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California Offshore Survey of Licensees Using Radioactive Material

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Department of Health Services
State of California

Prepared for
U.S. Nuclear Regulatory Commission

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CALIFORNIA OFFSHORE SURVEY
OF LICENSEES USING RADIOACTIVE MATERIAL

TABLE OF CONTENTS

ABSTRACT/CONCLUSION

A radiation safety survey of California offshore radioactive material is reported.

Review of Licensee authorizations for offshore work reveal that all uses are industrial and associated with petroleum production. Typical sealed source uses include radiography, well logging and density gauging. Unsealed sources are used for tracer studies at the completion of drilling operations.

It is concluded from observations during onsite visits to these unusual work environments, that periodic onsite compliance inspections are necessary to assure radiation protection for all concerned.

This report has been prepared to account for work performed under contract with the U. S. Nuclear Regulatory Commission, Fuel Facilities and Materials Branch, Division of Fuel Facilities Materials and Safeguards, Office of Inspection and Enforcement, Washington, D.C. 20555.

1. INTRODUCTION

This report is an account of offshore radioactive material activities and was prepared to provide information about their safe use in the marine environments beyond California's jurisdiction. The report supplies the essential information called for and (a) identifies licensees with radioactive nuclide utilization programs, (b) describes the licensees work stations, (c) identifies and/or describes radionuclide, quantities and their applications, and (d) describes the radiation safety concerns and existing methods for their resolution.

Finally, three offshore sites were inspected in a typical compliance manner and the findings reported. Enclosed photographs of the work stations, during source and equipment use, illustrate conditions and the licensees operations.

2. TYPICAL OFFSHORE RADIOACTIVE MATERIAL USAGES

(a) Well logging - Surface calibration sources typically include Ra-226, Am-241 and Cs-137 in the microcurie to millicurie range. Downhole logging sources are of higher activity, typically in the curie ranges; Cs-137, in the range from 0.1 to 2.0 curies and Am-241 in the range from 3.0 to 20.0 curies. In general, larger sources are used in open hole logging and smaller ones for cased holes.

(b) Industrial radiography - The isotope of choice for most offshore work is Ir-192 with activity in the 25Ci to 100Ci range. In lay-barge work this activity sometimes ranges to 200Ci. Radiographic operations are to check weldment (1) on initial production piping aboard offshore platforms, (2) on replacement or addition to production piping, and (3) on lay pipework. On rare occasion there may be underwater radiography.

(c) Density Gauging - Gauges are used to check the density of cement slurry or mix, prior to transfer downhole. A typical density gauge contains a Cs-137 source with activity ranging from 20 to 100 millicuries.

(d) Tracer Studies - Unsealed source materials have a number of uses. In the case of I-131, 5-10 mCi are injected downhole; (1) to test if water has replaced oil in subsiding formations, (2) for oil field flooding studies and (3) to estimate crude production rates.

Other tracer usages are sands or resins tagged with I-131 and other nuclides such as Sc-46, Ag-110 and Ir-192. These tracers are mixed with certain materials for oil formation treatment and stimulation. Typical quantities used range from 30 to 100 millicuries per treatment job. Still another use is Co-60 wire, threaded to a collar pipe with an activity of 3-10 microcuries per wire. The threading is done on the surface and when placed downhole serves as a depth or location marker.

3. IDENTIFICATION OF LICENSEES IN OFFSHORE WORK

Licensees currently performing activities pursuant to 10 CFR Part 150, in offshore waters, are as listed.

LICENSEE	LICENSEE #	ISSUING AGENCIES
Baker Sand Control	4113-70	State of Calif.
B. J. Hughes	3186-70	State of Calif.
Boothe-Twining, Inc.	2181-56	State of Calif.
Dowell, Inc.	1155-70	State of Calif.
Dresser Atlas	1916-56	State of Calif.
Go Wireline	1513-15	State of Calif.
Halliburton Services	3561-70	State of Calif.
Ideal Mobile X-Ray	3841-56	State of Calif.
Mobile Inspection Services, Inc.	2813-70	State of Calif.
NL McCullough	0121-70	State of Calif.
Schlumberger	0144-56	State of Calif.
Welex	0782-70	State of Calif.
Western Inspection and Testing	4007-15	State of Calif.

It is anticipated that few new licensees will need to be added to this list of offshore radioactive material users in the future.

4. IDENTIFICATION OF WORK LOCATIONS USING RADIOACTIVE MATERIAL

In the past 12 months, the use of radioactive material has occurred on about 16 platforms and 30 exploratory drilling stations. Table 1 identifies these current offshore platforms. The drilling stations are not listed and information on their exact locations (past, present and future) may be obtained from the U. S. Department of Interior, Minerals Management Service, Los Angeles, California. The pace of oil exploration indicates that 25 to 30 new drilling operations may be expected in the next 12 months.

TABLE 1

OFFSHORE PLATFORMS ON THE PACIFIC CA COASTLINE

NEARBY ONSHORE CITIES	OPERATOR	PLATFORM	DISTANCE TO SHORE (MI)
Carpinteria	Phillips	Hogan	3.7
Carpinteria	Phillips	Houchin	5.1
Carpinteria	Texaco	Habitat	9.0
Carpinteria	Sun	Henry	4.4
Carpinteria	Sun	Hillhouse	5.7
Carpinteria	Union	A	5.8
Carpinteria	Union	B	5.7
Carpinteria	Union	C	5.6
Goleta	Exxon	Hondo	5.5
Huntington Beach	Chevron	Edith	8.4
Huntington Beach	Shell	Elly	8.8
Huntington Beach	Shell	Ellen	8.8
Huntington Beach	Shell	Eureka	10.0
Port Hueneme	Chevron	Grace	10.4
Port Hueneme	Union	Gilda	8.5
Port Hueneme	Union	Gina	3.6

Figures 1 and 2 in Appendix A show these platform locations on a map.

5. DESCRIPTION OF OFFSHORE WORK LOCATIONS

As indicated earlier, most radioactive material used offshore are in support of oil and gas exploration and production and not surprisingly, the work stations are similar in design and operation. In its first phase, the work station is either a drill ship, semisubmersible station or a jack-up platform. These stations are designed to provide means for exploratory drilling for oil and gas, with spacing and layout like land stations. Upon completion of drilling, these stations are removed from such locations.

In the second phase, when the location for extraction of oil and gas has been selected, a platform is erected. This platform is essentially square, with dimensions of 180' by 200', with the top deck at 100' or more above the sea floor. There are areas set aside for drilling, heliport, sleeping quarters, galley, power machinery and boat docking. These platforms once erected remain in place over long periods.

The operations staff at these stations may remain aboard for 1-2 week stretches. If close to shore they may remain for the work shift. Contract personnel working under radioactive material licenses, typically spend one to several days aboard if necessary to complete the contracted work. The work force of the operator's crew may be as much as 50 people to as little as two. Licensee work force will typically be 2-3 people.

Another kind of work station is a lay barge, these are flat boats of about 100' wide by 300' long with superstructures at both ends. It is generally anchored in place one mile offshore when laying pipeline. In California, lay barges are infrequently employed because of the proximity of platforms to shore, which is usually less than 10 miles.

6. TRANSPORTATION OF RADIOACTIVE MATERIAL AND USERS

Transportation here deals with movement of both radioactive material and people from land to offshore. The transport of radioactive material is done either by crew boat or helicopter. If by crew boat it may take from a half-hour to 12 hours to arrive at destination while by helicopter it takes about a half-hour or less. All shipments of radioactive materials must comply with the Department of Transportation regulations in approved Type 7A or B packages. Applicable transportation regulations are Department of Transportation in the event of air transport, or by the U. S. Coast Guard in the case of shipment by boat.

7. INSPECTION PROCEDURES AND EQUIPMENT

Regulatory staff should provide notification and obtain prior permission from the operator of the work station before an inspection. This facilitates arrangements to get from land to station, whether by boat or helicopter. This means transport is without charge but subject to space availability and the operator's routine schedule of departure. The trip on a helicopter if contracted costs about $600 an hour and a lesser amount by boat. To conduct an inspection the schedule of licensee radioactive material work should be determined. Additionally, all essential equipment to perform the compliance inspection by the inspection team must be assembled packed and transported to the site.

A checklist of essential inspection equipment is below.

ITEM	PURPOSE/USE
Survey Meter	Compliance Measurements
Dosimeter (Film Badge or TLD)	Protection of Inspector
Pocket Dosimeter	Protection of Inspector
Pocket Alarm Device	Emergency Back-up Use
Hard Hat	Protection of Head
Safety Glasses	Protection of Eyes
Ear Plugs	Protection from Noise
Heavy Jacket/Clothing	Protection from Cold
Safety Shoes	Protection of Feet

All such equipment should be rugged, reliable and compact. The inspection team must be in good physical health as some work stations may for example, require them to use a self-contained breathing apparatus in the event of H_2S gas leaks and station evacuation.

As part of this contract study, three offshore work locations were inspected. These were Platforms Edith, Holly and JFP-3, and their results follow.

8. PLATFORM EDITH INSPECTION

On April 13, 1983, Platform Edith under construction by Kaiser Offshore Division for Chevron, located 8 miles offshore from Huntington Beach, California was visited. Prior arrangements were made for authorization and for transport from land to work station. The licensee, Mobile Inspection Services, Inc. of Santa Fe Springs, California provided information of their work schedules so that this was an announced inspection.

Arriving by helicopter that day at 6:00 p.m., the inspectors met with the Superintendent of Kaiser, at which time the inspectors informed the Superintendent of the reason for this inspection. The inspectors solicited and received information relative to Kaiser's policy and procedures governing radiographic operation at this station. It was stated that such work would only be allowed at night after the construction crew had left (i.e. between 8:00 p.m. and 6:00 a.m.). Also that Kaiser night employees, three people, were required to inform the licensee by intercom or hand-radio whenever they departed from the operator's room. Shortly thereafter at 6:30 p.m., the licensee arrived. The crew was made up to two radiographers and a film developer-technician.

They informed the inspector of their work plan, which was to do radiographs of production piping at various areas of the platform. There would always be two people in attendance when shooting. To do the work they brought an Automation Industries, Model 520 projector, using a 48Ci Ir-192 sealed source.

At about 10:00 p.m., the licensee began radiography. It was observed that the immediate areas were posted with "CAUTION RADIATION AREA" signs, including the stairways leading up or down from the shooting deck. See Photos #1 and #3 appended, taken during this visit. To cut down on unnecessary radiation, a homemade Pb collimator was used. Approximately 18 weldments were to be examined. This would require about 50 exposures.

Radiation measurements by the inspector, just prior to shooting, indicated 68 mr/hr at contact and 29 mr/hr at 6 inches away from the radiographic projector. During the period when this 48Ci source was cranked out and positioned in the collimator, it read 5-7 mr/hr at the crank handle position located 21 feet away and 2 mr/hr at 50 feet away. During a rest interval, examination of the utilization logs for work done thus far at this work station, indicated that the radiographer and his assistant received 15mr dose per day on average.

For radiation safety purposes, the licensee supplied this radiographic operation and his people with two radiation survey meters, radiation film badges, pocket dosimeters, a lead collimator, warning signs and rope. At the completion of our inspection, a closing conference was held and the licensee was informed of discrepancies noted. These were: (1) no evidence that a U. S. Nuclear Regulatory Commission reciprocity license had been issued, (2) no copy of shipping papers during the transport of radioactive materials by air, and (3) no copy of the licensee's radiographic, operating and emergency manual.

When morning arrived, the inspectors left by helicopter for Long Beach, California airport.

9. PLATFORM HOLLY INSPECTION

On September 15, 1983 an inspection was conducted on Platform Holly, a production platform 8 miles off Goleta, California operated by ARCO Oil Corporation. The inspectors were taken by crew boat and arrived at this station at 11:00 p.m. Radiography was planned for after 12:00 midnight. Prior to this inspection, authorization for inspection was obtained via the platform superintendent and information was gathered on the schedule for radiography from Ideal Mobile Inspection Services, the licensee.

Upon arrival, the inspectors met with the ARCO Assistant Superintendent, the two shift operators and the three-man crew of the licensee. About the time of the inspector's arrival, the production platform suffered compressor equipment malfunction. Soon thereafter, maintenance people from ARCO and equipment contractors began to arrive. The licensee did not perform any radiography during this period. Inquiry of the licensee on station at this time, indicated that radiographs of sections of piping at the welders station, at the platform's top deck were to be done. A 58Ci Ir-192 source in a Gulf Nuclear, Model 20V projector was on hand. The source was kept in a portable doghouse (darkroom) for safe storage.

Radiation protection equipment included a film badge and pocket dosimeter for each of the three individuals, two survey meters, Gamma Industries Model 252B and Victoreen Model 492 both calibrated 9/19/83, a commercial tungsten 60° solid angle beam collimator, rope and "CAUTION-RADIATION AREA" signs with the wording "KEEP OUT".

A survey conducted by the inspectors during radiography operations on the top deck, after the compressor was repaired and the crew left, indicated the following results (source inside the tungsten collimator): (a) in the operator's room, 0.1 mr/hr; (b) on the deck just below the shooting area, 1 mr/hr; and (c) on the top or shooting deck at 50 feet away, read up to 3 mr/hr. With the source stored in the projector, the maximum read 50 mr/hr at contact. See Photos #3, #4 and #5 taken during this visit.

A check of utilization logs for work done at this location, indicated that exposures ranged from 5 to 15 mr/day for each member of the radiographic crew with an average of 200 mr/month at this location.

Observation during this inspection disclosed the following: (1) it was difficult to restrict the operator's staff to the operations room or designated area, (2) communication to inform the radiography team was only effective initially and broke down when frequent movement occurred, and (3) the radiography survey procedure was not appropriate in that no survey was performed at the front area of the projector after the source was cranked in.

A closing conference was held with the lead radiography and findings were reviewed. The licensee representative was instructed to conduct adequate surveys at the completion of each exposure and to obtain complete and up-to-date copies of their license.

10. JACK-UP PLATFORM JFP-3 INSPECTION

Prior arrangements were made with Schlumberger to conduct this inspection and for them to inform the platform operator of this inspection. During this period drilling schedule changes necessitated last minute cancellation of two planned inspections.

The licensee informed this inspector that they would ship their well logging tools and sealed sources a week in advance but the logging crew would not depart until notified, 24 to 48 hours prior to the schedule. The sources were to be contained in a strong metal container called a "gang box".

On October 11, 1983, an inspection was finally underway on the Shell Oil Jack-Up Platform, located 4 miles offshore from Ventura, California. The inspector was taken by crew boat that morning, accompanied by a Schlumberger representative. The trip took approximately 1 hour, leaving from Port Hueneme, California. The inspector

was greeted by a representative of Shell and arrangements were made to stay overnight. The three members of Schlumberger logging crew, an engineer and two logging operators were already on this platform.

A check of logging schedules indicated electrical logging would take place over the next 6-10 hours before nuclear logging would begin. The logging would be from bottom at 12,200 feet to surface. During this lull, the shipping container was examined. Individually sealed sources had been placed in the steel shipping box (3' x 3' x 3') and padlocked (see Photo #6). The individual shielded container labels were then checked for kind and amount of radioactive material and their function. These are listed as follows:

ISOTOPE	AMOUNT	IDENTIFICATION & USE
		Schlumberger
Thorium Ore	1.7 microcuries	GSR-U, wraparound blanket for calibration of tool at surface
Cs-137/Ra-226	1mc/0.1mc respectively	FST-136, a box like device for surface logging tool calibration
Cs-137	1.5Ci	GSRJ, for downhole density measurement
Am-241	0.5Ci	NSR-GB, for at surface tool calibration
Am-241	16.0Ci	NSR-FA, for downhole porosity measurements and contained in a DOT approved Type B container

Radiation measurements were conducted by the inspector with all the sources contained in the metal source box; the contact reading was 40 mr/hr maximum and 2.5 mr/hr at 1 meter away. Radiation fields around the box are expected to be slightly higher than indicated since no neutron measurements were made.

The logging crew was checked for radiation protection equipment which included TLD chips to monitor for both gamma and neutron exposures, handling tongs and tightening wrenches, but no survey meter. It was Schlumberger's position that survey meters were not needed but would be available as required. Interview with the logging engineer indicated he was quite capable. He has a total of 14 weeks formal training with 5 years of experience. The two operators did not receive such formal training, other than video and shop instructions, but did have experience. They additionally work under the close supervision of the logging engineer whenever sources were handled.

Late that evening the logging tools having been previously calibrated and already surfaced, were loaded with the large Am-241 and Cs-137 sealed sources. In this source loading procedure, the engineer removed the source from the shipping container and carried it up to the drilling deck. With the logging tool which is about 25' long in a vertical position and using a 6' handling tong, the engineer removed the 1.5Ci Cs-137 sealed source and placed it in a recess of the logging tool (see Photo #7). The operator standing close, using a 3' long wrench, threads two bolts in place to secure the source. The handling event in which both the engineer and operator are a few feet away, takes about 1 minute. Thereafter the logging tool is positioned down in the borehole and the 16Ci Am-241 source is again transferred by identical remote handling techniques (see Photo #8) into a hinge component; the operator similarly secures the bolts with his wrench (see Photo #9). The tool is then placed down the borehole. Time for this procedure at close proximity is about half a minute. Observation and calculation indicates that the exposures to the engineer and operator ranged between 10-15 mrems. These exposures appear to be equally divided between fast neutrons and gamma rays.

11. SUMMARY

The knowledge gained in carrying out this study suggest that the inspection of offshore radioactive material operations, needs to be done in spite of difficulty and expense. Also, present offshore radioactive material applications are almost exclusively associated with the oil industry. Growth in this offshore use indicates a steady but modest increase in the use of radioactive material for the foreseeable future.

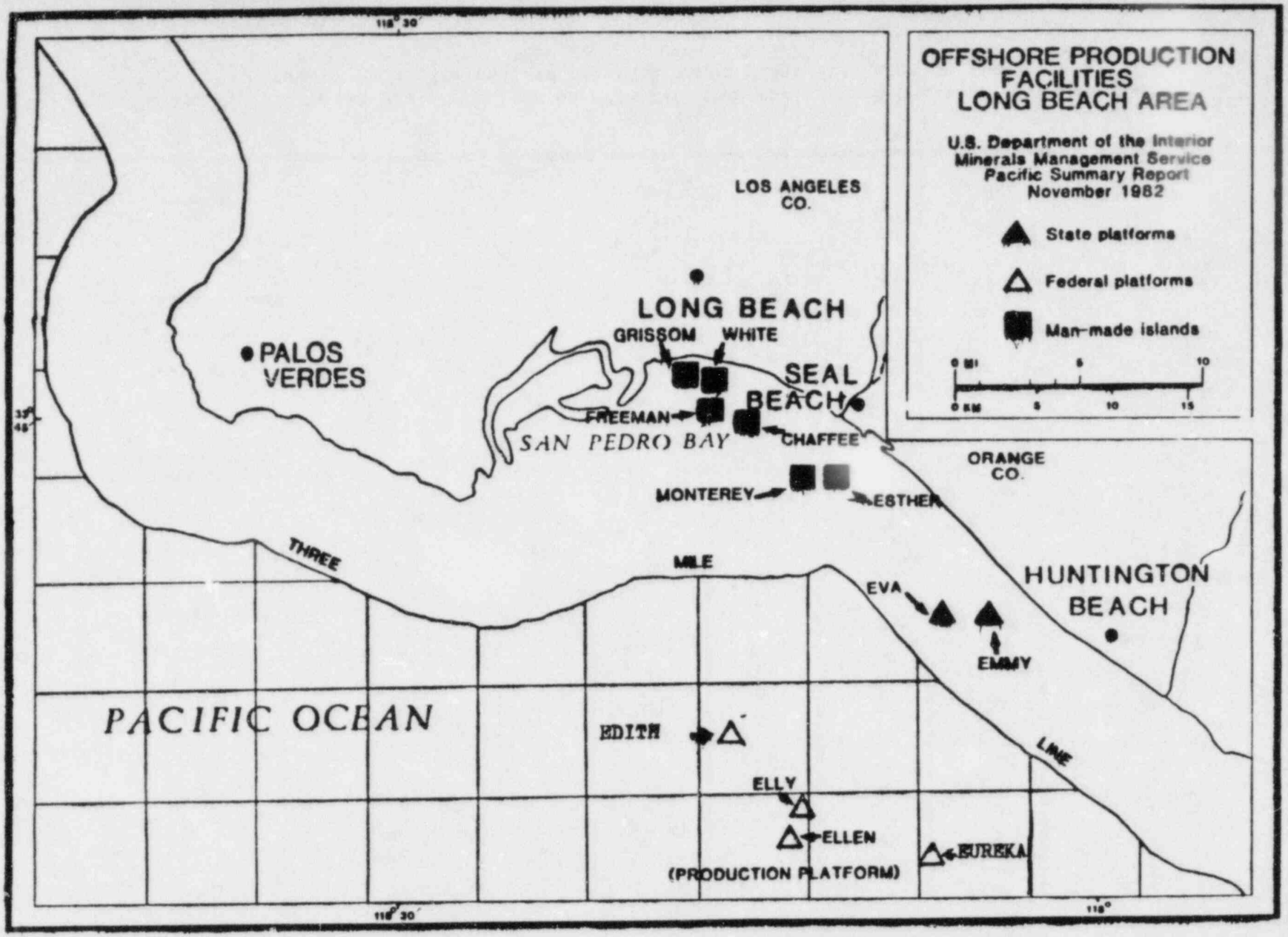

Figure 1. Permanent platforms located offshore from Orange and Los Angeles Counties Coastline where use of Radioactive Material takes place from time to time.

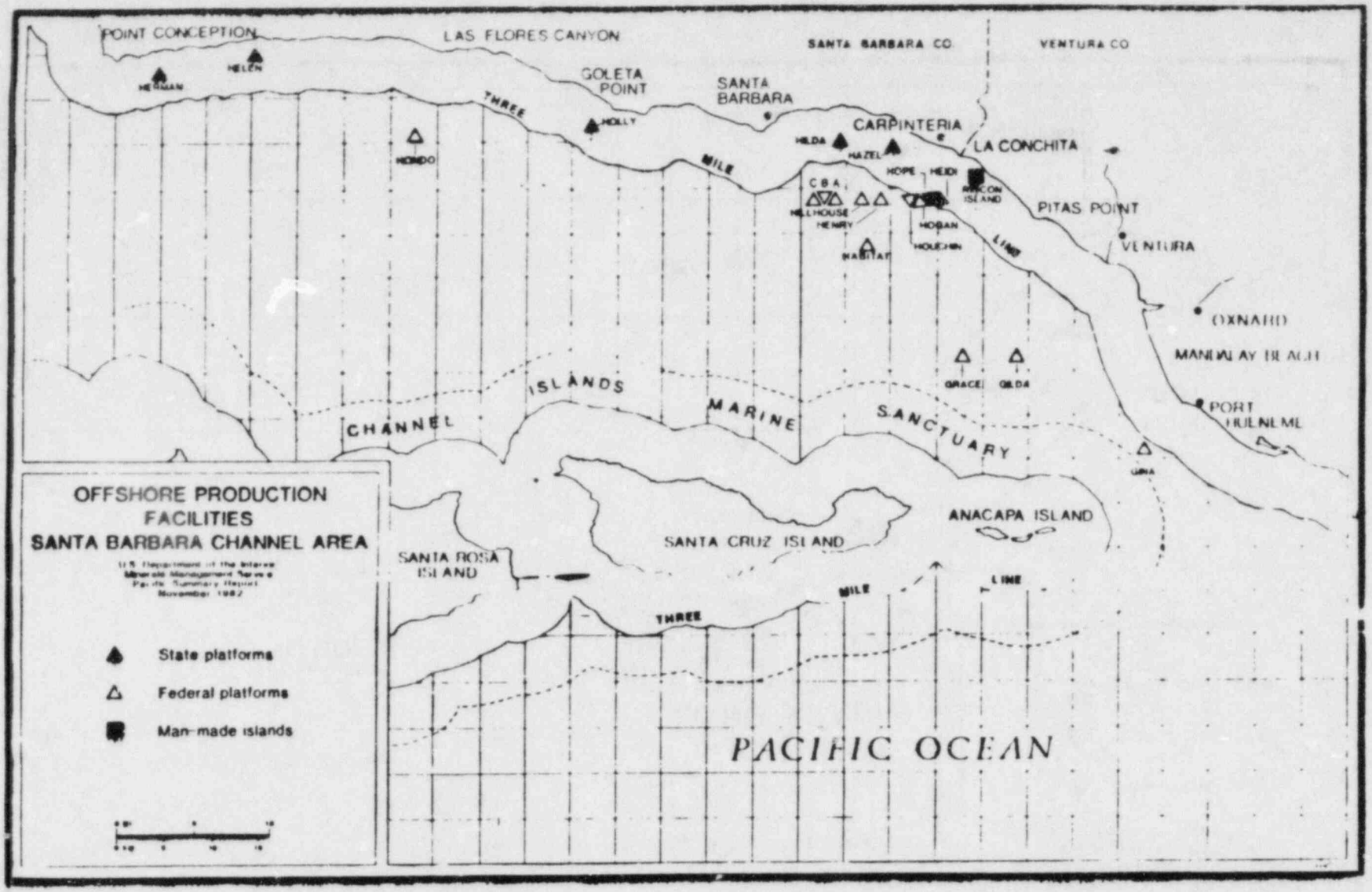

Figure 2. Permanent platforms located offshore from Ventura and Santa Barbara Counties, where use of Radioactive Material takes place from time to time.

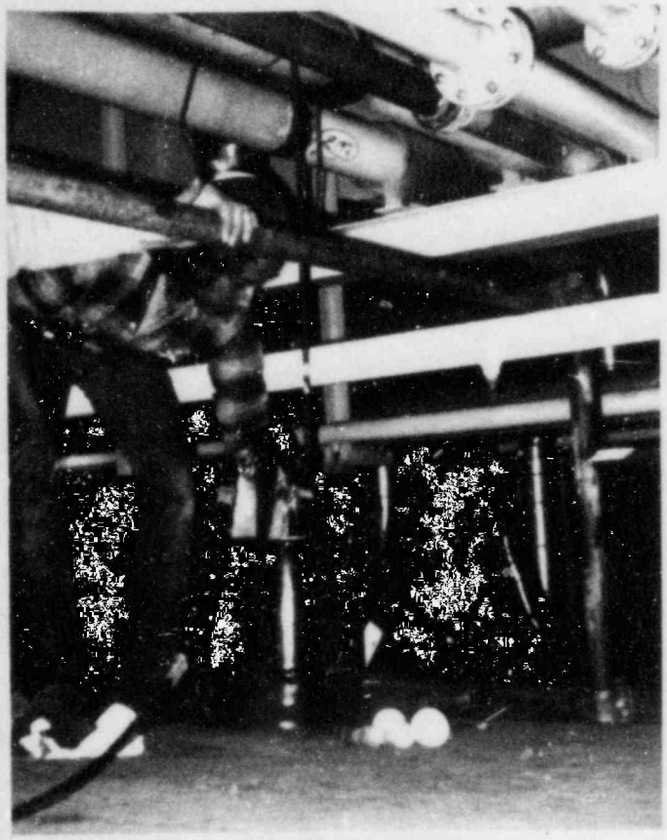

PHOTO #1. - PLATFORM EDITH
Pipe radiograph to take place.

PHOTO #2. - PLATFORM EDITH
Doghouse - A place to store source off-shore.

PHOTO #3. - PLATFORM HOLLY
Welded pipe section to be exposed.

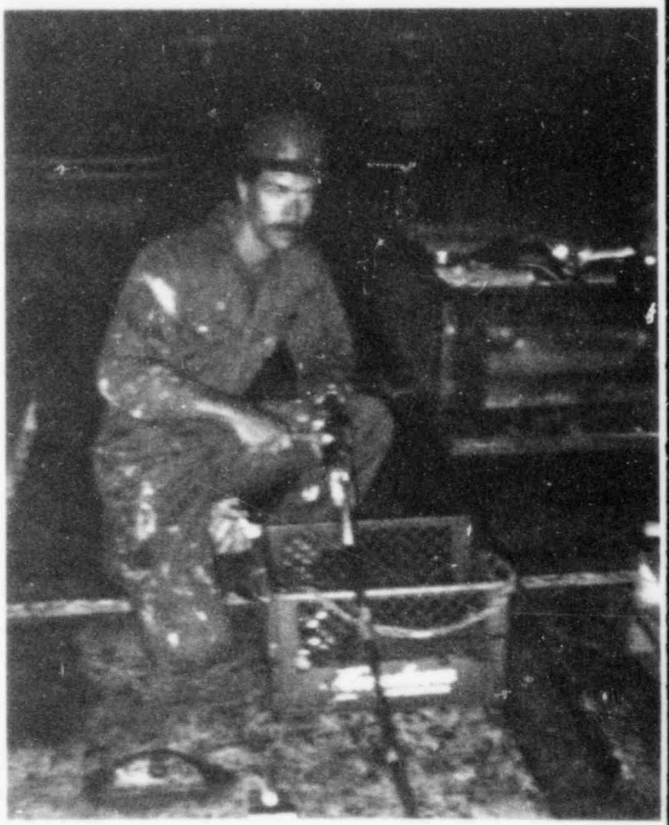

PHOTO #4. - PLATFORM HOLL
Crank-out of source from projector.

PHOTO #5. - PLATFORM HOLLY
Survey of Projecter after an exposure.

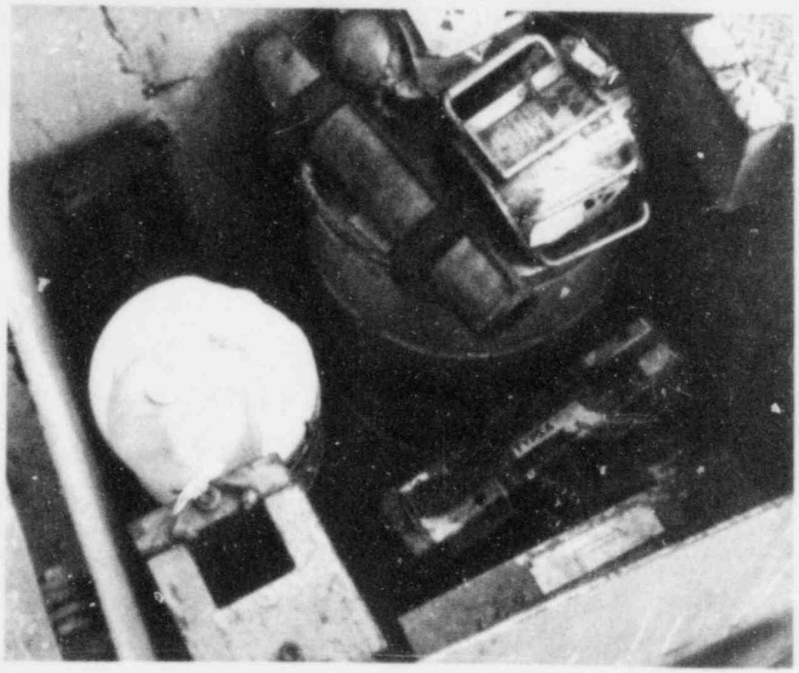

PHOTO #6 - PLATFORM JFP-3
Individual shipping containers in a 3'x3' steel gang box.

PHOTO #7 - PLATFORM JFP-3
Engineer inserts a 2Ci Cs137 in a logging tool.

PHOTO #8 PLATFORM JFP-3
Engineer inserts a 16Ci Am241 Be in a logging tool.

PHOTO #9 - PLATFORM JFP - 3
Operator secures source in logging tool using a wrench.

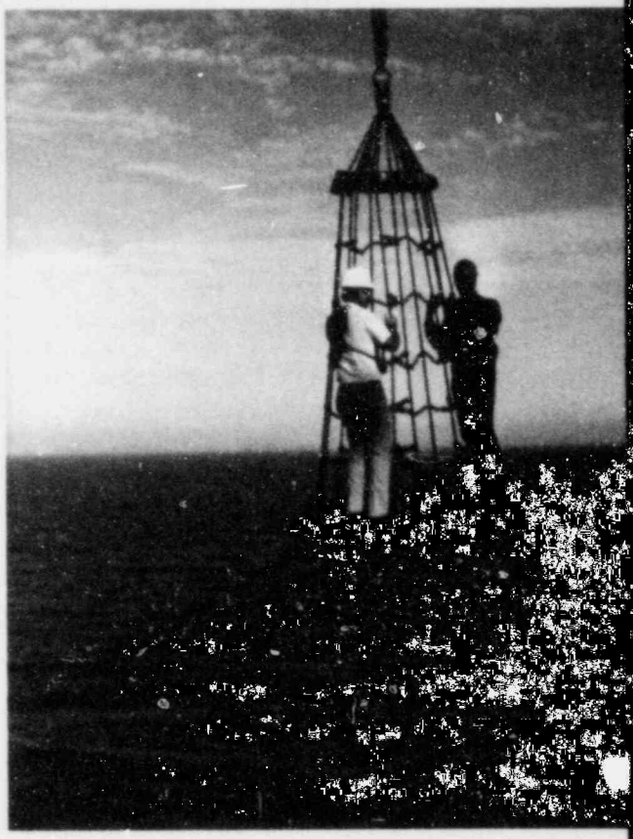

PHOTO #10. - PLATFORM JFP - 3
Mode of debarkation to crewboat from deck platform.

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13. ABSTRACT (200 words or less)

This report is an account of offshore radioactive material activities and was prepared to provide information about their safe use in the marine environments beyond California's jurisdiction. The report supplies the essential information called for and (a) identifies licensees with radioactive nuclide utilization programs, (b) describes the licensees' work stations, (c) identifies and/or describes radionuclide, quantities and their applications, and (d) describes the radiation safety concerns and existing methods for their resolution. Finally, three offshore sites were inspected in a typical compliance manner and the findings reported. Enclosed photographs of the work stations, during source and equipment use, illustrate conditions and the licensees' operations. It is concluded from observations during onsite visits to these unusual work environments, that periodic onsite compliance inspections are necessary to assure radiation protection for all concerned.

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