

OCEAN DISPOSAL INFORMATION ON SITES IN THE PACIFIC OCEAN¹

Site P 1 - Farallon Islands (AEC Licensees and Non-AEC Licensees)

The number of containers which were disposed at the site at a depth at or greater than 490 fathoms has been estimated to be 47,500. The radiological activity in the containers at time of packaging has been estimated to be 14,500 curies and consisting of byproduct material, source material, and special nuclear material. The weight of the source material was about 557 pounds and the weight of the special nuclear material was about 1.2 kilograms. The disposals took place from 1946 to 1970. The organizations performing the disposals were Nuclear Engineering Company, Ocean Transport Company, Chevron Research, the U.S. Naval Radiation Development Laboratory, and the AEC. Based on data available, all the containers were disposed within the area bound by the following coordinates:

37° 12'N, 123° 19'W; 37° 12'N, 123° 55'W; (Approximate)

37° 41'N, 123° 19'W; 37° 41'N, 123° 55'W; (Approximate)

Site P 2 - Hawaiian Islands (AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 1890 fathoms has been estimated to be 39. The radiological activity in the containers at time of packaging has been estimated to be 0.09 curies of byproduct material. The disposals took place in 1959 and 1960. The organization performing the disposals was the University of Hawaii. Based on data available, the containers were disposed at the following coordinates:

21° 28'N, 157° 25'W

It should be noted that according to an August 14, 1980 memorandum from NRC Region V an additional number of disposals took place in the sixties. We do not know the number of containers or the activities at this time.

Site P 3 - Midway Islands (Non-AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 3000 fathoms has been estimated to be 7. The radiological activity in the containers at time of packaging has been estimated to be 14 curies of byproduct material. The disposal took place in 1960. The organization performing the disposal was the Military Sea Transportation Service. Based on data available, the containers were disposed at the following coordinates:

34° 58'N, 174° 52'W

Site P 4 - Santa Cruz Basin (Non-AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 1000 fathoms has been estimated to be 3114. The radiological activity in the containers at time of packaging has been estimated to be 108 curies and consisting of byproduct and source material. The weight of the source material was about 13 pounds. The disposals took place from 1946 to 1962. The organizations performing the disposals were Pneumodynamics and the AEC. Based on data available, all the containers were disposed within the area bound by the following coordinates:

33° 30'N, 119° 30'W; 33° 40'N, 119° 45'W; (Approximate)

33° 45'N, 119° 30'W; 33° 50'N, 119° 45'W; (Approximate)

Site P 5 (AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 1800 fathoms has been estimated to be not more than 26. The radiological activity in the containers at time of packaging has been estimated to be not more than 0.95 curies of byproduct material. The disposal took place between 1955 and 1958. The organization performing the disposal was Chevron Research. Based on data available, the containers were disposed at the following coordinates:

42° 12'N, 129° 31'W

Site P 6 (AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 1600 fathoms has been estimated to be 4. The radiological activity in the containers at time of packaging has been estimated to be 0.08 curies of byproduct material. The disposal took place in 1960. The organization performing the disposal was Chevron Research. Based on data available, the containers were disposed at the following coordinates:

43° 52'N, 127° 44'W

Site P 7 (AEC Licensee)

The number of containers which were disposed at the site is 4. AEC regulatory staff sea disposal logs give the depth to be 2240 fathoms; however, coast and geodetic charts indicate the depth to be about 550 fathoms. The radiological activity in the containers at time of packaging has been estimated to be 0.08 Curies of byproduct material. The disposal took place in 1960. The organization performing the disposal was Chevron Research. Based on data available, the containers were disposed at the following coordinates:

42° 04'N, 125° 01'W

Site P 8 (AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 2000 fathoms has been estimated to be not more than 26. The radiological activity in the containers at time of packaging has been estimated to be not more than 0.95 curies of byproduct material. The disposal took place between 1955 and 1958. The organization performing the disposals was Chevron Research. Based on data available, the containers were disposed at the following coordinates:

30° 25'N, 139° 10'W and 30° 43'N, 139° 00'W

Site P 9 (AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 1900 fathoms has been estimated to be not more than 29. The radiological activity in the containers at time of packaging has been estimated to be not more than 1.1 curies of byproduct material. The disposals took place between 1955 and 1960. The organization performing the disposals was Chevron Research. Based on data available, the containers were disposed at the following coordinates:

28° 56'N, 134° 42'W and 28° 38'N, 135° 18'W

Site P 10 (AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 2000 fathoms has been estimated to be 4415. The radiological activity in the containers at time of packaging has been estimated to be 34 curies and consisting of byproduct material, source material, and special nuclear material. The weight of the source material was about 1100 pounds and the weight of the special nuclear material was about 10 grams. The disposals took place in 1960 and 1961. The organizations performing the disposals were Coastwise Marine Disposal Corporation and Isotopes Specialties Company. Based on data available, the containers were disposed at the following coordinates:

32° 00'N, 121° 30'W

Site P 11 (AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 1000 fathoms has been estimated to be 29. The radiological activity in the containers at time of packaging has been estimated to be 0.22 curies of byproduct material and source material. The weight of the source material was one pound. The disposal took place in 1960. The organization performing the disposal was American Mail Line. Based on data available, the containers were disposed at the following coordinates:

40° 07'N, 135° 24'W

Site P 12 (AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 1800 fathoms has been estimated to be 197. The radiological activity in the containers at time of packaging has been estimated to be 96 curies of byproduct material and source material. The weight of the source material was about 145 pounds. The disposals took place between 1958 and 1966. The organization performing the disposals was American Mail Line. Based on data available, the containers were disposed within the area bound by the following coordinates:

50° 36'N, 133° 38'W; 50° 50'N, 139° 27'W;

51° 30'N, 136° 31'W (Approximate)

Site P 13 (AEC Licensee)

The number of containers which were disposed at the site at a depth at or greater than 1800 fathoms has been estimated to be 163. The radiological activity in the containers at time of packaging has been estimated to be 28 curies of byproduct material and source material. The weight of the source material was about 130 pounds. The disposals took place between 1962 and 1969. The organization performing the disposals was American Mail Line. Based on data available, all the containers were disposal within the area bound by the following coordinates:

51° 46'N, 139° 41'W; 52° 08'N, 141° 09'W;

54° 10'N, 141° 00'W (Approximate)

1/Source of Information

1. AEC regulatory staff logs based on information supplied by AEC licensees.
2. AEC letter, H. F. Soule to Robert P. Brown dated April 1, 1969 which forwarded tables showing sea disposal operations by the AEC and its licensees.
3. Statement by A. R. Luedecke, General Manager, U.S. Atomic Energy Commission, before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy of the Congress, dated July 29, 1959.
4. EPA Fact Sheet, "Radioactive Waste Dumping Off the Coast of California" dated August 14, 1980.
5. U.S. Coast and Geodetic Survey Charts, numbers 5002 (dated 1960), 5052 (dated 1960), 1007 (dated 1959), and 8500 (dated 1957), 1000 (dated 1959), and 1207 (dated 1953).
6. Memorandum from H. Book, NRC Region V to K. Dragonette, Subject: Waste Disposal at Sea by the University of Hawaii, Honolulu, License No. 53-00017-04 (terminated).

OCEAN DISPOSAL INFORMATION ON SITES IN THE ATLANTIC OCEAN^{1,2}

Site A 1 - Massachusetts Bay (AEC Licensee)

The number of containers which were disposed at the site at a depth of about 50 fathoms has been estimated to be 4,008. The radiological activity in the containers at time of packaging has been estimated to be 2,440 curies of byproduct material. The disposals took place between 1952 and 1959. The organization performing the disposals was Crossroads Marine Disposal Corporation. The containers were disposed at the following coordinates:

42°25.5'N, 70°35'W

It should be noted that the license was amended in 1959 to require disposal at a minimum depth of 1,000 fathoms in the Atlantic bounded by 41°38' and 41°28' north and 65°28' and 65°45' West or within a 5 mile radius circle from coordinates 38°30'N, 72°00'W. We have no record of this licensee actually performing any disposals at these newer locations.

Site A 2 (AEC Licensee)

The number of containers which were disposed at the site at a depth greater than 1,000 fathoms has been estimated to be 834. The radiological activity in the containers at time of packaging has been estimated to be 85 curies of byproduct material. The disposals took place between 1949 and 1967. The organization performing the disposal was the National Institutes of Health. The containers were disposed within the area bound by the following coordinates:

36°53'N, 73°58'W; 36°53'N, 74°26.5'W; (approximate)

36°59'N, 73°58'W; 36°59'N, 74°26.5'W (approximate)

It should be noted that one accidental release occurred next to this site. Nine NIH containers containing about 2 curies of byproduct material were disposed in 1962 at a depth of about 230 fathoms at the following coordinates:

37°00'N, 74°37'W

Site A 3/A 4 (Non-AEC Licensee)

The number of containers which were disposed at the site at a depth greater than 1,000 fathoms has been estimated to be 28,801. One of the containers was the Submarine Seawolf Reactor Shell. The radiological activity in the containers at time of packaging was 76,500 curies of byproduct material (33,000 curies associated with reactor shell). The disposals took place from 1951 to 1960 (reactor shell disposed in 1959). The organization performing the disposals was the AEC. The containers were disposed at two locations as follows:

38°30'N, 72°06'W and 37°50'N, 70°35'W

The reactor shell was disposed at the following coordinates:

38°30'N, 72°06'W.

Site A 5 (AEC Licensee)

The number of containers which were disposed at the site at a depth greater than 1,000 fathoms has been estimated to be not greater than 119. There was one exception where a disposal took place in 500 fathoms. In addition, some of the material may have not been containerized and may have been disposed as liquids or readily dispersible solids. The radiological activity at time of packaging has been estimated to be not greater than 0.66 curies of byproduct material. The disposals took place from 1955 to 1962. The organizations performing the disposals were Socony Mobile Oil Company and Atlantic Refining Company. The containers were disposed within the area bounded by the following coordinates:

33°55'N, 75°11'W (approximate)

32°50'N, 75°20'W; 29°38'N, 77°27'W;

31°27'N, 76°48'W; 31°53'N, 76°28'W

Site A 6 (AEC Licensee)

The material disposed was unpackaged and was probably liquids or readily dispersible solids. The depth was about 10 fathoms. The radiological activity of the disposed material has been estimated to be 0.3 curies of byproduct material. The disposals took place from 1955 to 1961. The organization performing the disposals was the U.S. Fish and Wildlife Service. The disposals were at the following coordinates:

34°32'N, 76°40'W

Site A 7 thru A 11 (Non-AEC Licensee)

The number of containers which were disposed at the site at a depth greater than 2,000 fathoms has been estimated to be 228. The radiological activity in the containers at time of packaging was reported to be 456 curies of byproduct material; however, our sea disposal logs have a caption that states "Highly Unlikely." The disposals took place between 1959 and 1960. The organization performing the disposals was the Military Sea Transportation Service. The containers were disposed at the following coordinates:

36°20'N, 45°00'W; 37°07'N, 45°00'W;

38°41'N, 45°00'W; 42°07'N, 45°00'W; 43°49'N, 45°00'W

Site A 12 - Sapelo Island (AEC Licensee)

Radioactive liquids were disposed at this site between 1955 and 1961 in less than 6 fathoms. The radiological activity has been estimated to be 0.005 curies of byproduct material. The organization performing the disposals was the University of Georgia. The disposals were made off of Sapelo Island, Georgia.

1/ Source of Information

1. AEC regulatory staff logs based on information supplied by AEC licensees.
2. AEC letter, H. F. Soule to Robert P. Brown dated April 1, 1969 which forwarded tables showing sea disposal operations by the AEC and its licensees.
3. Statement by A. R. Luedecke, General Manager, U.S. Atomic Energy Commission, before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy of the Congress, dated July 29, 1959.
4. EPA Fact Sheet, "Radioactive Waste Dumping Off the Coast of California" dated August 14, 1980.
5. U.S. Coast and Geodetic Survey Charts, numbers 5002 (dated 1960), 5052 (dated 1960), 1007 (dated 1959), and 8500 (dated 1957), 1000 (dated 1959), and 1207 (dated 1953).
6. U.S. Navy Hydrographic Office Chart 1411, dated 1960.

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NOTE: The U.S.S. Thresher was lost in the Atlantic in April 1963 and the U.S.S. Scorpion was lost in the Atlantic in May 1968. Both submarines were nuclear powered. Information on specifics such as locations, depths, and radionuclide inventories are not in the NRC files.

OCEAN DISPOSAL INFORMATION ON SITES IN GULF OF MEXICO¹

Site GM 1 (Non-AEC Licensee)

One container was disposed at the site at a depth greater than 1,000 fathoms. This occurred before 1958. The radiological activity in the container at time of packaging has been estimated to be 10 curies of byproduct material. The organization performing the disposal was Magnolia Petroleum. The container was disposed at the following coordinates:

27°14'N, 89°33'W

Site GM 2 (AEC Licensee)

The number of containers which were disposed at the site at a depth greater than 1,700 fathoms has been estimated to be not more than 78. The radiological activity in the containers at time of packaging has been estimated to be not more than 0.002 curies of byproduct material. The disposal took place between 1955 and 1957. The organization performing the disposal was Socony Mobile Oil Company. The containers were disposed at the following coordinates:

25°40'N, 85°17'W

^{1/}Source of Information

1. AEC regulatory staff logs based on information supplied by AEC licensees.
2. AEC letter, H. F. Soule to Robert P. Brown dated April 1, 1969 which forwarded tables showing sea disposal operations by the AEC and its licensees.
3. Statement by A. R. Luedecke, General Manager, U.S. Atomic Energy Commission, before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy of the Congress, dated July 29, 1959.
4. EPA Fact Sheet, "Radioactive Waste Dumping Off the Coast of California" dated August 14, 1980.
5. U.S. Coast and Geodetic Survey Charts, numbers 5002 (dated 1960), 5052 (dated 1960), 1007 (dated 1959), and 8500 (dated 1957), 1000 (dated 1959), and 1207 (dated 1953).

U.S. AEC AUTHORIZED LLW DISPOSAL SITES IN PACIFIC OCEAN¹

<u>AEC Licensed Sites</u>	<u>Central Coordinates (Approximate)</u>	<u>Approximate Nautical Miles Off U.S. Land Points</u>
P 1 (Farallon Islands)	37° 27'N - 123° 37'W	50 Miles W of San Francisco, California
P 2 (Hawaiian Islands)	21° 28'N - 157° 25'W	20 Miles NE of Honolulu, Hawaii
P 3 (Midway Islands)	34° 58'N - 174° 52'W	300 Miles N of Midway Islands
P 4 (Santa Cruz Basin)	33° 40'N - 119° 35'W	35 Miles SW of Port Hueneme, California (Port Hueneme is NW of Los Angeles, California)
P 5	42° 12'N - 129° 31'W	230 Miles W of Oregon/California State Line at Coast
P 6	43° 52'N - 127° 44'W	190 Miles NW of Oregon/California State Line at Coast
P 7	42° 04'N - 125° 01'W	35 miles W of Oregon/California State Line at Coast
P 8	30° 34'N - 139° 05'W	1000 Miles WSW of San Francisco, California
P 9	28° 47'N - 135° 00'W	800 Miles SW of San Francisco, California
P 10	32° 00'N - 121° 30'W	200 Miles W of San Diego, California
P 11	40° 07'N - 135° 24'W	800 Miles WNW of San Francisco, California
P 12	50° 56'N - 136° 03'W	Greater than 350 Miles NW of Cape Flattery, Washington
P 13	52° 25'N - 140° 12'W	Greater than 350 Miles NW of Cape Flattery, Washington

¹/Source of Information

1. AEC regulatory staff logs based on information supplied by AEC licensees.
2. AEC letter, H. F. Soule to Robert P. Brown dated April 1, 1969 which forwarded tables showing sea disposal operations by the AEC and its licensees.
3. Statement by A. R. Luedecke, General Manager, U.S. Atomic Energy Commission, before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy of the Congress, dated July 29, 1959.
4. EPA Fact Sheet, "Radioactive Waste Dumping Off the Coast of California" dated August 14, 1980.

U.S. AEC AUTHORIZED LLW DISPOSAL
SITES IN GULF OF MEXICO¹

<u>AEC/AEC Licensee Sites</u>	<u>Central Coordinates</u>	<u>Nautical Miles Off U.S. Land Points</u>
GM 1	27°14'N, 89°33'W	170 miles S of New Orleans, Louisiana
GM 2	25°40'N, 85°17'W	250 miles S of Appalachicola, Florida

1/ Source of Information

1. AEC regulatory staff logs based on information supplied by AEC licensees.
2. AEC letter, H. F. Soule to Robert P. Brown dated April 1, 1969 which forwarded tables showing sea disposal operations by the AEC and its licensees.
3. Statement by A. R. Luedecke, General Manager, U.S. Atomic Energy Commission, before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy of the Congress, dated July 29, 1959.
4. EPA Fact Sheet, "Radioactive Waste Dumping Off the Coast of California" dated August 14, 1980.

USE OF RADIOACTIVE MATERIAL UNDER
AEC/NRC LICENSE IN THE OCEAN

Plutonium for Use in Radioisotope Thermal Generators

From 1967 to 1978, the U. S. Navy conducted underwater tests of plutonium-238 fuel forms used in operational and proposed radioisotope thermal generators (RTG) to evaluate the effects of sea water on the fuel. The tests were conducted in approximately 50 feet of water off San Clemente Island which is approximately 85 miles from San Diego, California. During the tests, a small amount (approximately 0.05 grams) of plutonium-238 was lost from the fuel and dispersed in the sea water. The concentration of plutonium-238 found in sediment, sea water, and algae in the vicinity of the test area was in the order of a few femtocuries per gram for solids and a few femtocuries per liter for the plutonium-238 dissolved in water. The maximum permissible concentrations for soluble and insoluble plutonium-238 are 5,000,000 femtocuries per liter and 30,000 femtocuries per gram, respectively.

Depleted Uranium as Bullets and Weapon Projectiles

Since 1974, the U. S. Navy has conducted a program for testing of depleted uranium alloy penetrators over the Pacific Missile Range. The testing resulted in dispersal of the depleted uranium over an approximate 6 square mile area off San Nicolas Island where the minimum water depth is 60 feet. The target area is located off the California coast roughly bounded by 118° to 122° west longitude and 32° to 35° north latitude.

In 1976, the Navy was authorized to fire approximately 25,000 rounds of depleted uranium ammunition over the Atlantic Fleet Weapons Range and off the United States east coast. The Alpha and Bravo Ranges of the Atlantic Fleet Weapons Range were used. The Alpha Range is northeast of Puerto Rico and the Bravo Range is south-southwest of Puerto Rico. The areas off the United States east coast are bounded by longitude 75° 30', 74° 0', and latitude 30° 30', 35° 20' and longitude 80° 50', 78° 40' and latitude 31° 30', 28° 40'.

Strontium-90 Radioisotope Thermal Generators

The Navy has 6 strontium-90 powered radioisotope thermal generators implanted in ocean waters. The generators are used as power sources for electrical equipment. The strontium-90 is in an insoluble form encapsulated in high integrity materials. The intent by the Navy is to recover the generators after their useful life although that may not be possible in all cases.

One generator containing 23,600 curies of strontium-90 was implanted in November, 1970 off the Bermuda coast at 32° 02' N, 64° 15' W. Three generators, each containing about 6,500 curies of strontium-90, are implanted off the coast of Midway Island at 28° 42' N, 177° 37' W, 28° 39' N, 177° 38' W; and 28° 40' N, 177° 35' W. There are 2 classified devices implanted in the Air Force Eastern Test Range.

USE OF RADIOACTIVE MATERIAL UNDER
AEC/NRC LICENSE IN THE OCEAN

Plutonium for Use in Radioisotope Thermal Generators

From 1967 to 1978, the U. S. Navy conducted underwater tests of plutonium-238 specimens used in operational and proposed radioisotope thermal generators (RTG) to evaluate the effects of sea water on the specimens. The tests were conducted in approximately 50 feet of water off San Clemente Island which is approximately 85 miles from San Diego, California. During the tests, a small amount (approximately 0.05 grams) of plutonium-238 was lost and dispersed in the sea water.

Surveys conducted in the vicinity of the test area revealed that the concentration of plutonium-238 found in sediment and algae was less than 1% of the maximum permissible concentration for plutonium-238 in an unrestricted area. In sea water the concentration of plutonium-238 was less than one-millionth of the maximum permissible concentration.

Depleted Uranium as Bullets and Weapon Projectiles

Since 1974, the U. S. Navy has conducted a program for testing of depleted uranium alloy penetrators over the Pacific Missile Range. The testing resulted in dispersal of the depleted uranium over an approximate 6 square mile area off San Nicolas Island where the minimum water depth is 60 feet. San Nicolas Island is approximately 80 miles southwest of Long Beach, California.

In 1976, the Navy was authorized to fire approximately 25,000 rounds of depleted uranium ammunition over the Atlantic Fleet Weapons Range and off the United States east coast. The Alpha and Bravo Ranges of the Atlantic Fleet Weapons Range were used. The Alpha Range is northeast of Puerto Rico and the Bravo Range is south-southwest of Puerto Rico. The areas off the United States east coast are at a minimum distance of 80 miles up to several hundred miles from the coast.

Depleted uranium is about half as radioactive as normal uranium.

Strontium-90 Radioisotope Thermal Generators

The Navy has 6 strontium-90 powered radioisotope thermal generators implanted on the ocean floor. The generators are used as power sources for electrical equipment. The strontium-90 is in an insoluble form encapsulated in high integrity materials. The intent by the Navy is to recover the generators after their useful life although that may not be possible in all cases.

One generator containing 23,600 curies of strontium-90 was implanted in November, 1970 off the Bermuda coast at a depth of about 14,400 feet. Three generators, each containing about 6,500 curies of strontium-90, are implanted off the coast of Midway Island at depths of over 16,000 feet. There are 2 generators, each containing about 6,500 curies of strontium-90, implanted in the Air Force Eastern Test Range in the Atlantic Ocean northwest of Brazil at depths of over 10,000 feet.