Memorandum

UNOCAL 76

CBS 86-058

March 27, 1986

TO: Mr. R. J. Stegemeier

FROM: C. B. Scott

CLEAN-UP OF CONTAMINATED SOIL AND GROUNDWATER

This note supplements our March 21, 1986 conversation about the costs of cleaning up soil and groundwater at sites of prior leaks and spills. Included are brief descriptions of the scope of the problem, the potential costs (excluding possible litigation), what currently is being done about the problem, and recommendations for reducing costs and risks of litigation.

1. SCOPE OF PROBLEM

1.1 Existing and upcoming regulations are expected to require the Company to clean up or replace contaminated soil, and to clean up any contaminated groundwater, at the following facilities: onshore production and pipeline facilities, refineries, marketing terminals, service stations, truckstops, LCL terminals, chemical plants, mining and processing sites, and PureGro facilities.

Some 95 such Company facilities already are known to have soil and/or groundwater contamination problems of varying severity. An additional 220 facilities are suspected of having such problems.

In addition to clean-ups that are driven by regulations, site evaluations and clean-ups (if contamination is found) increasingly are being required prior to changes in property ownership.

Nominal clean-up requirements are from less than 1 ppm to 1000 ppm of the contaminant in soil, and 100 ppb or less in groundwater.

1.2 Most contaminated soil must be handled as a hazardous waste, which involves permitting, manifesting, waste-end taxes (in some states) and disposal fees in the increasingly scarce hazardous waste disposal sites.

Groundwater clean-up, either in-situ or ex-situ, similarly involves permitting from air and/or water agencies, depending upon the treatment procedure that is acceptable to the agencies.

1.3 Litigation can be expected in most cases where drinking water aquifers have become contaminated.

1.4 Clean-up costs and liability risks increase steadily, due to continuing migration of contaminants, when prompt action to evaluate and stabilize the situation is delayed. Failure to correct leaks, to stop practices that add to contamination, or to contain further migration, directly increase costs and risks.

2. POTENTIAL CLEAN-UP COSTS

Costs obviously vary widely, but following are examples of cost ranges developed from Company experience as well as the experience of others:

Site evaluations leading up to remedial action	-	$ 1,000 - 1 million $50,000 mid-range
Service station clean-up	-	$ 1,000 - 1 million $100,000 mid-range

Spill of aromatics (5,000-10,000 gallons):

soil removal and disposal	-	$200,000 - 400,000
containment system	-	$150,000 - 350,000
recovery and treatment system	-	$0.5 - 2 million

Groundwater treatment systems:

bioreclamation	- $150,000 - 200,000/year
air strippers plus carbon adsorbers	- $400,000 - 1 million capital

Disposal costs for contaminated soil:

$ 17/ton for Oil and Gas waste
$280/ton for PureGro waste

Waste taxes for contaminated soil:

$2-25/ton in California

Current estimates of the Company's potential soil and groundwater clean-up costs range from a minimum of $40 million to more than $75 million, exclusive of any litigation, replacement costs for domestic water supplies, new facilities to replace leaking or demolished facilities, or purchases of contaminated buildings (Chevron allegedly spent over $20 million on just one site where soil beneath several buildings was contaminated).

3. WHAT IS BEING DONE

3.1 The Company's Waste Management Assistance Team, which was formed following our 1984 hazardous waste strategy report prepared for Messrs. Hartley and Brinegar, is providing a limited amount of help to facilities that request assistance.

Our waste management coordinator, Noel Kurai, and our hydrogeologist, Tom Kuebrich, are swamped with work providing site evaluation and clean-up design services to facilities that request assistance.

It has become obvious that a broader effort is required if risks and costs are to be stabilized and then reduced.

3.2 Our environmental legislative and regulatory group, under Pat O'Toole, has been effective in tempering state bills and proposed regulations which would have increased clean-up and disposal costs. Identified savings exceed some $20 million.

This work continues, and future savings are anticipated.

3.3 Dave Gaudio is leading an effort at S&T to evaluate technical alternatives to soil excavation and disposal. A report is understood to be issued in April.

3.4 Herb Pomerantz in Schaumburg has made a preliminary survey of opportunities for providing technology and clean-up services. He is understood to be waiting for Gaudio's report, and then will conduct a definitive feasibility and market survey to see if there are actual opportunities for his Applied Technology Group.

3.5 PERF is understood to be considering research proposals covering in-situ clean-up via steam injection, in-situ biotreatment of hydrocarbons, and migration rates of hydrocarbons in soil and groundwater. Actual work on any of these proposals remains uncertain.

3.6 API has researched clean-up for several years, and a limited amount of work may continue subject to budget constraints. Techniques include venting, surfactant flushing, and surface clean-up of contaminated groundwater. We are represented on the API task force.

4. RECOMMENDATIONS

The Company's soil and groundwater contamination costs and risks clearly will increase. The extent of increase can be limited by promptly investigating and correcting potential leaks, by stabilizing existing contaminated areas so those areas do not continue to spread, by choosing the best clean-up procedure for each individual site, and by negotiating the most advantageous provisions with the controlling regulatory agencies.

The following steps are recommended:

4.1 Establish a central coordination point for tracking developments at each site and for ensuring the availability of site evaluation and clean-up expertise, legal assistance and regulatory assistance. This central coordination point could be built upon the existing Waste Management Assistance Team which includes representatives from all operating divisions and key corporate departments.

4.2 Direct operating groups to promptly investigate and correct suspected leaks, to increase precautions against future leaks, spills and overflows, and to request assistance from the Waste Management Assistance Team as soon as a contamination problem is discovered in stopping migration, in designing the appropriate clean-up system, and in negotiating with the regulatory agencies.

4.3 Strengthen the Waste Management Assistance Team by bringing in more hydrogeological and engineering talent. Use this talent to replace outside contractors in evaluating sites, designing containment and clean-up procedures, and in overseeing the required follow-up monitoring. Contractor savings are estimated at $9-12 million, assuming some 300 sites.

We currently have a joint effort underway with Corporate Human Resources to see if geologists and engineers whose work is temporarily affected by the recent downturn could be used effectively for this purpose. Initial conclusions are positive.

4.4 Accelerate work at S&T and with PERF to get reliable cost, performance and environmental data on potential alternatives to soil excavation such as portable incineration or washing facilities, in-situ stripping or flushing, and enhanced biological or oxidative degradation. Concurrently develop requirements and strategy for obtaining the necessary permits on each promising alternative.

Please call if there are questions, or if supplemental information is needed.

CBS:llg

cc: Mr. C. S. Brinegar

bcc: Messrs. E. D. Blum
S. L. Zwicker
D. A. Monroe
N. Kurai
G. Frost
W. J. Quinn
T. D. Kuebrich
Ms. P. M. O'Toole