CTO-161/0217

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MCAS EL TORO
SSIC #5090.3

Bob C.
(AR)

# Department of Toxic Substances Control

Jesse R. Huff, Director
5796 Corporate Avenue
Cypress, California 90630

ete Wilson
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Peter M. Rooney
Secretary for
Environmental
Protection

November 23, 1998

Mr. Joseph Joyce
BRAC Environmental Coordinator
U.S. Marine Corps Air Station - El Toro
P. O. Box 95001
Santa Ana, California 92709-5001

Dear Mr. Joyce:

**COMMENTS ON DRAFT TECHNICAL MEMORANDUM, UNSAT-H INFILTRATION MODELING FOR LANDFILL COVERS, MARINE CORPS AIR STATION (MCAS) El TORO**

The Department of Toxic Substances Control (DTSC) has reviewed the above subject document dated October 21, 1998, prepared by Bechtel National Inc. The document presents the results of the UNSAT-H computer modeling of infiltration for landfill covers at MCAS El Toro.

The model estimates that the annual infiltration rate through the monolithic cover (Alternative 3) will range between 5.0 and 13.7 inches for golf course scenarios. DTSC cannot accept this infiltration range as a permissible leakage rate for the landfill. The state's performance standard for the allowable percolation amount at monolithic soil covers is "zero" infiltration, and any leakage into the waste beneath the cover would thus be considered a design failure. However, we will reconsider this determination if the Navy/Marines conduct site and waste characterization studies at the landfills to demonstrate that, under the currently proposed irrigated postclosure land use, the waste does not pose any significant threat to public health and safety or to the environment.

DTSC agrees with and supports the California Integrated Waste Management Board's comments dated November 17, 1998 on the subject document (copy enclosed). DTSC has also reviewed draft technical comments from the MCAS El Toro Local Redevelopment Authority (LRA); we note that the LRA has posed some valid questions for which the answers are not clear. Please send us a copy of your response to those comments when it becomes available.

If you have any questions, please contact Mr. Tayseer Mahmoud, Remedial Project Manager, at (714) 485-5418.

Sincerely,

Sharon Fair
Unit Chief
Base Closure Unit
Office of Military Facilities

Enclosure:

cc: Mr. Glenn Kistner, SFD-8-2
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cc: Ms. Polin Modanlou
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# California Integrated Waste Management Board

Daniel G. Pennington, Chairman
8800 Cal Center Drive • Sacramento California 95826 • (916) 255-2200
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Peter M. Rooney
*Secretary for Environmental Protection*

Pete Wilson
*Governor*


November 17, 1998

Mr. Joseph Joyce
BRAC Environmental Coordinator
U.S. Marine Corps Air Station - El Toro
P.O. Box 95001
Santa Ana, California 92709-5001

**Review of Draft Technical Memorandum, Unsat-H Infiltration Modeling for Landfill Covers, Marine Corps Air Station (MCAS), El Toro, California**

Dear Mr. Joyce:

On October 22, 1998, the California Integrated Waste Management Board (Board) Remediation, Closure, and Technical Services Branch staff received the draft technical memorandum addressing the landfill cover infiltration model for inactive landfills at El Toro MCAS.

Board staff have reviewed the submitted report and acknowledge its findings. However, Board staff do not concur with the report's final conclusion that, based on the assumed permeability of the soil ($5X10^{-5}$ centimeter/second) from the proposed borrow source, the proposed monolithic soil cover will provide infiltration protection performance equivalent to the prescriptive clay barrier cover performance.

Board staff do not dispute the fact that under certain conditions (arid climate, lack of irrigation, dry and/or inert waste), use of a monolithic soil cover may be justifiable for certain landfills. However, such covers have been allowed only as site-specific occurrences and only under conditions (long-term moisture monitoring, requirement to upgrade landfill cover in an event of failure) with none of the proposed sites approved for an irrigated postclosure land use.

Board staff would like to point out that the reference to the theoretical permeability (and leakage) of the clay barrier ($1X10^{-6}$ cm/sec) as a performance standard for a landfill final cover is not correct for the following reasons:

- As stated in Title 27, California Code of Regulations, final cap design and permeability requirements have been established as minimum standards which may be upgraded based on, among other conditions, irrigated postclosure land use and surrounding land development.

- A performance standard that is used for evaluation of alternative final cover designs such as monolithic soil cover is zero infiltration through the bottom of the final cover. Any leakage into the waste beneath the cover is considered a failure. Although a theoretical leakage rate can be calculated for any final cover material, closure regulations provide design guidelines to prevent and/or minimize conditions under which full cover infiltration can occur (site grading, runoff and runon collection, subsurface drainage collection). Thus, the net infiltration equal to the infiltration based on the theoretical permeability of the clay barrier cannot be accepted as a permissible leakage.

- Because there is no adequate waste characterization study and landfill gas monitoring, Board staff cannot determine the effects of increased moisture in the waste on landfill gas generation and waste settlement. Thus, no infiltration is the performance standard for comparison purposes of alternative covers.

Please refer to the attached review memorandum for the infiltration model analysis.

At this time, Board staff cannot approve the proposed monolithic soil cover design for an irrigated postclosure land use (Title 27, California Code of Regulations, Section 21140). Options available to El Toro MCAS include:

1. Install monolithic soil cover but preclude irrigated postclosure land use,

2. Install synthetic cover with drainage and gas collection layers and allow landfill irrigation, or

3. Conduct site and waste characterization of the landfills to demonstrate that the waste does not pose any significant public health and safety or environmental threat under currently proposed (irrigated) postclosure land use.

Should you have any questions, please contact Peter Janicki of my staff at (916) 255-1195.

Sincerely,

Michael B. Wochnick

Michael B. Wochnick, Manager
Closure and Remediation Section
Permitting and Enforcement Division

Attachment

cc: Mr. Tayseer Mahmoud, Department of Toxic Substances Control

Mr. Glenn Kistner, U.S. Environmental Protection Agency

Ms. Patricia Hannon, Santa Ana Regional Water Quality Control Board

Mr. Steve Sharp, Orange County Health Care Agency

State of California

California Environmental Protection Agency

# MEMORANDUM

**To:** Peter Janicki
Waste Management Engineer
Remediation, Closure & Technical Services

**Date:** November 4, 1998

**From:**
Glenn K. Young, P.E.
Associate Waste Management Engineer
Remediation, Closure & Technical Services
CALIFORNIA INTEGRATED WASTE MANAGEMENT BOARD

**Subject:** **REVIEW OF UNSAT-H MODELING MCAS EL TORO LANDFILLS**

Peter, I have reviewed the subject report and have the following comments & notes:

**Section 2 Proposed Borrow Source**

a) The borrow soil investigation appears to be reasonable, however were soil samples taken from the surface or at depth (if at depth, what depth)? Can soil be scraped from the surface or will overburden need to be removed? Note that removal of overburden will impact borrow soil costs.

b) The soil gradation from borrow soil samples is consistent with monolithic covers being tested in San Bernardino County (Milliken Landfill). The soils have a significant sand fraction (60%) and fines (30%) fraction. The modeled soil permeability of $2.0 \times 10^{-5}$ cm/sec is consistent with laboratory permeability data taken from construction quality assurance tests during construction of the East Mound Cap at Milliken Landfill.

**Section 2.1 Geotechnical Soil Analysis & Section 2.2 Mean Hydraulic Conductivity**

c) The geotechnical section appears reasonable. The appropriate tests were performed to determine final cover infiltration performance as well as soil construction specifications and construction quality assurance acceptance values. The geometric mean permeabilty appears to be representative of borrow soils obtained.

**Section 3 UNSAT-H Methodology**

d) Although this methodology appears to be valid for the first two alternatives, e.g. drought and base condition, it may not yield conservative results for applications where saturated flow conditions are prevalent, such as those conditions likely to occur due to irrigation from the landscape and golf course alternatives. Unsaturated models are used to depict the flow of moisture through a soil column and account for entrapped air which can impede the wetting front (these soil matrix properties are accounted for in the modeling by the Van Genuchten Parameters; similar to matric potential coefficients used in Richard's equation for unsaturated flow). This assumption is suitable for soils, such as those in the desert, where low initial moisture content and unsaturated conditions are the prevalent conditions. HELP and UNSAT-H Models were designed to model the water balance for geographic specific, meteorologic and climatic

conditions occurring (site-specific SCS run-off curves, rainfall data, evaporation data, etc). Man-made irrigation practices (such as golf course irrigation) may not be adequately modeled using the above models. IWMB staff recommend that further research be conducted to determine if field testing has been conducted for this application, i.e. installation of a moisture monitoring station to control irrigation in a golf course application. As a frame of reference, note that if a constant potential condition is allowed over a saturated soil column with a saturated hydraulic conductivity of $5.2 \times 10^{-5}$ cm/sec, the net annual infiltration could be up to 645 inches/year. A 27 CCR prescriptive cap exhibiting a permeability of $1.0 \times 10^{-6}$ cm/s under the same conditions would be 12.41 inches/year.

**5.4 Plant Data**

e) What are the root zone depths for bermuda grass? Most grass systems are shallow rooting and are usually 12 inches in depth or less. Is the modeled root zone of 24 inches a conservative value for Bermuda Grass? Since root zone transpiration accounts for a significant portion of infiltration, what is the impact of a 12-inch versus a 24-inch root zone on the net infiltration results modeled.

**Section 7 Summary**

f) Since the model does not account for lateral drainage effects and run-off , how will these effects impact infiltration in areas such as drainage confluences and drainage collection areas?

In summary, it is not recommended that UNSAT-H be used in the modeling of irrigated conditions (or saturated conditions) since this is contrary to the conditions which are modeled (unsaturated conditions). Consultants modeling the monolithic cover for landfills in San Bernardino County have stated that saturated conditions must be avoided within the cover profile in order for it to perform equivalently to a prescriptive cover. Note also, that key conditions for applying the monolithic cover concept include, positive drainage and elimination of conditions which would cause a constant potential over the cover soil profile (eliminating any driving force on the wetting front).

Let me know if you have any questions.

Glenn

# PLANT MATERIAL REFERENCE MATRIX

| BOTANICAL/COMMON NAME | PLANT TYPE | ROOT DEPTH | GROWTH RATE | ESTABLISH. RATE | DROUGHT TOLER. | FIRE TOLER. | NATURAL RAINFALL | IRRIGATION | SOIL TYPE | LONGEVITY | FERTIL. REQ. | NATURALIZE | ZONE DISTRIB. | CALIFORNIA NATIVE | SOURCE | PLANTING SEASON | PLANT HEIGHT | SHORT TERM PROT | SALT TOLER. | EROSION PROTECT | MAINTEN REQ | NURSE CROP | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WILDFLOWERS | | INCHES | | YEARS | | | INCHES | | | YEARS | | | | | | | INCHES | | | | | | | | |
| **Alyssum maritimum** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Sweet Alyssum* | 2 | <12 | M | 1-2 | P | | >20 | H | S | 2 | H | 2 | ALL | | S | ALL | 8 | | P | M | M | | | | |
| **Achillea millefolium** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *White Yarrow* | 2 | 12 | F | 1-2 | G | | >20 | M | C | >2 | M | | ALL | | S | ALL | 24 | ● | M | G | M | ● | | | |
| **Achillea tomentosa** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Wooly Yarrow* | 2 | 12 | F | 1-2 | G | ● | >20 | M | C | >2 | M | 2 | ALL | | S | ALL | 12 | ● | M | G | M | ● | | | |
| **Baileya multiradiata** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Desert Marigold* | 1 | <12 | M | 0-1 | G | | >4 | F | S | 1 | L | | 1,2,3 | ● | S | F | 24 | ● | H | M | L | ● | | | |
| **Centaurea cyanus** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Bachelor Button* | 1 | <12 | F | 0-1 | G | | >4 | F | C | 2 | L | | ALL | ● | S | ALL | 36 | | M | M | L | ● | | | |
| **Coreopsis lanceolata** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Lance Leaf Coreopsis* | 2 | 12 | M | 0-1 | G | | >10 | L | C | 2 | M | 2 | ALL | | S | F | 36 | | L | M | L | | | | |
| **Cotula coronofolia** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Brass Buttons* | 2 | <12 | F | 0-1 | G | ● | >10 | F | C | 2 | L | 1 | 1 | | S | ALL | 12 | | M | M | L | ● | | | |
| **Eriogonum giganteum** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *St. Catherines Lace* | 2 | <12 | M | 1-2 | M | | >10 | M | S | >4 | M | 3 | 1,2 | | S | F | 72 | | M | G | M | | | | |
| **Eriophyllum confertiflorum** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Golden Yarrow* | 2 | >12 | M | 0-1 | G | ● | >10 | M | C | >5 | M | 2 | 1-2 | ● | S | ALL | 24 | ● | M | E | M | ● | | | |
| **Eschscholzia californica** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Poppy* | 1 | <12 | F | 0-1 | E | ● | >4 | L | C | 1 | L | 1 | ALL | ● | S | F | 12 | | M | M | L | ● | | | |
| **Gazania splendens** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Gazania* | 2 | <12 | M | 0-1 | M | | >20 | M | C | 3 | M | 2 | 1,2,3 | | S,C | F | 12 | | L | M | M | | | | |
| **Iris douglasiana** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Douglas Iris* | 2 | <12 | S | 1-2 | G | | 20 | F | S | >2 | M | 2 | 1,4 | ● | S,C | F | 24 | | P | M | M | | | | |
| **Iris missouriensis** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Western Blue Flag* | 2 | <12 | S | 1-2 | M | | 20 | F | S | >2 | M | 2 | 1,2,4 | ● | S,C | F | 24 | | P | M | M | | | | |
| **Lasthenia glabrata** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Goldfields* | 1 | <12 | F | 0-1 | E | | >4 | L | C | 1 | L | | ALL | ● | S | F | 18 | ● | H | G | L | ● | | | |
| **Linum lewisii** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Blue Flax* | 2 | <12 | M | 0-1 | M | | >4 | L | C | 2 | L | 1 | ALL | | S | F | 24 | | H | G | L | ● | | | |
| **Lupinus bicolor** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pigmy-Leafed Lupine* | 1 | <12 | F | 0-1 | E | ● | >4 | L | C | 1 | L | 1 | 1-2 | ● | S | F | 10 | ● | H | G | L | ● | | | |
| **Lupinus nanus** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Sky Lupine* | 1 | <12 | F | 0-1 | E | | >4 | L | C | 1 | L | 1 | ALL | ● | S | F | 24 | ● | H | G | L | ● | | | |
| **Lupinus succulentus** | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Arroyo Lupine* | 1 | <12 | F | 0-1 | E | | >4 | L | C | 1 | L | 1 | ALL | ● | S | F | 48 | ● | H | G | L | ● | | | |

# PLANT MATERIAL REFERENCE MATRIX

| BOTANICAL/COMMON NAME | PLANT TYPE | ROOT DEPTH | GROWTH RATE | ESTABLISH RATE | DROUGHT TOLER. | FIRE TOLER. | NATURAL RAINFALL | IRRIGATION | SOIL TYPE | LONGEVITY | FERTIL. REQ. | NATURALIZE | ZONE DISTRIB. | CALIFORNIA NATIVE | SOURCE | PLANTING SEASON | PLANT HEIGHT | SHORT TERM PROT | SALT TOLER. | EROSION PROTECT | MAINTEN REQ | NURSE CROP | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WILDFLOWERS | | INCHES | | YEARS | | | INCHES | | | YEARS | | | | | | | INCHES | | | | | | | | |
| **Oenothera cheiranthifolia** *Beach Evening Primrose* | 2 | 12 | F | 0-1 | M | ● | >10 | F | S | 4 | M | 2 | 1,2 | ● | S,C | ALL | 24 | | M | G | M | | | | |
| **Oenothera speciosa** *Showy Evening Primrose* | 2 | 12 | F | 0-1 | G | ● | >10 | F | C | 4 | M | 2 | 1,2 | | S,C | ALL | 24 | | M | G | M | | | | |
| **Orthocarpus purpurascens** *Owl's Clover* | 1 | <12 | M | 0-1 | G | | >10 | L | C | 2 | L | 1 | ALL | ● | S | F | 12 | | M | M | L | ● | | | |
| **Penstemon spectabilis** *Showy Penstemon* | 2 | 12 | S | 1-2 | G | | >4 | L | S | >4 | L | 2 | 1,2 | ● | S,C | F | 42 | | M | M | L | | | | |
| **Ratibita pinnata** *Prairie Coneflower* | 2 | <12 | M | 1-2 | G | | >10 | L | C | 2 | L | | 2 | | S | ALL | 42 | | M | M | L | ● | | | |
| **Sisyrinchium bellum** *Blue Eyed Grass* | 2 | 12 | M | 1-2 | G | | >10 | F | C | 3 | L | 2 | ALL | ● | S | F | 16 | | L | M | L | | | | |