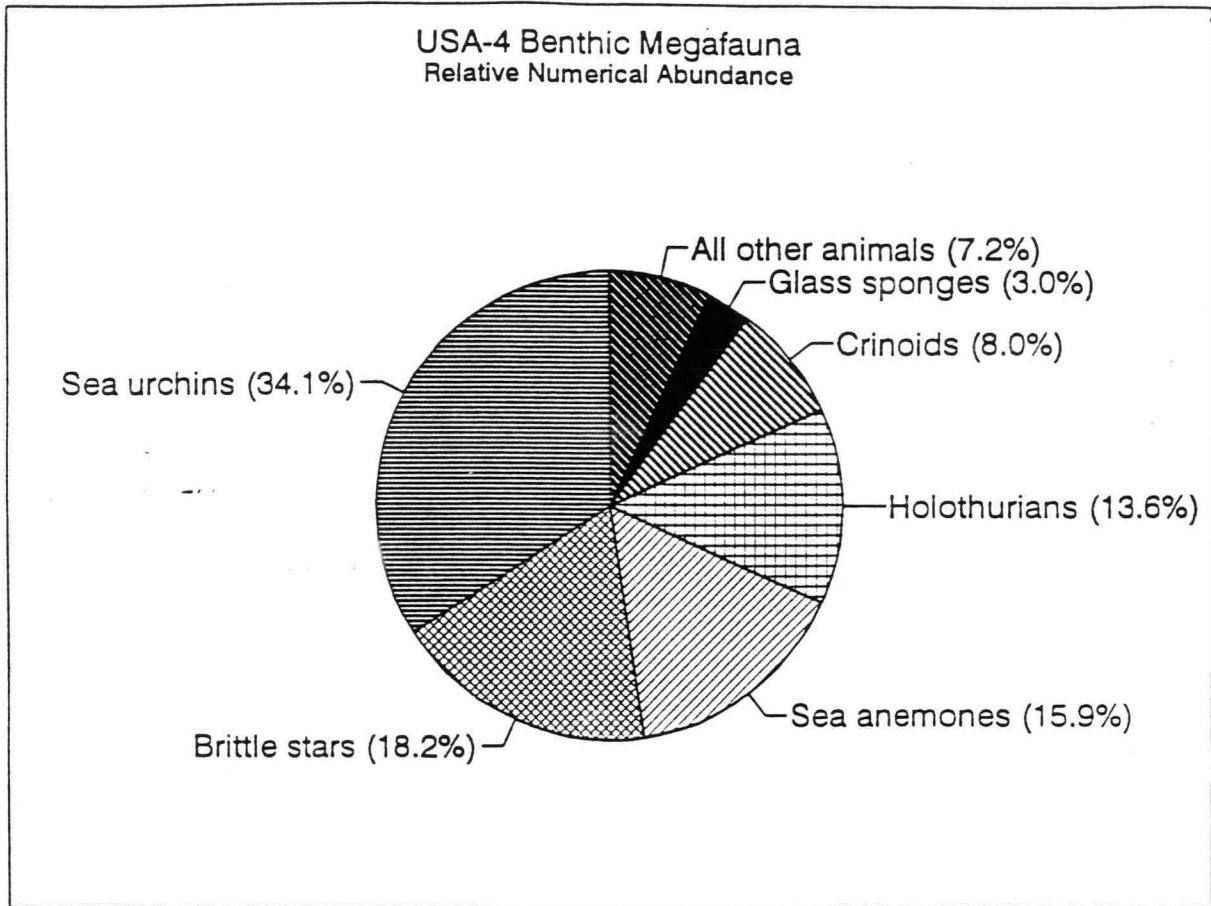


Figure 5. Relative Numerical Abundance of Megafauna from Analysis of Seafloor Photographs in USA-4 (OMCO License Application, 1993).

echinoderms to be the dominant megafaunal group, with sea anemones, sea cucumbers, and brittle stars in greatest abundance within that group (Foell, 1989).

Wilson (1992), in his analysis of the macrofaunal and meiofaunal communities found in 16 box cores taken in the PIPRA (approximately 13N, 128W), found the average density of macrofauna to be 184.3 individuals per 0.25 m², with a range of 103 to 299 individuals. These densities are two times higher than the densities seen in the area of DOMES Site C. Polychaetes, tanaids, isopods, bivalves, and nemertea were the most abundant macrofauna. The two most abundant macrofauna, polychaetes and isopods, are also less diverse in the PIPRA than at DOMES Site A.

Smith (1993) analyzed 10 box core samples collected at the BIE site for macrofaunal composition and abundances. Figure 6 shows a comparison of these data with the data of Wilson. The mean macrofaunal abundances in the October 1989 and September 1992 samples were 40-50% higher than the August 1991 samples. Because the samples were collected 3 years and about 10 km apart, it is not clear whether these differences are due to temporal or spatial changes.

Because the meiofauna are much more abundant than the macrofauna in the deepsea sediment, they may be more useful for monitoring mining impacts.

Thistle (1993), in his preliminary analysis of the meiofauna in box cores taken at the BIE site, found nematodes, harpacticoid copepods, ostracods, and kinorhynchans, in that order, to be the four taxa abundant enough to be studied.

Faunal Data Comparisons

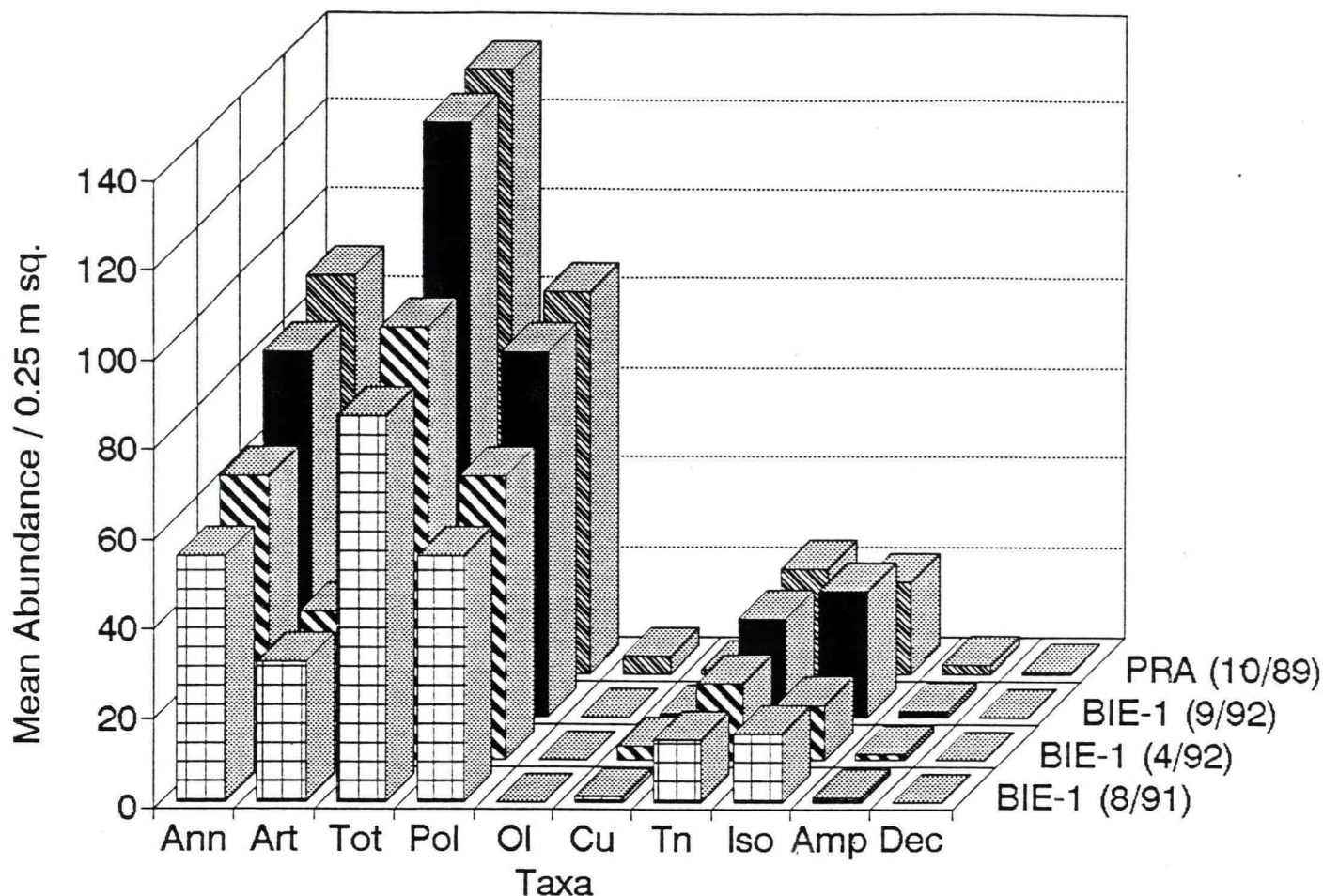


Figure 6. Macrofaunal Data Comparisons of Box Core Samples Taken in the BIE-1 Area and in the PIPRA (NOAA, from data of Smith, 1993 and Wilson, 1992).

Ann: Annelids (=Polychaetes + Oligochaetes)

Art: Arthropods (=sum of all other taxa)

Tot: Total (=Annelids + Arthropods)

Pol: Polychaetes

Ol: Oligochaetes

Cu: Cumaceans

Tn: Tanaids

Iso: Isopods

Amp: Amphipods

Dec: Decapods

PRA (10/89): All of the samples from the PRA study.

BIE (8/91): All control samples collected for BIE-1 that have been sorted.

BIE (4/92): A single sample collected prior to initiating the failed BIE-1 experiment.

BIE (9/92): Zone 1 samples collected in 9/92.

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IV. License Activity Impingement on Marine Environment

IV.A Activities Permissible Under the Act

Exploration is prohibited except under a NOAA license (Section 101(a)). The Act defines exploration to mean:

- "(A) any at-sea observation and evaluation activity which has, as its objective, the establishment and documentation of
- (i) the nature, shape, concentration, location, and tenor of a hard mineral resource; and
 - (ii) the environmental, technical, and other appropriate factors which must be taken into account to achieve commercial recovery; and
- (B) the taking from the deep seabed of such quantities of any hard mineral resources as are necessary for the design, fabrication, and testing of equipment which is intended to be used in the commercial recovery and processing of such resource".

Although no further at-sea activities are planned by OMCO in its license area, past exploration activities in USA-4 included at-sea testing of OMCO's pilot-scale mining system in 1979 and extensive surveying and sampling activities of the type included under (A) in the definition of exploration.

All initial exploration activities were judged by NOAA to have no potential for

significant environmental impact [15 CFR 970.701(a)] and would normally not require an EIS under NEPA; however, the Act [Section 109(d)] requires an EIS on each license NOAA considers issuing.

IV.B. Proposed Activities

The objective of exploration, in general, is to delineate the important features of a target area discovered during prospecting in sufficient detail to permit the evaluation of the area as a mine. The subject is discussed in the Deep Seabed Hard Mineral Resources Act, NOAA's Deep Seabed Mining Final PEIS (Appendix 3, pages 255-258), NOAA's Deep Seabed Mining Final Technical Guidance Document (Section 2.2), and NOAA's Deep Seabed Mining Final Exploration Regulations (15 CFR 970.701).

Before enactment of the Act, OMCO had collected significant data from the USA-4 area related to mineral deposit characterization, mining-system performance, and benthic biological composition. The primary efforts to be undertaken under the license will consist of the specification of future development methods and schedules based upon these existing data, augmented with information gathered from the extensive current worldwide developments in the relevant technologies.

Based upon the extensive deposit and benthic biological characterization work carried out by OMCO in the USA-4 area, OMCO is confident that permit-site and mine-site specification will require significant analysis of the existing data but only very limited field verification surveys.

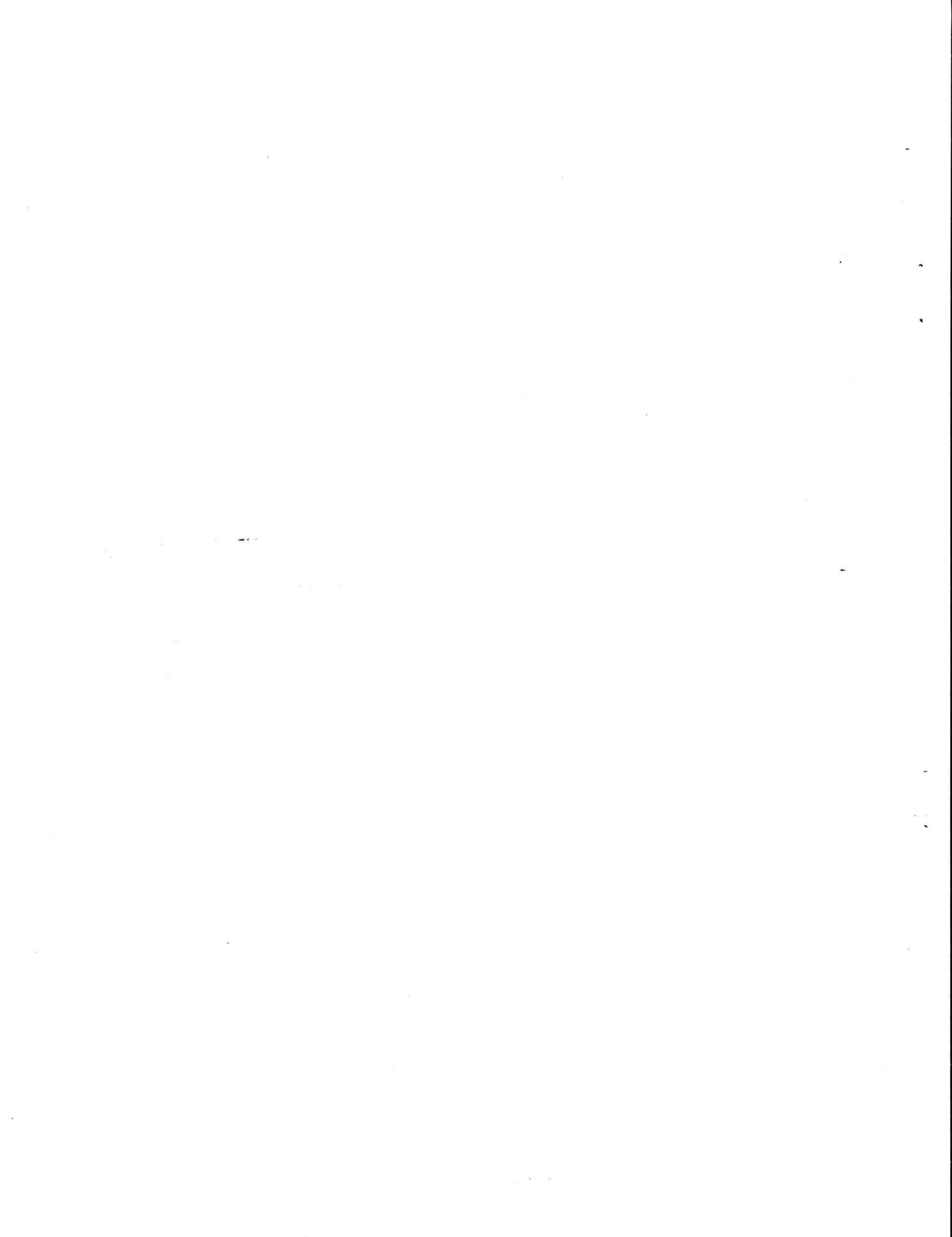
No additional at-sea work will be accomplished during the license period. OMCO will monitor all domestic and international activities in the field of ocean mining. Specific tasks will be aimed at equipment development studies, deposit data analysis, environmental analysis, and commercial re-evaluation. OMCO will use existing deposit data

to determine nodule grade and abundance, determine seafloor morphology and obstacle distribution, and sediment properties. Data analysis will be focused on the statistical characterization of deposit and terrain variability within the license area. OMCO will perform environmental analysis studies using its existing data. Developing technologies will be assessed to determine their potential usefulness for exploration and commercial mining operations. OMCO will conduct ongoing re-evaluations of the feasibility of commercial mining and will review an earlier economic feasibility study and update it according to technological and market developments.

V. ENVIRONMENTAL CONSEQUENCES 35

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V. Environmental Consequences

V.A. Exploration Activities

The at-sea mine site delineation activities (Section IV.B) originally scheduled to be conducted by each consortium during its exploration license were of the type judged by NOAA to have no potential for significant environmental impact (15 CFR 970.701(a); OMCO license EIS, Section V). These activities, which did not include at-sea equipment tests, were to consist of sampling and remote sensing to collect environmental baseline data, to collect information on the topography, sediments, and nodule location and abundance, and to collect small quantities of nodules.

The "worst case" potential for environmental impact during exploration activities would, excluding mining equipment testing, occur from seafloor sampling with basket samplers. Basket samplers, also called chain bag dredges, vary from a fraction of a m³ to several m³ in volume and are generally designed to be dragged along the seafloor while the vessel is underway (Society of Mining Engineers, Mining Engineering Handbook, Vol. 2, pg. 20-86, 1973). The actual amount of nodules recovered is commonly one tonne or less. The small quantities of nodules collected in this manner could be used for onshore testing of collector system components or in further onshore processing development tests. Because NOAA had already determined that the action of a pilot-scale mining collector during test mining has no potential for significant adverse impact (PEIS, pages 100-108), NOAA considered the effect of basket sampling exploration to be insignificant.

Since the license activities described by OMCO in its exploration plan for USA-4 do not include any planned additional at-sea activities of any type, there will not be any significant adverse effects associated with the license.

V.B. Endangered Species

Section 7 of the Endangered Species Act (P.L. 95-632) requires Federal agencies to insure that any action authorized, funded, or carried out by them does not jeopardize the continued existence of listed species or destroy or modify the critical habitat of any endangered or threatened species. Section 7 also requires all Federal agencies to consult with the Department of the Interior (Fish and Wildlife Service) and the Department of Commerce (National Marine Fisheries Service) when any of their actions may affect endangered species. A biological opinion is then issued by each agency indicating whether the action is likely to jeopardize a species or adversely modify its critical habitat.

NOAA, in preparing the proposed regulations for the issuance of deep seabed exploration licenses, recognized that license activities might affect threatened or endangered species or their designated critical habitat. Since a total of 17 endangered or threatened species of marine mammals and turtles could inhabit the DOMES area or transportation corridors leading to possible onshore process plant locations (Appendix 8, PEIS), NOAA requested a Section 7 consultation and biological opinion from the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS). The biological opinions prepared by each office stated that the implementation of the regulations is not likely to jeopardize the continued existence of any endangered or threatened species or destroy or adversely modify any of their critical habitats. The basis for their respective opinions is the fact that the regulations contain sufficient provisions to allow NOAA to protect these species and to meet its responsibilities under the Endangered Species Act.

One of these protective provisions is the requirement for NOAA to continue, prior to the issuance of a license, their consultations with other Federal agencies. Copies of the OMCO license application were distributed to pertinent Federal agencies, including the

FWS and NMFS for review of the proposed license activities. No additional Section 7 consultation was required at this stage because no "may affect" situation exists for the listed species or their critical habitats.

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VI. Monitoring

The Deep Seabed Hard Mineral Resources Act requires each licensee "to monitor the environmental effects of the exploration and commercial recovery activities in accordance with guidelines issued by the Administrator...". Because all activities conducted during exploration have been deemed by NOAA to have no potential for significant environmental impact, no monitoring of exploration activities will be required unless OMCO conducts any at-sea exploration activities or desires to test mine under a license. If test mining becomes feasible, the TCRs require that a monitoring plan be submitted by the consortium no later than one year prior to the initiation of tests and be concurred in by NOAA. The license TCRs will then be modified prior to mine tests to incorporate the monitoring plan and any special conditions required as a result of baseline data submission. No test mining or at-sea exploration is however planned by OMCO in license area USA-4.

VI.A. National Pollutant Discharge Elimination System Permit

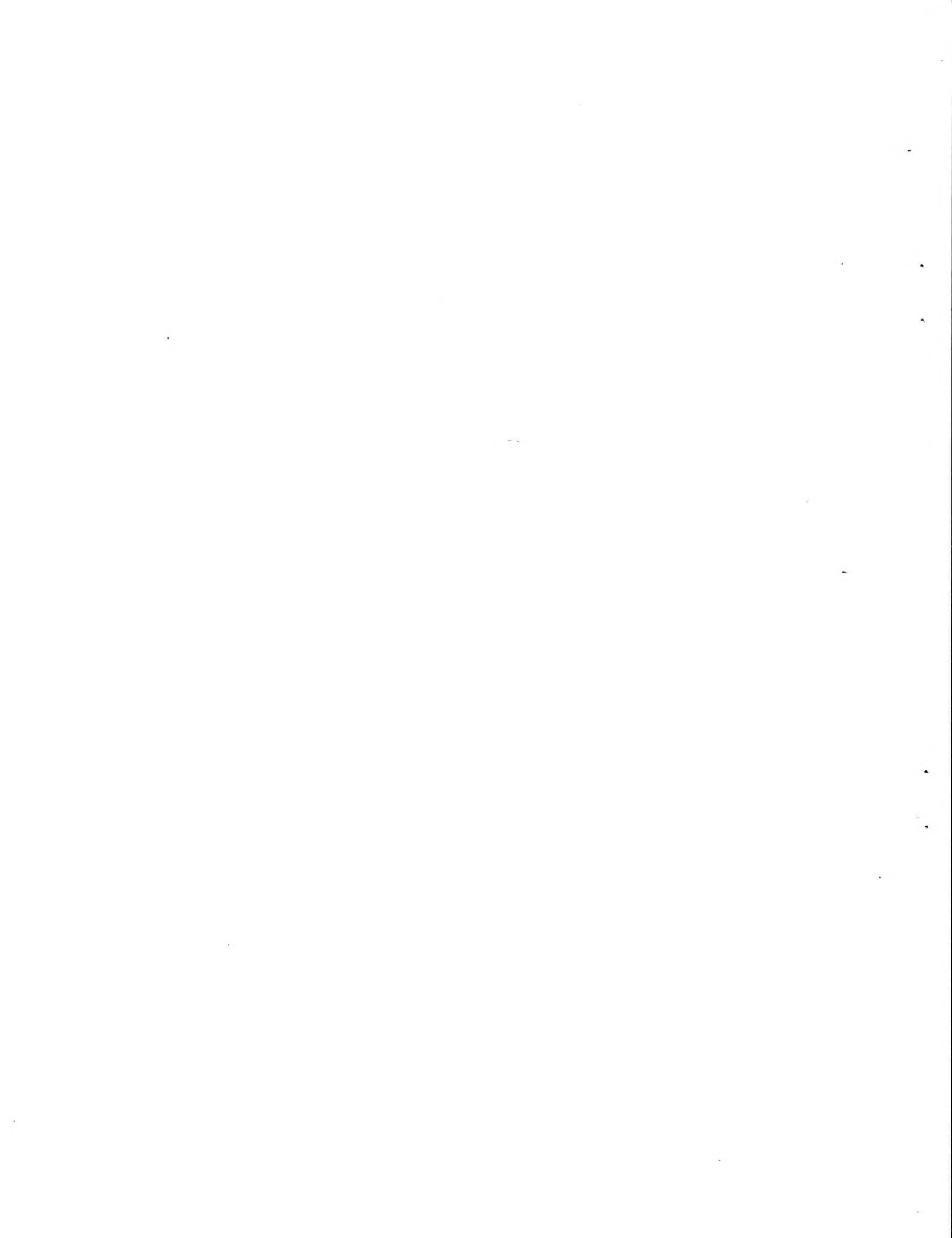
Because the Act specifically states that discharges from a vessel engaged in commercial recovery or exploration shall be subject to the Clean Water Act (P.L. 92-500, as amended), each original licensee, because they planned to conduct at-sea exploration activities, was required to obtain an NPDES permit. The Environmental Protection Agency, which issues these permits beyond state waters, issued a general permit (195 FR 39442, October 5, 1984) for vessels or other floating craft subject to the Deep Seabed Hard Mineral Resources Act. The permit covered all vessels under a mining license, and applied to routine vessel discharges (e.g., deck drainages, sanitary wastes, domestic wastes). The permit was valid for five years and expired on October 5, 1989. If a consortium wished to test mine, the NPDES general permit would have been modified for that consortium to address impacts from the surface and benthic plumes. No NPDES permit is required for this license issuance

because no at-sea activities are planned by OMCO under the license. However, as mentioned by EPA in its comments on the DEIS, if OMCO proposes to conduct at-sea activities, a new NPDES permit must be issued.

VI.B. Licensees' Monitoring Plans

No formal monitoring plan was submitted to NOAA by OMCO or any of the other licensees in their initial applications. No at-sea equipment tests were proposed so no monitoring plan was required with the license application. No monitoring plan is therefore required to be submitted by OMCO for the type of activities planned under this license.

VII. ONSHORE 45



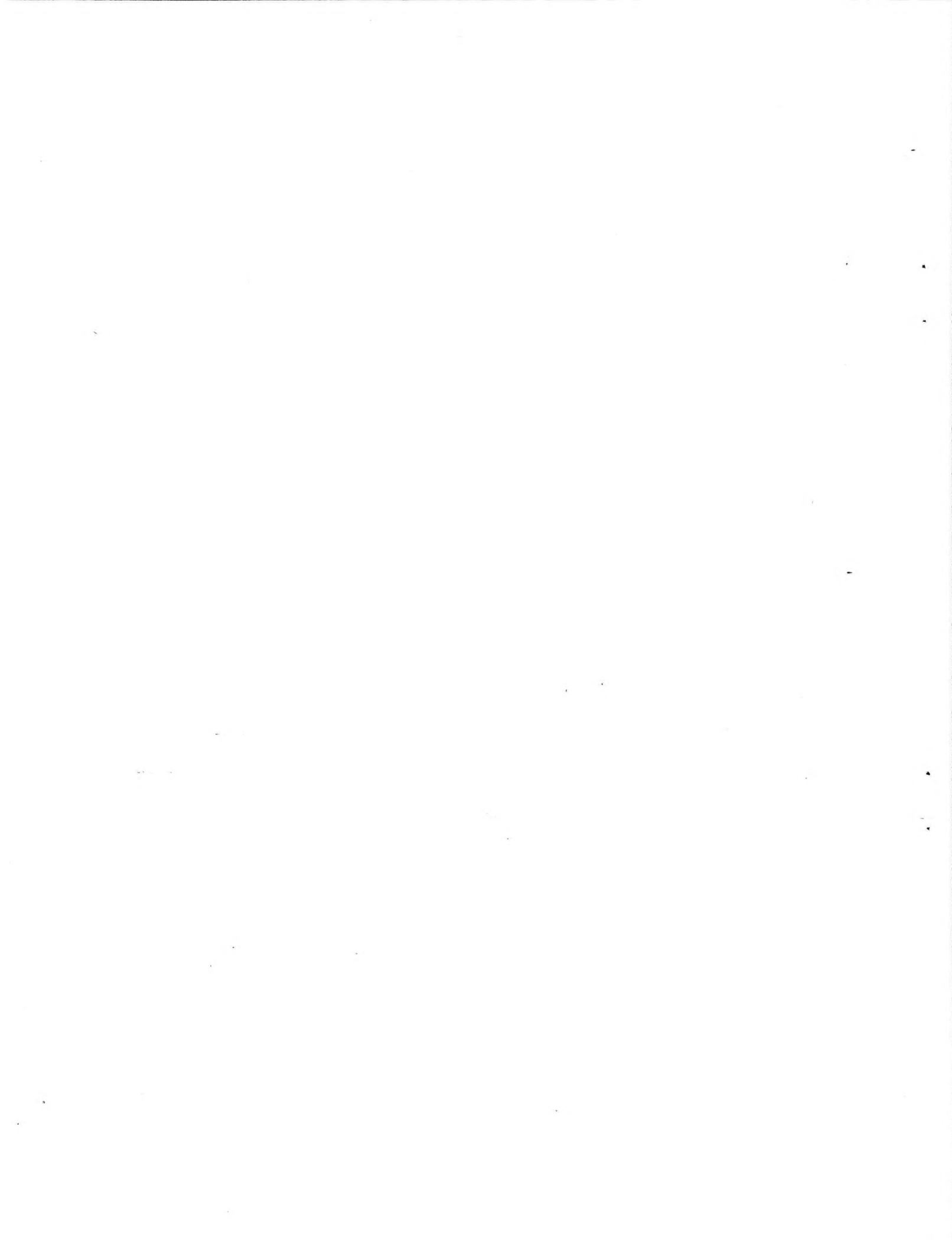
VII. Onshore

Ocean Minerals Company has not selected a site for the facilities necessary for onshore processing of the nodules. Therefore, no site-specific environmental analysis of onshore processing can be made until their processing methodology and site locations are determined. The design, fabrication, and operation of a large-scale pilot plant is the next step in the development of their process technology. However, because of the large amount of nodules required to operate this plant, its operation is only feasible in conjunction with the nodules recovered through at-sea testing of a scaled down version of a commercial recovery system. The continued evaluation of the economic and technical feasibility of commercial recovery and processing during the license period will dictate when and if these activities take place. If onshore processing tests are conducted either at existing onshore facilities or newly constructed facilities, OMCO shall consult with NOAA as soon as possible, prior to operations, so that a determination can be made as to the need for a supplementary EIS. If it is determined that a supplement to the EIS is required, OMCO shall submit the necessary data to NOAA no later than one year prior to the proposed initiation of operations (see Technical Guidance Document, dated September 1981). NOAA will work with other Federal, state and local agencies to incorporate their environmental information needs into a supplementary EIS, if deemed necessary, or other environmental assessment documentation and assist in facilitating the obtainment of the necessary permits from state, local and Federal agencies, as appropriate.

Section 307(c)(3)(A) of the Coastal Zone Management Act (P.L. 92-583, as amended) requires that all Federal licenses and permits for activities that affect the land or water uses in the coastal zone be consistent with approved state coastal zone management programs. However, because of the type and location of the activities to be conducted under the

exploration license, there should be no effect on any coastal area and no consistency determination is needed at this time (although one could be needed when coastal facilities are selected).

VIII. LIST OF PREPARERS 49



VIII. List of Preparers

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IX. LIST OF PERSONS, ORGANIZATIONS, AND AGENCIES TO WHOM EIS SENT

The Final Site-Specific EIS was sent to the following International, Federal, State and local agencies, industry, interest groups, and individuals.

Federal Officials and Agencies

Senate

Committee on Commerce, Science, and Transportation

Committee on Energy and Natural Resources

Committee on Environment and Public Works

Foreign Relations

House

Committee on Merchant Marine and Fisheries

Committee on Natural Resources

Committee on Foreign Affairs

Environmental Protection Agency

Department of the Interior

Department of Defense

Department of State

Department of Commerce

Department of Labor

Department of Transportation (U.S. Coast Guard; Maritime Administration)

Department of Justice

Department of the Treasury

National Science Foundation

Federal Trade Commission

Federal Officials and Agencies (continued)

Small Business Administration

Special Interest Groups

American Mining Congress

National Ocean Industries Association

Individuals

Brian Hoyle

Charles L. Morgan

John Padan

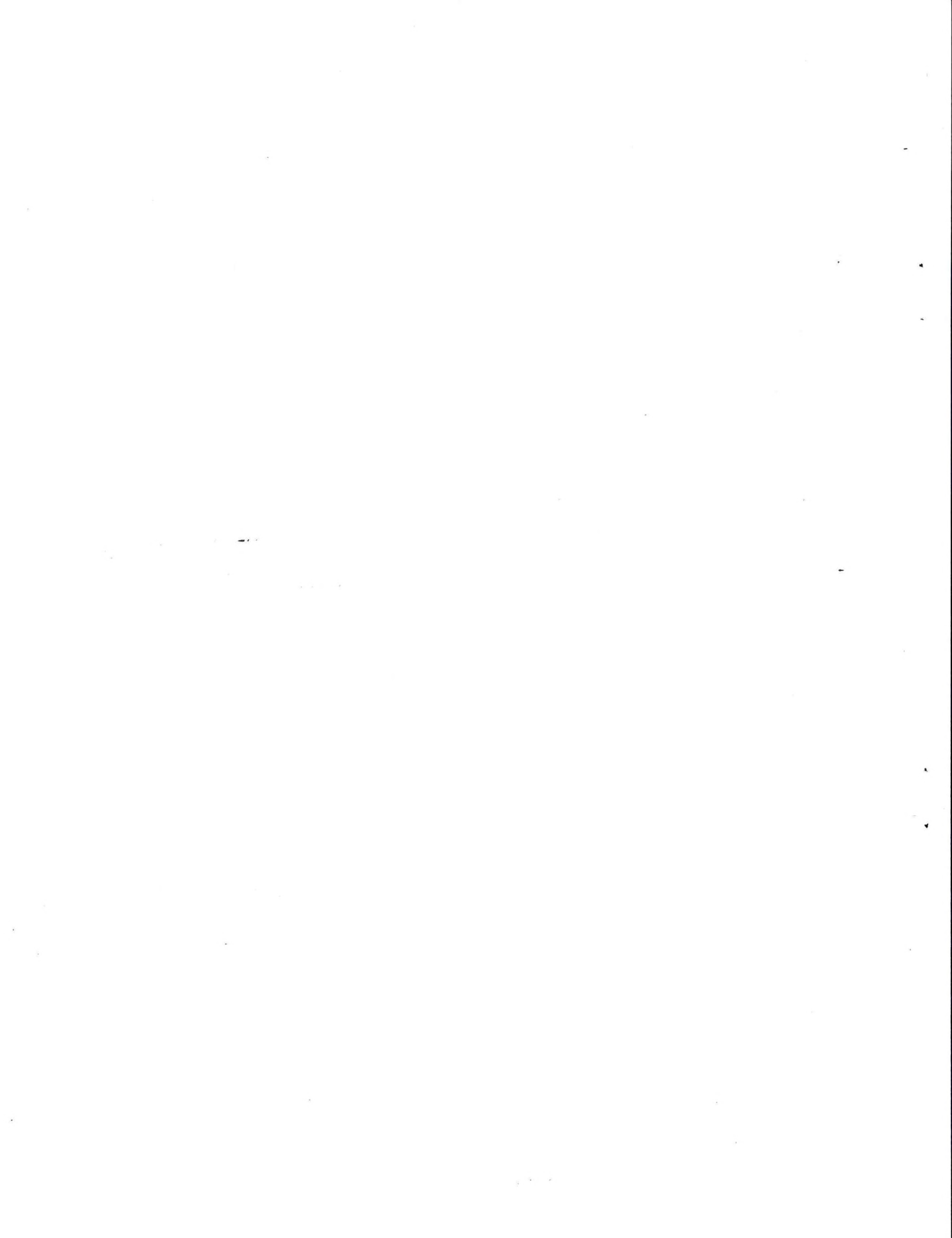
Deep Seabed Mining Consortia

Conrad Welling - (Ocean Minerals Co.)

Richard Greenwald - (Ocean Mining Assoc.)

Lewis Messulam - (Ocean Management, Inc.)

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Appendix 1References

- Foell, E.J., 1989. Analysis of Three Videotapes from the Kennecott Consortium Exploration License Areas. Final Report to NOAA under contract number 40-AANC-900-179. 21 pp.
- National Oceanic and Atmospheric Administration, 1981. Deep Seabed Mining Final Programmatic Environmental Impact Statement Vol. 1, September 1981.
- National Oceanic and Atmospheric Administration, 1981. Deep Seabed Mining Technical Guidance Document, September 1981.
- National Oceanic and Atmospheric Administration, 1984. Environmental Impact Statement on Issuing an Exploration License to Ocean Minerals Company. May 1984.
- National Oceanic and Atmospheric Administration, 1989. An updated Environmental Assessment of NOAA Deep Seabed Mining Licensees' Exploration Plans. January 1989.
- Ozturgut, E., G. C. Anderson, R. E. Burns, J. W. Lavell, S. A. Swift, 1978. Deep Ocean Mining of Manganese Nodules in the North Pacific: Pre-mining Environmental Conditions and Anticipated Mining Effects. NOAA Tech. Memorandum ERL MESA-33, 133 pp.
- Pawson, D.L., 1988. Analysis of Some OMCO Seafloor Photographs from Cruises GR7901, 8005, and 8102: Megafauna and Manganese Nodule Data. Final Report to NOAA under contract number 40-AANC-602101. 81 pp.
- Smith, C.R., 1993. Final Progress Report for FY-93 for Sea Grant Project "Benthic Community Disturbance and Succession Following Simulated Manganese Nodule Mining in the Equatorial Pacific Ocean", University of Hawaii Component.
- Society of Mining Engineers Mining Engineering Handbook, Vol. 2, 1973.
- Thistle, D., 1993. Meiofauna: Tools for Evaluating the Environmental Impact of Polymetallic Nodule Mining in the Deep Sea. Progress Report for the period February 1, 1992 to January 31, 1993.
- Wilson, G. D., 1992. Biological Evaluation of a Preservation Reserve Area - Faunal Data and Comparative Analysis. Final Report to NOAA under contract number 50-DSNC-9-00108.

Appendix 2Glossary

Abyssal hills - Elongate, sediment covered features of the seafloor with a relief of 50 to 300m and a 2° to 3° slope.

Amphipods - An order of elongate, usually laterally compressed, mostly benthic crustaceans.

Basket sampler - See chain bag dredge.

Benthic - Pertaining to seafloor.

Benthic plume - A stream of water containing suspended particles of seafloor sediment, abraded manganese nodules, and macerated benthic biota that emanates from the mining collector as a result of collector disturbance of the seafloor and subsequent rejection of seafloor sediment from the mining system. The far-field component of the benthic plume is termed the "rain of fines."

Benthos - Organisms living on or in the seafloor.

Bongo net - A device for sampling subsurface plankton populations.

Bivalves - A class of molluscs that possess a hinged shell and a hatchet-shaped foot. Includes clams, oysters and mussels.

Box corer - A type of corer that retrieves relatively undisturbed and quantitative sediment and faunal samples in a block rather than in a cylinder.

Brachiopods - A phylum of attached, marine, mollusk-like animals in which the body is enclosed in a calcareous bivalve shell.

Brittle Star - A class of phylum Echinodermata of spiny-skinned, starfish-like, bottom-dwelling, mobile organisms with five or more elongated, brittle arms.

Bryozoan - A phylum of minute, colonial animals with body walls often hardened by calcium carbonate that usually grow attached to plants, rocks, or other firm surfaces.

Chaetognaths - One of a phylum of small, elongate, transparent, wormlike animals pelagic in all seas from the surface to great depths. Also called arrow worms.

Chain bag dredge - A sampling device consisting of a large metal frame attached to a heavy chain mesh bag which is dragged along the seafloor. Also called basket samplers and dredge baskets.

Glossary (continued)

Chlorophyll a - One of a group of green pigments, identified as chlorophyll a, b, and c, occurring in plants that are active in the process of photosynthesis. The concentration of these pigments is used as an index of the standing crop of phytoplankton.

Clay - As a size term, refers to sediment ranging from 0.0039 to 0.00024 mm. Mineralogically, clay is a hydrous aluminum silicate material with plastic properties and a crystal structure.

Cnidarians (Coelenterates) - A phylum of mostly colonial marine animals that exist in both a free-swimming and an attached stage. Includes corals, sea anemones, and jellyfish.

Copepods - Minute shrimplike crustaceans that often occur in large concentrations in the surface waters and are an important link in many marine food chains.

Crinoids - One of a class of echinoderms most of which either permanently or when immature are attached by a long stalk to the bottom. Includes sea lily and feather star.

Crustaceans - A class of animals with a segmented external skeleton and jointed appendages. Includes barnacles, crabs, shrimp, lobster, copepods, and amphipods.

Echinoderms - One of a phylum of principally benthic marine animals having calcareous plates with projecting spines forming a rigid or articulated skeleton or plates and spicules embedded in the skin; includes starfish, sea urchins, and sea cucumbers.

Epifauna - Animals which live at the water-substrate interface, either attached to the bottom or moving freely over it, e.g., starfish.

Euphausiids - One of an order of shrimplike, planktonic crustaceans, widely distributed in oceanic and coastal waters.

Fracture zone - An extensive linear zone of irregular topography of the seafloor; characterized by seamounts, steep-sided ridges, and escarpments.

Free-fall grab sampler - An untethered, bottom sampling device that sinks to the seafloor, recovers nodules, and returns automatically to the surface. May also have a sediment sampler and a camera attached.

Gastropods - A large class of mostly bottom-dwelling molluscs. Most forms have a spiral shell.

Holothurians - See sea cucumber.

Ichthyoplankton - Larval fish.

Isopods - An order of crustaceans with generally flattened bodies. Most are deposit feeders.

Glossary (continued)

Larvacean - One of a class of small, transparent, planktonic tunicates in which the body is covered by a large tunic and is composed of a trunk and a long tail.

Macrofauna - Marine animals retained on a sieve of 0.3 to 1.0 mm meshes.

Macrozooplankton - Zooplankton ranging in size from about 1 mm to 1 cm in length.

Megafauna - Animals large enough to be seen with the naked eye.

Meiofauna - Usually refers to animals that will pass through a 0.3 0.5 or 1.0 mm mesh sieve and be retained on a 0.05 mm mesh seive.

Micronekton - Early planktonic stages of fish and other actively swimming organisms, such as squids.

Mollusk - A phylum of soft, unsegmented animals, most of which are protected by a calcareous shell. Includes clams, oysters, squids, and octopi.

Neuston - Surface dwelling organisms.

Oxygen minimum zone - A subsurface water layer in which the dissolved oxygen is very low.

Phytoplankton - Plant forms of plankton.

Plankton - Passively drifting or weakly swimming organisms. May consist of plants, animals, and eggs or larval stages of fish.

Polychaete worms - Marine worms with segmented bodies.

Primary productivity - The amount of organic matter synthesized by organisms from inorganic substances in unit time in a unit volume of water.

Salinity - A measure of the quantity of dissolved salts in sea water.

Sea anemone - Sedentary marine animal of the phylum Coelenterata, having a columnar body and one or more circles of tentacles surrounding the mouth.

Sea cucumbers - A class of the phylum Echinodermata; elongate, tube-like, bottom-dwelling organisms that feed by ingesting sediment or suspension feeding.

Sea star - True starfish with a flat, usually five-armed body.

Sea urchins - Bottom-dwelling marine animals with a skeleton composed of immovable hard plates; many species possess long sharp spines.

Glossary (continued)

Siliceous ooze - A fine-grained pelagic sediment containing more than 30% siliceous skeletal remains of pelagic plants and animals.

Siphonophore - One of an order of coelenterates. Many are luminescent and some possess an air-filled float.

Surface mixed layer - Layer of surface waters that overlay the thermocline. It is characterized by fairly uniform temperature, salinity, and density values. The waters are well-mixed through wind and wave action and are high in oxygen content. Nutrient content is low because of uptake by phytoplankton.

Surface plume - The suspended particles in the surface water composed of the sediment, nodule fragments, and bottom water discharged over the side of the mining vessel.

Suspended particulate matter - Concentrations of organic and inorganic particles found suspended in the water column.

Tanaids - An order of very small crustaceans that live burrowed in the mud or in self-constructed tubes. Superficially, they resemble tiny (1 mm) lobsters.

Thermocline - Layer of water, at the base of the surface mixed layer, in which there is a sharp decrease in temperature with depth.

Tiering - Refers to the coverage of general matters in a broad PEIS with subsequent narrower statements or environmental analyses in a site-specific EIS.

Tonne - A metric ton (1000 kilograms).

Zooplankton - Animal forms of plankton.

Appendix 2 (continued)ABBREVIATIONSChemicals and Trace Metals

Al	-	aluminum	Fe	-	iron
Cd	-	cadmium	Mn	-	manganese
C	-	carbon	Ni	-	nickel
Cu	-	copper	Zn	-	zinc

MeasurementsDistance

mm	-	millimeters
m	-	meters
km	-	kilometers

Others

°C	-	degrees Centigrade or Celsius
Km ²	-	square kilometers
m ²	-	square meters
m ³	-	cubic meters
s	-	seconds

Ratios

ug-at/l	-	microgram atoms per liter
cm/s	-	centimeters per second
‰	-	parts per thousand
g/m ²	-	grams per square meter
m/s	-	meters per second
mg/m ³	-	milligrams per cubic meter
mgC/m ² /day	-	milligrams carbon per square meter per day

Appendix 3Federal Agency Review of License Applications

Section 103(e) of the Deep Seabed Hard Mineral Resources Act and Section 970.211 of the regulations implementing the Act require NOAA to consult with other Federal agencies which have programs or activities within their statutory responsibilities which would be affected by the activities proposed in the application. NOAA has provided copies of the application to and received comments and recommendations from the agencies listed below.

Agency

Environmental Protection Agency

Department of the Interior

Department of the Navy

Department of State

Federal Trade Commission

Department of Commerce - National Marine Fisheries Service; Coastal Zone Management;
Office of Export Licensing

Department of Labor - Mine Safety and Health Administration

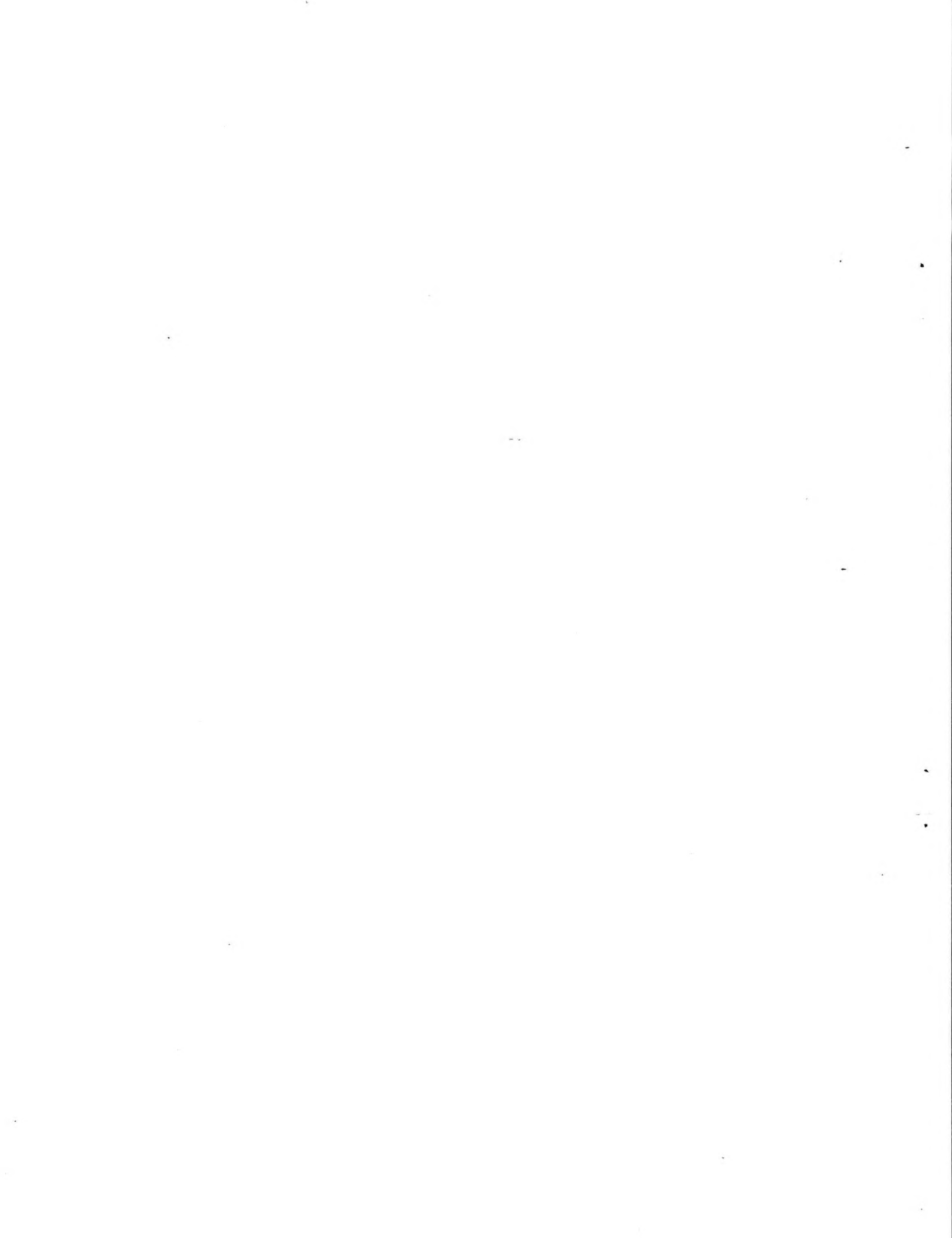
Department of Transportation - U.S. Coast Guard; Maritime Administration

National Science Foundation

Department of the Treasury

Department of Justice

Small Business Administration



Appendix 4

Proposed Terms, Conditions, and Restrictions for
Ocean Minerals Company (OMCO)
License Area USA-4

NOAA proposes to issue a license authorizing OMCO to engage in the deep seabed mining exploration activities described in OMCO's exploration plan, consistent with the provisions of the Act and 15 CFR Part 970 and subject to the proposed terms, conditions and restrictions (TCRs) below. The issuance proposal is contingent upon a finding by NOAA that the exploration proposed in the OMCO application will meet the requirements of §105(a) of the Act. The proposed license would be exclusive with respect to OMCO as against any other United States citizen or any citizen, national or governmental agency of, or any legal entity organized or existing under the laws of, any reciprocating state.

Proposed TCRs(1) Diligence.

(a) OMCO shall pursue diligently the activities described in its approved exploration plan (15 CFR 970.602). In order to show that it has diligently pursued the activities in its approved exploration plan (15 CFR 970.517), OMCO shall submit to the Division of Ocean Minerals and Energy of NOAA, in accordance with 15 CFR 970.602 and 971.801 and within 90 days of each anniversary of the date of the license, an annual report demonstrating OMCO's conformance to the schedule of activities, level of activity, and expenditures set out in its application. This report shall focus on exhibiting to NOAA the evolving ability of OMCO to apply for a permit for commercial recovery by the end of the 10 year license period.

(2) Environmental Protection and Monitoring Requirements.

(a) OMCO shall conduct activities under the license to assure protection of the environment (15 CFR 970.518) and so as not to create a significant adverse effect on the environment (15 CFR 970.506).

(b) OMCO shall notify NOAA of any endangered species it observes, within 60 days of such observations, as discussed in NOAA's Technical Guidance Document (September 1981).

(c) OMCO is not required to conduct any environmental monitoring under this license if no at-sea mining tests are conducted.

(d) In order to ensure protection of the environment and in accordance with 15 CFR 970.700-.702, OMCO is prohibited from engaging in at-sea mining system test activities until NOAA has both approved an OMCO exploration plan revision (including NOAA preparation of a supplemental environmental impact statement (EIS)) relating to test activities, and amended the TCRs applicable to OMCO's license to include an approved environmental monitoring plan and any necessary TCRs relating to conduct of mining system test activities.

(e) If OMCO proposes to conduct at-sea mining system tests, OMCO shall submit to NOAA, at least one year prior to the proposed test initiation date, an exploration plan revision and a plan by which OMCO proposes to monitor the environmental impacts of test activities (hereafter, monitoring plan).

(f) If OMCO proposes to conduct at-sea mining system tests, in order to prepare the supplement to the EIS, referenced in paragraph (2)(d) and as part of the site-specific monitoring activities required of OMCO, the exploration plan revision shall include detailed test plans and test site-specific baseline data which NOAA determines are adequate

to address the unresolved environmental concerns and to assess the adequacy of the environmental predictions contained in NOAA's Programmatic Environmental Impact Statement (1981) (see NOAA's Technical Guidance Document, September, 1981, for further guidance).

(i) The baseline data must include data from water column measurements acquired during at least two seasons, spaced approximately six months apart, and at least one statistically designed sampling of the benthic fauna.

(ii) OMCO is strongly encouraged to consult with NOAA concerning the adequacy of OMCO's proposed sampling strategy prior to initiation of baseline data collection. At the request of OMCO, NOAA will provide written confirmation of the adequacy of a sampling strategy devised as a result of such a consultation.

(g) OMCO's proposed environmental monitoring plan referenced in paragraph (2)(e) shall be responsive to the objectives in (2)(f) above, and shall incorporate the information developed from the baseline data. The monitoring plan shall involve areas expected to be impacted as well as nearby control areas and shall include provision for immediate pre-test data collection, test monitoring and post-test monitoring, and a schedule for submission of resulting data to NOAA. Post-test monitoring shall include at least three years of sampling, the most intensive sampling being conducted immediately following testing and emphasizing the recovery of the benthic fauna.

(h) Baseline and monitoring data shall be submitted to NOAA in accordance with current formats of NOAA's National Oceanographic Data Center.

(i) If onshore processing tests are to be conducted at either existing onshore facilities or newly constructed facilities, OMCO shall consult with NOAA as soon as possible, so that a determination can be made as to the need for a supplementary EIS. If

NOAA determines that a supplement to the EIS is required, OMCO shall submit the necessary data to NOAA no later than one year prior to the proposed initiation of operations (see Technical Guidance Document, dated September, 1981). NOAA will work with other Federal, state and local agencies to incorporate their environmental information needs into a supplementary EIS, if deemed necessary, or other environmental assessment documentation and assist in facilitating the obtainment of the necessary permits from state, local and Federal agencies, as appropriate.

(3) Resource Conservation Requirements. OMCO shall conduct activities with due regard for prevention of waste and future opportunity for commercial recovery of the unrecovered balance of the hard mineral resources in the license area (15 CFR 970.519). If at-sea mining system tests are conducted, NOAA requires timely information on the implications of OMCO's pattern of mining. Therefore, OMCO shall submit to NOAA all collector tracks, and relevant nodule production and other data indicative of mining efficiency, no later than 60 days after completion of each mining test (15 CFR 970.603).

(4) Freedom of the High Seas Requirements. OMCO shall conduct its exploration activities in a manner which will not unreasonably interfere with the interests of other nations in their exercise of the freedoms of the high seas, as recognized under general principles of international law, such as fishing, navigation, submarine pipeline and cable laying, and scientific research (15 CFR 970.520).

(5) Safety at Sea Requirements. In order to promote the safety of life and property at sea (15 CFR 970.521), all U.S. flag vessels used in activities authorized by OMCO's license shall meet existing regulatory requirements applicable to such vessels, including the possession of a current valid Coast Guard Certificate of Inspection issued under 46 CFR Subchapter I. Foreign flag vessels used in activities authorized under the license

must be inspected under 33 CFR 140.101 and shall comply with the certificate requirements of either the International Convention for the Safety of Life at Sea, 1974 (SOLAS 74), or the International Convention for the Safety of Life at Sea, 1960 (SOLAS 60), whichever is applicable to the flag state nation. If the nation where a vessel is documented is not a signatory of SOLAS 74 or SOLAS 60, alternatively, the International Association of Classification Societies (IACS) requirements shall be met (15 CFR subpart H).

(6) Federal Observers' Monitoring Requirements.

(a) OMCO shall permit NOAA to place Federal officers or employees designated as observers aboard vessels used by the licensee in exploration activities to (i) monitor, including data and sample collection by the observer, such activities at such time and to such extent as NOAA deems reasonable and necessary to assess the effectiveness of the TCRs of the license; and (ii) report to NOAA whenever such officers or employees have reason to believe there is a failure to comply with such TCRs.

(b) Whenever OMCO is engaged in collection of baseline data or is otherwise monitoring pursuant to a monitoring plan, as described in (2) above, the at-sea observer, after consultation with OMCO, is authorized to specify minor changes in OMCO's sampling protocol or strategy if the observer determines that a change is necessary to address unanticipated results or to assure that the objectives of the monitoring strategy are met. The observer shall document such changes and rationale, in writing, and OMCO shall comply with such changes.

(c) Arrangements for any observer shall be made between NOAA and OMCO, and OMCO shall cooperate with observers in the performance of their monitoring function, in accordance with 15 CFR 971.1005. OMCO shall notify NOAA of each exploration cruise and the scope of cruise activities at least 60 days prior to each vessel departure.

(7) Records.

(a) OMCO shall keep and maintain for not less than three years such records, consistent with standard accounting principles, as will facilitate an effective audit of OMCO's expenditures for exploration for hard mineral resources in its license area (15 CFR 971.801).

(b) Records used as the basis for the annual report shall be maintained for not less than three years following submission of the report, except that environmental data, photographic records and samples shall be kept for the term of the license unless the licensee has requested, and received in writing from NOAA, either permission to dispose of these data, records and samples or instructions to deliver them to a location designated by NOAA. The licensee shall make its request to NOAA in writing six months in advance of its proposed disposition, and shall bear the expenses of delivery of such data, records and samples to the location designated by NOAA.

(8) Special TCRs. NOAA is authorized to issue special TCRs for the conservation of natural resources, protection of the environment and safety of life and property at sea, when required by differing physical and environmental conditions in the license area (15 CFR 970.523). At this time, NOAA does not intend to impose any special TCRs on the OMCO license; however, should additional data (e.g., license-submitted environmental baseline data acquired in accordance with paragraph (2)(f)) suggest that such conditions are necessary, NOAA will amend the license TCRs to reflect appropriate conditions.

(9) Shipwrecks and Cultural Materials. Within 60 days of discovery, OMCO shall notify NOAA of any shipwrecks or other cultural materials discovered in the course of exploration activities. (See National Historic Preservation Act.)

(10) Violations. It is unlawful for OMCO to violate any provision of the Act, any regulation issued under the Act, or any term, condition or restrictions of the license.

(11) Emergency orders. NOAA may order immediate suspension of the license, or immediate suspension or modification of particular activities under this license, if the President determines by Executive Order that such immediate suspension or modification is necessary to avoid any conflict with any international obligation of the United States established by any convention or treaty in force with respect to the United States or to avoid any situation which may be reasonably expected to lead to a breach of international peace and security involving armed conflict, or if the Administrator of NOAA determines such an action is necessary to prevent a significant adverse effect to the environment or to preserve the safety of life or property at sea. Upon receipt of an emergency order used pursuant to 15 CFR 970.511, OMCO shall immediately suspend or modify activities in accordance with the requirements of the order until such time as OMCO receives written notification from NOAA that the emergency order is rescinded.

(12) Notice of Changes. OMCO shall notify NOAA promptly of any changes in the membership or legal structure of its consortium, of any changes in its exploration plan, or of any other circumstances that might substantially affect any NOAA determination, or basis for license issuance or transfer, or the sufficiency of the TCRs to accomplish their intended purpose.

(13) Notice of Other Federal Requirements.

(a) The Department of Defense requested that the licensee be notified of requirements to file appropriate Notices to Mariners and, as required by law, obtain export licenses.

(b) Pertinent statutory and regulatory authorities and requirements of other

agencies and units of government are not satisfied by the issuance of this license and TCRs.

(14) Modifications

These TCRs may be modified in accordance with 15 CFR 970.512 should OMCO modify its exploration plan or otherwise change its program.

Date: _____

W. Stanley Wilson
Assistant Administrator

Appendix 5

COMMENT LETTERS RECEIVED ON THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Attached are the full texts of the 4 letters received on the Draft Environmental Impact Statement (DEIS). Each commenter is listed below. NOAA's response, if required, appears on the right side of each page.

<u>Comment</u>	<u>Comment and Affiliation</u>	<u>Page</u>
	<u>Federal Agencies</u>	
1	Department of Transportation	76
2	National Marine Fisheries Service	77
3	Environmental Protection Agency	78
4	Department of Labor	80

Mr. Karl Jugel
National Oceanic and Atmospheric Administration
Office of Ocean and Coastal Resource Management
Chief, Ocean Minerals and Energy Division
SSMC-4, Room 11425
1305 East-West Highway
Silver Spring, MD 20910

Dear Mr. Jugel:

This is in response to Ms. Donna Wieting's letter of June 23, 1994, requesting review of the Draft Environmental Impact Statement (DEIS) on issuing a deep seabed mining exploration license to Ocean Minerals Company (OMCO).

We have reviewed the material and recommend certification and issuance of an exploration license.

We have the following comment:

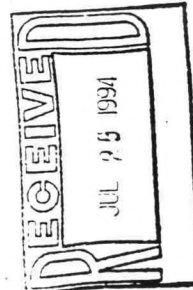
- a. The only area of the DEIS that involves Coast Guard compliance/regulations is that pertaining to the mining vessels. This is addressed in Appendix 4, page 70 item (5). We agree with the requirements of item (5), but would suggest adding the following: "A mining ship must be in compliance with the Coast Guard's Outer Continental Shelf (OCS) regulations, found in 33 CFR Subchapter "N", in order to operate on the U.S. OCS. If the ship is U.S. flagged it must have a valid Coast Guard "Certificate of Inspection" (COI), issued under 46 CFR Subchapter I. If the ship is foreign flagged it must be inspected under 33 CFR 140.101".

Sincerely,



A. D. CUERRERO
Commander, U.S. Coast Guard
Chief, Fishing Vessel and
Offshore Safety Branch
Merchant Vessel Inspection
and Documentation Division
By direction of the Commandant.

Copy: Donna Wieting



1. Ocean Minerals Company license area is in international waters and no operations will be conducted on the U.S. OCS.
2. Agree. Appropriate wording has been added to reflect the comment. See errata sheet and page 70.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
 NATIONAL MARINE FISHERIES SERVICE

National Marine Fisheries Service

Southwest Region
 501 West Ocean Boulevard, Suite 4200
 Long Beach, California 90802-4213
 TEL (310) 980-4000; FAX (310) 980-4018

August 18, 1994 F/SW023:JJN

Mr. Karl Jugel
 National Oceanic and Atmospheric
 Administration
 Ocean Minerals and Energy Division
 SSMC-4, Room 11425
 1305 East-West Highway
 Silver Spring, Maryland 20910

Dear Mr. Jugel:

Thank you for the opportunity to review the draft environmental impact statement (DEIS) on Issuing An Exploratory License to Ocean Minerals Company, U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA, June 1994). The National Marine Fisheries Service (NMFS) offers the following comments for your consideration.

The DEIS was developed to assess the impacts of issuing an exploratory license for deep seabed mining to Ocean Minerals Company (OMCO). The seabed area is known as USA-4 within the Clipperton-Ciarion Fracture Zone and was previously licensed to Kennecott Consortium.

NMFS concurs with NOAA's preferred alternative; to issue, rather than delay or deny issuing, the license in order to provide a better understanding of the environmental impacts and commercial potential of deep seabed mining through a continued analysis of the existing environmental and resource data in area USA-4. The license activities proposed in OMCO's application cannot reasonably be expected to result in a significant effect on the environment, including living marine resources.

If you have any questions regarding these comments please contact Mr. John Naughton at: (808) 973-2939.

Sincerely,

Rodney R. McInnis
 Acting Regional Director

CC:
 F/SW023 - J. Naughton





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Environmental Protection Agency

REGION IV

345 COURTHOUSE STREET, N.E.
ATLANTA, GEORGIA 30365

JUL 22 1994

Karl Jugel
Ocean Minerals and Energy Division
SSMC-4, Room 11425
1305 East-West Highway
Silver Springs, MD 20910

RE: Deep Seabed Mining Draft Environmental Impact Statement
(DEIS) on Issuing an Exploration License to Ocean Minerals
Company

Dear Mr. Jugel:

The U. S. Environmental Protection Agency (EPA) has reviewed the referenced DEIS in accordance with EPA's responsibilities under Section 309 of the Clean Air Act and Section 102(2)(C) of NEPA. The referenced DEIS assesses the impacts of issuing a deep seabed mining exploration license to Ocean Minerals Company (OMCO).

Exploration by OMCO will be authorized by license from the National Oceanic and Atmospheric Administration (NOAA) for ten years in the Pacific Ocean equatorial high seas, in an area situated roughly between the Central America and Hawaii. The exploratory area, known as USA-4, was previously licensed to the Kennecott Consortium. OMCO proposes to monitor the development of exploration and mining system equipment and technologies; use existing mineral deposit data to resolve unknown factors affecting permit area delineation; perform environmental analyses using existing data; and, conduct re-evaluations of commercial viability for development. Because no at-sea activities or on-shore processing or testing are proposed, the DEIS does not assess impacts associated with at-sea mining equipment tests or onshore processing of minerals. At-sea mining system test activities and on-shore processing tests are prohibited until a determination has been made by NOAA as to the need for a supplemental EIS. At that time the OMCO license should be revised to include appropriate terms, conditions, and restrictions on at-sea mining activities.

EPA concurs that the proposed activities have little potential for significant environmental impact. We recognize the need to ensure site tenure and to continue exploration and research activities to develop the environmental data needed for predicting mining impacts and to continue to develop the deep seabed mining industry. However, we note that the general National Pollutant Discharge Elimination System (NPDES) permit, issued in October 5, 1984 (195 FR 39442; Page 43) was valid for

only five years and has expired. If OMCO proposes to conduct at-sea activities, they must contact the Environmental Protection Agency, Region 9, NPDES Permits Issuance Section for a new NPDES Permit.

Based upon our review of the DEIS, we rate this action as category LO, Lack of Objection - Adequate Information. We appreciate the opportunity to review this DEIS. Please send two (2) copies of the Final EIS to Region 4 when the Final EIS is filed with EPA's Office of Federal Activities in Washington. If you have any additional questions, please call John Hamilton (national reviewer) at (404) 347-3776 or Laura Fujii (Region 9 contact, San Francisco) at (415) 744-1579.

Sincerely,
Heinz Mueller

Heinz J. Mueller, Chief
Environmental Policy Section

Agreed. See errata sheet and pages 43 and 44.



SEP - 0 1984

Mr. Karl Jugel
Ocean Minerals and Energy Division
SSMC-4, Room 11425
1305 East-West Highway
Silver Spring, Maryland 20910

Dear Mr. Jugel:

This is in response to Ms. Donna Wieting's letter of June 23 in which she asked that the Mine Safety and Health Administration (MSHA) review and provide comments on the draft environmental impact statement concerning the issuance of a deep seabed mining exploration license to Ocean Minerals Company.

At the present time, MSHA does not have the technical expertise to evaluate this environmental impact statement and, therefore, wishes to decline from making any comments. I do appreciate the Commerce Department providing MSHA with the opportunity to respond.

If I can be of any assistance on other matters, please do not hesitate to contact me.

Sincerely,

J. Davitt McAteer
Assistant Secretary for
Mine Safety and Health

cc: Ms. Donna Wieting
Acting Director
Ecology and Conservation Office
U.S. Department of Commerce
Room 6222, PSP
Washington, D.C. 20230