MINUTE ITEM
This Calendar Item No. 90
was submitted for information only, no action thereon being necessary.

INFORMATIONAL
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REPORT ON A PROJECT, UNDERTAKEN BY THE MARINE FACILITIES DIVISION AND FUNDED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA), TO DEVELOP INSPECTION GUIDELINES AND STRUCTURAL STANDARDS FOR MARINE OIL TERMINAL STRUCTURES TO ADDRESS SEISMIC SAFETY, LIQUEFACTION AND FIRE DETECTION AND SUPPRESSION

INFORMATIONAL ITEM:
The purpose of this item is to allow the Marine Facilities Division (MFD) of the California State Lands Commission to present information only. No action is requested of the Commission at this time.

SUMMARY
The California State Lands Commission has been granted $500,000 from Federal Emergency Management Agency (FEMA), through the Hazard Mitigation Grant Program (HMGP), directed by the Governor's Office of Emergency Services, for the development of seismic and fire detection/suppression standards for marine oil terminals. This HMGP is a result of the 1994 Northridge earthquake and is designed to mitigate future seismic damage in Ventura, Los Angeles and Orange counties (tri-counties), the area most affected by this earthquake. This project will develop seismic standards for terminal structures, criteria for mitigating liquefaction damage, requirements for fire detection and suppression equipment and guidance for underwater inspections of these facilities. The funding is provided over a three-year period.

Associated with this project are two others, both of which will provide collateral information for this work. The first is an offshore seismic hazard assessment project to be performed by Lawrence Livermore National Laboratory (LLNL), and the second is a tsunami hazard assessment by the University of Southern California (USC). The Commission's Staff will be coordinating these two other projects.

The final goal of all these efforts is the codification of the standards, criteria, requirements and guidelines regarding seismic safety and fire detection and

suppression at marine oil terminals in furtherance of the statutory mandate given to the California State Lands Commission. In addition, the standards and criteria will be usable at marine facilities throughout the State, whether or not under the Commission's jurisdiction.

STATUTORY AND OTHER REFERENCES:

A. 42 United States Code Section 5170c
B. 44 Code of Federal Regulations Part 206, Subpart N
C. Public Resources Code: Div. 7.8

PERMIT STREAMLINING ACT DEADLINE:

N/A

OTHER PERTINENT INFORMATION:

Seismic safety and fire detection and suppression at marine oil terminals is of direct interest to the Commission because of the responsibilities given to it under the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act of 1990 (the Act). That legislation requires that the Commission's regulations governing these facilities provide the best achievable protection of public health and safety and of the environment.

Because of the unique structural and operational characteristics of marine oil terminals, involving as they do high-volume transfers of oil over water to and from tank vessels, attended by a significant risk of large spills, of concern is their structural integrity under extreme environmental loading during seismic and tsunami events. Fires, explosions and large releases of oil and hazardous substances into marine waters could result from such disasters.

Maintaining the integrity of these structures is also critical for the economic recovery of the region following a major seismic event. The California Energy Commission estimates about 50 percent of oil feedstock used at Southern California refineries and 60 of that used by Northern California refineries pass through marine terminals. Keeping these facilities operational even after a moderate or severe seismic event could be critical in maintaining adequate oil supplies for refineries and in supporting repair and reconstruction efforts for the State. Maintaining an adequate supply of crude oil for California has been called a "critical function." Even if refineries were lost, these terminals could be quickly converted to support importation of petroleum products necessary to sustain the economy.

It is well established that marine facilities along the Southern California coastline are vulnerable to seismic events. Both the Ports of Los Angeles and Long Beach are in close proximity to the Newport-Inglewood and Palos Verdes Faults and possibly other blind faults. Additionally, there are numerous known and probably a number of unknown faults, both offshore and onshore, that could seriously affect the tri-county area coastal zone. There was a measurable amount of liquefaction at the Port of Los Angeles from the Northridge event, more than 40 miles away. It is a likely scenario that one of these faults could set-off a moderate earthquake at any time, creating damage to any and all of the facilities in the three county coastal zone. Obviously, these facilities would also be susceptible to tsunami or liquefaction damage.

Despite these concerns, MFD has found no existing seismic performance standards for marine oil terminals. Research into the Uniform Building Code and American Petroleum Institute Recommended Practice has revealed no standards specifically addressing the structural design, tsunami or liquefaction mitigation or fire detection and suppression criteria for piers, wharves or moorings. The National Marine Board and the American Society of Civil Engineers (ASCE) have informed the Commission's engineering staff, during discussion relating to seismic requalification standards, that neither is planning any action on this particular problem. The U.S. Navy has addressed these issues for new facilities, but does not have any guidelines for the seismic assessment of existing wharves, piers or moorings. The American Petroleum Institute (API) published a new standard (July 1994), API Standard 2610 - Design, Construction, Operation, Maintenance and Inspection of Terminal & Tank Facilities, but this standard does not include any structural criteria or design for piers, wharves or moorings. Furthermore, an ASCE Technical Committee, which has been tasked to address the problems of seismic criteria for ports and harbors, expects only to "isolate and identify problem areas" without providing any real solutions or corrective measures.

MFD believes that the following must be developed, insofar as there are at present neither governmental regulations nor industry-accepted guidelines addressing any of the following as they relate specifically to marine oil terminals:

- Appropriate seismic criteria, loading combinations and safety factors for new facilities and for new construction at existing terminals;

- Actions to be taken to mitigate the effects of inundation and high velocity currents from tsunamis;
- Fire detection and suppression systems;
- Safety factors for liquefaction at existing facilities, given new information regarding peak ground acceleration;
- Design safety factors for new major equipment loads which may be placed on an old terminal; and
- Inspection and retrofitting requirements for identified structural deficiencies.

MFD therefore proposed the project to remedy these deficiencies. The objective would be to limit losses from future seismic disasters by reducing the vulnerability of marine oil terminal structures and related equipment, so that with minimum costs the structure would survive a "moderate" event without collapsing or polluting the waters of California. Toward that end, the project entails development of the following:

- Seismic design criteria for new and existing marine oil terminals;
- Fire detection and suppression criteria;
- Liquefaction mitigation criteria; and
- Standards for underwater inspection of marine oil terminals.

The funds provided by FEMA for this project are given on a matching basis. The grant provides 75% of the actual funding, and the Commission will provide the remaining 25% through contribution of staff time. The program is designed to solicit the use of an engineering contractor who will work toward completion of this project under the direction of Staff. The funds would be expended as follows:

	Year 1	Year 2	Year 3	Cumulative

Funds Requested:	$215,000	$170,000	$115,000	$500,000
Commission Matching Funds: (Contributed Staff time)	71,667	56,667	38,333	166,667

The following are the proposed program elements:

1. Acquisition of consultant services to facilitate and assist Staff in conducting workshops and reviewing critically input from marine terminal operators, industry representatives, academia and interested parties in order to establish standards leading to regulations.

2. Development of performance regulations for new construction and reassessment of existing marine terminals.

3. Establishment of inspection procedures directed toward the identified risks.

4. Development of fire detection and suppression design criteria and subsequent regulations to mitigate seismically-induced fire and explosion scenarios.

5. Development of liquefaction mitigation criteria and subsequent regulations for existing facilities, including possible guidelines to reduce the risk of loss, as necessary.

6. Implementation of the proposed regulations, as a pilot test project, on at least two facilities, with the associated evaluation of costs and benefits and postulated economic impact. If any extreme measures are postulated, these exercises will allow the Commission to modify the regulations where appropriate to take into consideration the costs of upgrading the facility as they relate to financial returns from the facility and estimated post-disaster repair costs.

7. Development of a peer review or workshop program with invited experts will be used to evaluate and comment on the standards and proposed regulations, in order to establish industry, academic and governmental consensus that the regulations represent good engineering without

resulting in excessive costs for implementation or onerous operational constraints.

While the program will address the potential threats to facilities along the Southern California coast, it would also have application as a "model project" to facilities elsewhere. This would include not only other areas within California, such as the San Francisco Bay area, but also other seismically active regions of the United States, such as Alaska, Washington and portions of the East Coast.

Directly related to this project are the two others undertaken under separate FEMA grants. The Commission's project will use data from both to provide the basis for the engineering criteria and requirements that will be developed into regulations.

The LLNL project, under the direction of Dr. Robert Murray, will provide an offshore seismic hazard assessment for the tri-county area. LLNL has extensive expertise in the area of seismic hazard analysis, having developed seismic hazard assessments for DOE facilities ranging from office buildings to plutonium handling facilities. While there have been extensive analyses of onshore seismic hazards, little has been done in regards to the Southern California offshore earthquake hazards. The LLNL effort will perform this task and, because a number of faults cross the shoreline, will seek consistency between the offshore and onshore data. This project will provide an estimate of the potential earthquake magnitudes, such as peak ground accelerations, and the recurrence interval of those events.

The second collateral project, undertaken by USC under the direction of Dr. Costas Synolakis of the USC Civil Engineering Department, involves the analysis of potential hazards of tsunamis along the coast of Southern California. Particular attention will be paid to the port areas. The USC project will rely substantially on the seismic fault data obtained from the LLNL project. There have been twelve tsunamis along the California coast since 1868, with a number of deaths and considerable damage recorded. These may have been generated by distant earthquakes off, for example, Alaska or Asia, called "far-field events," or by earthquakes directly off California, called "near-field events." New evidence in the geologic record from both sides of the Pacific Ocean indicates that huge tsunamis have been generated by very large earthquakes of Magnitude 9.0± in the Cascade Subduction Zone lying along the coasts of Washington, Oregon, and Northern California. A large tsunami would severely impact not only the general tri-counties coastal population, but also the industrial

infrastructure; i.e. oil production and transportation facilities both within and outside the port areas. Inundation and high velocity currents from such an event may cause these facilities to fail. The resulting damage could result in the release of large quantities of oil and hazardous substances into marine waters. This effort consists of modeling the coastal bathymetry and then incorporating the seismic hazards for the various offshore faults identified by the LLNL project.

With the data available from the two collateral projects, MFD will have accurate information on these hazards and be able to draft more specific regulations regarding design criteria for new and existing marine oil terminals and associated safety systems. These regulations will help provide the best achievable protection of the public health and safety and the environment.