



# STATE MINING AND GEOLOGY BOARD

## EXECUTIVE OFFICER'S REPORT



ARNOLD  
SCHWARZENEGGER  
GOVERNOR

For Meeting Date: July 9, 2009

**Agenda Item No. 9: Review of Strategy to Stabilize Existing Cutslope and Implement Revegetation Measures for Richmond (Chevron) Quarry (California Mine ID # 91-07-0006), Dutra Materials (Operator), Mr. Brian Peer (Agent), City of Richmond.**

**INTRODUCTION:** The State Mining and Geology Board (SMGB) is the lead agency for all surface mine operations in the City of Richmond that are subject to the Surface Mining and Reclamation Act (SMARA, Public Resources Code Section 2710 et seq.). The Richmond (Chevron) Quarry is located in the City of Richmond, and encompasses approximately 126 acres and includes a processing and recycling plant, significant volumes of imported stockpiles of landscape debris and construction debris, and asphalt and soil, which is used for reuse and recycling. In response to the need to evaluate the overall stability of an existing cutslope, geotechnical studies have been performed by both Dutra Materials (Operator) and the Chevron Energy and Technology Company (subject property and adjacent property landowner).

**REGULATORY AUTHORITY:** In regards to cut slopes, and final highwalls and quarry faces, performance standards provided in the SMGB's regulations, California Code of Regulations (CCR) 3704(f) state:

*"Cut slopes, including final highwalls and quarry faces, shall have a minimum slope stability factor of safety that is suitable for the proposed end use and conform with the surrounding topography and/or approved end use."*

CCR Section 3502(b)(3) states, in part:

*"The designed steepness and proposed treatment of the mined lands' final slopes shall take into consideration the physical properties of the slope material, its probable maximum water content, landscaping requirements, and other factors. In all cases, reclamation plans shall specify slope angles flatter than the critical gradient for the type of material involved."*



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CCR Section 3501 defines Critical Gradient as:

*“The maximum stable inclination of an unsupported slope under the most adverse conditions that it will likely experience, as determined by current engineering technology.”*

CCR Section 3700(b) states:

*“Where an applicant demonstrates to the satisfaction of the lead agency that an exception to the standards specified in this article is necessary based upon the approved end use, the lead agency may approve a different standard for inclusion in the approved reclamation plan. Where the lead agency allows such an exception, the approved reclamation plan shall specify verifiable, site-specific standards for reclamation. The lead agency may set standards which are more stringent than the standards set forth in this Article; however, in no case may the lead agency approve a reclamation plan which sets any standard which is less stringent than the comparable standard specified in this Article.”*

**BACKGROUND:** The Richmond (Chevron) Quarry is located in the City of Richmond, and encompasses approximately 126 acres. The site is characterized by a flat quarry floor, a hide wall constructed from fill material, and quarry cut slopes with vertical dimensions of up to approximately 350 feet.

Surface mining operations include a processing and recycling plant, significant volumes of imported stockpiles of landscape and construction debris, and imported concrete and asphalt material and soil, which is reprocessed on site and recycled. A chronology of past administrative and enforcement actions set forth by the SMGB is summarized in Table 1.

<b>TABLE 1</b>	
<b>CHRONOLOGY OF ADMINISTRATIVE AND ENFORCEMENT ACTIONS</b>	
<b>Date</b>	<b>Action</b>
November 17, 2004	SMARA mine inspection performed by SMGB.
October 24, 2005	SMARA mine inspection performed by SMGB.
December 12, 2005	Notice of Violation issued by SMGB.
March 14, 2006	Order to Comply issued by SMGB.
September 14, 2006	Administrative Penalty of \$10,000 issued by SMGB.
November 9, 2006	Additional Administrative Penalty of \$90,000 issued by SMGB.
December 28, 2006	SMARA mine inspection performed by SMGB.
February 8, 2007	Administrative Penalty of \$90,000 deferred by SMGB.
June 17, 2007	SMGB forwarded matter to Geohazards Committee, prior to considering action on the proposed reclamation plan and financial assurance amount.
September 7, 2007	Geohazards Committee commenced discussions.
December 6, 2007	SMARA mine inspection performed by SMGB.
January 9, 2008	Geohazards Committee continued discussions and held meetings on January 9, March 9, May 8 and July 10, 2008.
October 16, 2008	SMARA mine inspection performed by SMGB.

**Previous Submittals:** In addition to previously submitted geotechnical reports for the subject site, as discussed in the May 8, 2008, and July 10, 2008 Executive Officer's Reports, OMR and SMGB staff have reviewed the following reports and letters:

- a) "Analysis of Slope Mitigation Alternatives, Richmond Quarry, Richmond California," prepared for Dutra Materials by ENGEO Incorporated, dated November 24, 2008, and received November 26, 2008.
- b) "Richmond Quarry: Joint MMI-ENGEO Commentary on SMGB Executive Officer's Reports Regarding Analyses of Chevron Tank 1799," letter to the SMGB and OMR prepared by MMI Engineering, Inc., dated December 4, 2008, and received January 12, 2009.
- c) "Quarry Floor End Use Evaluation, Rockfall Hazard Analysis, Richmond Quarry, Richmond, California," prepared for Chevron Energy and Technology Company by MMI Engineering, Inc., dated December 8, 2008, and received January 13, 2009.
- d) "Peer Review, Geologic/Geotechnical Documentation, Quarry Slope and Portion of Main Tank Field, Richmond, California," letter to SMGB prepared by URS Corporation, dated December 10, 2008, and received January 15, 2009.

**Operator’s Proposed Mitigation Alternatives:** The Geohazards Committee reviewed geotechnical documents and held meetings to discuss geotechnical issues associated with the subject site on September 7, 2007, and January 9, March 9, May 8 and July 10, 2008. In April of 2008 SMGB staff requested a summary of proposed mitigation alternatives, which was subsequently provided in ENGEO’s report titled: “*Discussion of Conceptual Slope Mitigation Options*,” dated April 24, 2008. This report provided more information on the conceptual slope mitigation options previously presented in ENGEO’s October 18, 2007 report, and provided preliminary estimates of construction quantities, costs, and impacts for each alternative, which collectively were meant to represent a range of typical mitigation measures for stabilization of rock slopes.

The discussion of each alternative relied on an approach of comparing “conceptual advantages,” “conceptual impacts,” and estimated costs to make conclusions about the feasibility of a particular measure. Table 5 of their report summarized the results of this exercise with the following options discussed:

Alternative 1 – Imported Fill Buttress

Alternative 2 – Ridge Cut\Fill Buttress Balanced on Site

Alternative 3 – Cut\Fill Buttress Balanced on Site with Retained Slope

Alternative 4 – Structural Slope Stabilization

Alternative 5 – Slope Setback, Monitoring, and Maintenance

Alternative 5 was the least costly by an order of magnitude, and ENGEO and Dutra also favored this alternative because it presumably would have the least impact on the environment and infrastructure of the mine site and surrounding area. In fact, ENGEO’s report indicated that Alternative 5 would have no impacts. However, the report did not carefully and adequately consider all advantages and impacts of each mitigation alternative.

The April 24, 2008 discussion of the preferred alternative as presented by ENGEO was framed as a preliminary assessment of possible alternatives for consideration, but was considered inadequate for conduct of a comprehensive analysis of mitigation alternatives. Essentially, the approach proposed was to conduct ongoing monitoring while leaving an unstable slope that would continue to fail and potentially degrade into an eyesore and hazard to the public and the environment. The approach also only focused on the next movement and did not consider the long-term effects on the slope and the safety of nearby petroleum storage tanks. The assessed feasibility of each alternative did not recognize the importance of the requirements of SMARA, which states that final mined slopes should be stable and

properly revegetated. Stable slopes and successful revegetation were noted as conceptual advantages for Alternatives 1 through 4, but these advantages were downplayed in the discussion by narrowly interpreting that the end use would be industrial for the entire site. The industrial end use and appropriate SMGB-defined factor of safety were used to inflate the stated impacts and estimated costs for Alternatives 1 through 4 rather than providing other, possibly more practical solutions to the problem.

Based on the above considerations, at their May 8, 2008 meeting, the Committee requested that additional evaluation and reconsideration of potential slope mitigation alternatives be presented which meet the requirements of SMARA and the SMGBs regulations. At the Committee's July 10, 2008, meeting, the operator indicated that their consultant had not completed their re-evaluation of the cut slope. It was recommended by the Executive Officer that this matter be deferred and rescheduled for the Committee's upcoming September 2008 meeting. After an additional time extension was granted in order to complete further slope stability analysis by both the operator and the landowner, and for each to conduct peer reviews, a revised report prepared by ENGEО titled "*Analysis of Slope Mitigation Alternatives, Richmond Quarry, Richmond, California*", dated November 24, 2008, was received by the SMGB on November 26, 2008.

At its February 5, 2009, meeting, the Committee considered the Alternatives presented and unanimously moved to recommend approval of Alternative No. 5 to the whole SMGB, albeit, the Committee also requested that trench logs be provided with the assumption that trench logs prepared at the time the trenches were excavated were completed, and results obtained would clearly and definitively support conclusions set forth by the operator's consultants.

**Operator's Mitigation Alternatives and Conclusions:** ENGEО's November 24, 2008, report described the following slope mitigation alternatives to address the stability of the failed cutslope:

- Alternative 1 – Imported Fill Buttress
- Alternative 2 – Ridge Cut\Fill Buttress Balanced on Site
- Alternative 3 – Cut\Fill Buttress Balanced on Site with Retained Slope
- Alternative 4 – Structural Slope Stabilization; and
- Alternative 5 – End Use Restriction, Setback, Berm Placement, and Monitoring and Maintenance.

These mitigation alternatives are similar to those presented in ENGEО's April 24, 2008 report titled "*Discussion of Conceptual Slope Mitigation Options*," however, the proposed end use of

the quarry slope and a portion of the quarry floor at the toe of the slope has been clarified to be open space, and costs for Alternatives 1 through 4 have been revised. Based on ENGEO's revised analysis, it appears that implementation of any one of Alternatives 1 through 4 would result in a stable quarry slope that would be consistent with SMGB regulations.

ENGEO's November 24, 2008, report presents a new Alternative 5 that contemplates a combination of 1) a deed-restricted open space end use designation for the quarry slope and 100-foot setback area at the toe of the slope, 2) construction of a rock fall catchment structure within the setback area, 3) long-term (30 years) geotechnical and revegetation monitoring of the slope, and 4) periodic maintenance of the slope and catchment structure as needed. It is noted that, in support of Alternative 5, ENGEO specifically refers to the California Geological Survey's (CGS) Special Publication 117A, "*Guidelines for Evaluating and Mitigating Seismic Hazards in California*," (SP-117A) as revised and re-adopted by the SMGB on September 11, 2008. Although it appears that implementation of Alternative 5 would result in a safe industrial end use for a large portion of the quarry floor, it is not compatible with SMGB regulations requiring final cut slopes to be stable.

**Previous Analysis of Proposed Mitigation Alternatives by SMGB and OMR Staff:** As noted on numerous occasions, Alternative 5 would result in a safe industrial end use for a large portion of the quarry floor; however, it is not compatible with the legislative intent of SMARA and the SMGB's regulations that require final cut slopes to be stable. As noted above, SMGB regulations state that in all cases, reclamation plans shall specify slope angles flatter than the critical gradient of the type of material involved. As reiterated by ENGEO in their November 24, 2008 report, the '*critical gradient*' is defined as the maximum stable inclination of an unsupported slope under the most adverse conditions that it will likely experience, as determined by current engineering technology. Cut slopes, including final highwalls and quarry faces, shall have a minimum slope stability factor of safety that is suitable for the proposed end use. In other words, the cut slope should be stable as determined by current engineering technology. Current engineering technology indicates that the cutslope is not stable. Additionally, Alternative 5, as presented, includes no costs for construction of the rock fall containment berm that is mentioned in ENGEO's report and recommended by MMI.

An important issue with respect to the unstable mined cut slope is the safety of nearby petroleum storage tanks and more specifically tank T-1799. Geologic and geotechnical studies undertaken by Dutra and Chevron conclude that tank T-1799 is not threatened or that the threat is very low from the mining-related slope failure. Submitted documents provided by the operator attempted to clarify and provide additional assurances that there is no need to consider the long-term effects on tanks and mention that the only relevant tank is T-1799.



It has been noted that the conclusion that the landslide shear plane does not extend beneath Tank T-1799 appears to be based on professional judgment and minimum geotechnical data that does not conclusively demonstrate such conditions. Given the available information, OMR and SMGB staff remained concerned about the impact of continued slope deformation on the existing tank T-1799.

**RECENT ANALYSIS AND DISCUSSION BY SMGB STAFF:** Three items require further discussion based on recently received documents and further analysis: 1) an addendum to MMI Engineering's Geoengineering Evaluation dated June 2009, 2) communications with the City of Richmond Planning Department, and 3) consideration of the SMGBs regulations pertaining to cut slope stability as previously discussed during its May 14, 2009, regular business meeting. These items are discussed below.

**Addendum to MMI Engineering's Geoengineering Evaluation:** During their February 5, 2009 meeting, members of the Geologic Hazards Committee expressed a desire to review logs of exploratory excavations conducted during evaluations of potential slope stability hazards in the vicinity of Tank T-1799. Following a subsequent request by the Executive Officer, on June 12, 2009, the SMGB office received documentation relating to sub-surface exploration activities conducted by MMI Engineering at specific locations adjacent to tank T-1799, and on the ridge line separating tank T-1799 from the failed quarry cut slope. The documentation, which serves as an Addendum to MMI Engineering's September 7, 2007 report titled *Geoengineering Evaluation of the Static and Seismic Slope Stability of Tank T-1799, Chevron Refinery, Richmond, CA*, consists of five post-excavation "Trench Logs" of exploratory excavations completed on May 30, 2004 and June 4, 2004, select stereo photographs showing features observed on the walls of the exploratory excavations, and related correspondence. Multiple photographs taken during the conduct of the exploratory excavations were also provided in electronic format. The subject documentation will hereby be referred to as MMI's June 2009 Addendum.

Upon review of MMI's June 2009 Addendum, and further consideration of previously submitted information, SMGB staff cannot conclude that continued failure of the quarry cut slope and adjacent ridgeline poses no significant risk to Tank T-1799. It is acknowledged that information presented within MMI's June 2009 Addendum supports their previous conclusion that no evidence of historic ground failure beneath Tank T-1799 was observed. However, a lack of definitive evidence remains that would rule out the continuation of the identified shear zone beneath Tank T-1799.

For instance, it appears that exploratory trenches adjacent to Tank T-1799 (Tank Test Pit 1 and Tank Test Pit 2) were located, at least in part, based upon the occurrence of variably offset cracks in a concrete drainage swale situated around the perimeter of the tank. The post-excavation logs of these test pits show no soil offsets, yet the NW-SE trend of the main shear zone that defines the upper bounding scarp on the failed quarry cut slope and adjacent

ridgeline appears to project between the two test pits. It is not clear why the observed cracks and observed displacements exist in the concrete drainage swale, nor is it clear why one continuous exploratory trench extending completely across the projected trend of the main shear zone was not excavated during the subject sub-surface investigation.

**City of Richmond's Perspective on Proposed Slope Mitigation Alternatives:** SMGB staff routinely provides information to the City of Richmond Planning Department (City) regarding surface mining operations within the City's jurisdiction. During the past year, SMGB staff has discussed the ongoing review of proposed reclamation alternatives at the Richmond (Chevron) Quarry on several occasions. On March 23, 2009, SMGB staff forwarded an electronic copy of ENGEO's November 24, 2008 Analysis of Slope Mitigation Alternatives, along with related information, to City staff for review and comment. During a follow-up conversation on June 10, 2009, City staff indicated that they would support proposed Alternative 2 (Ridge Cut\Fill Buttress Balanced on Site), or a variation thereof, in order to minimize the environmental impacts due to slope repair activities and to provide the opportunity for visual beautification, while still achieving a reclaimed slope that is stable.

**Consideration of SMGB Regulations Pertaining to Cut Slope Stability:** As presented during the SMGB's regular business meeting held on May 14, 2009, current SMGB regulations (CCR Section 3704(f)) require that all cut slopes, including final highwalls and quarry faces, shall have a minimum slope stability factor of safety (FOS) that is suitable for the proposed end use and conform with the surrounding topography and/or approved end use. With this specific regulation in mind, it is acknowledged that repair of the failed quarry cut slope in order to achieve a suitable slope stability FOS may have significant impacts on the surface mining operation and/or the adjacent property (Chevron's petroleum storage tanks and related infrastructure). As noted above, ENGEO's November 24, 2008 Analysis of Slope Mitigation Alternatives cites SP117A in support of their recommendation for the preferred Alternative 5, which involves long term monitoring and hazard mitigation in lieu of slope reclamation.

SP117A provides three general means for natural slopes in which earthquake induced hazards can be treated. These means are:

1. Avoid the Hazard: Where the potential for failure is beyond an acceptable level of safety during the life of the project and not preventable by practical means, the hazard should be avoided. Developments should be built sufficiently far away from the threat that they will not be affected by potential offsite failures. Proposed development areas at or near the base of unstable slopes should be avoided and relocated to areas where stabilization is feasible;

2. Reduce the Hazard to an Acceptable Level: Several techniques can be used to increase the factor of safety to a level that is acceptable to the local permitting agency. The commonly accepted factor of safety for slopes is greater than 1.5 for static and greater than 1.1 for dynamic loads; and,

3. Accommodate the hazard: Where conditions exist that will cause some measurable amount of strain, engineering techniques based on performance can be used to accommodate the stress. Reducing the hazard may not ensure that the project will remain stable indefinitely; however, the continued success of mitigation often depends on timely inspection, maintenance and ongoing repair.

Current SMGB regulations only recognize approach No. 2 as provided in SP117A. In other words, SMARA requires that all final reclaimed slopes shall have a minimum slope stability FOS that is suitable for the proposed end use. Furthermore, such slopes should be stable as determined by current engineering technology. Other mitigation means, notably, approach Nos. 1 and 3 as provided in SP117A, are considered by some as applicable, or potentially applicable, for failed or unstable slopes encountered at surface mine sites. Such strategies may incorporate end use restrictions, setbacks, placement of berms, catchment basins, and long-term monitoring and maintenance. Despite these efforts, the subject slope remains in an unstable form, and over time, reclamation of such slopes for future development considerations are passed on to the developer, or other party, not the operator that caused the problem in the first place.

If SP117A approach Nos. 1 and 3 were considered applicable, further questions may be raised. For example, would the mine operator realize an unfair advantage since the requirements for reclamation are reduced? Also, would having an avoidance or accommodation mitigation alternative generate an environment where mine operators would use such option as a fallback position, as opposed to mining in a responsible manner so as to avoid creating adverse slope conditions that warrant such consideration? Finally, SP117A approach Nos. 1 and 3 are not reclamation as currently defined in SMARA.



### **EXECUTIVE OFFICER'S FINDINGS:**

- It is the Executive Officer's opinion that any reclamation mitigation alternative that does not improve the gross stability of an unstable mined slope should not be considered feasible and in accordance with SMARA and the SMGB's regulations.
- The SMGB at its May 14, 2009, regular business meeting heard a presentation defining the difference between avoidance, accommodation and hazard reduction, as it pertains to dealing with natural slopes, and reclamation of cut and fill slopes pursuant to SMARA. Alternative 5 is essentially one of avoidance. It remains the opinion of the Executive Officer that Alternative 5 can not be deemed acceptable without first amending the SMGB's regulations, and even then, such amendment would remain inconsistent with the overall intent of SMARA, and thus require a legislative change as well.
- The City of Richmond has expressed a preference for Alternative 2, which incorporates a "Ridge Cut\Fill Buttress Balanced on Site" approach, or a variation thereof, in order to minimize the environmental impacts due to slope repair activities and to provide the opportunity for visual beautification, while still achieving a reclaimed slope that is stable.

### **CONSIDERATIONS BEFORE THE SMGB:** The SMGB has several options for consideration:

- Option No. 1: The SMGB can re-direct this matter back to the Geohazards Committee, in order to further review and discuss the additional trench information provided, and its implications.
- Option No. 2: The SMGB or Committee can also request that the operator conduct further study, which would include adequate trenching across the shear zone, before further consideration. Regardless of such studies, the overall unstable nature of the cut slope remains an issue.
- Option No. 3: The SMGB can direct this matter to the Policy and Legislation Committee, as recommended during its May 14, 2009, regular business meeting, should the SMGB wish to pursue potential regulatory and possibly legislative change, in order for SMARA to incorporate avoidance and/or accommodation as a viable strategy under SMARA.
- Option No. 4: The SMGB can reject Alternative 5 as an acceptable slope mitigation strategy, as it does not meet the current minimum requirements of SMARA and the SMGBs regulations. The SMGB can also direct the



operator to prepare an amended reclamation plan for the site that describes how the slope will be reclaimed to a stable condition with a factor of safety appropriate for the proposed end use(s), in accordance with SMARA and the SMGB's regulations, and adjust the financial assurance, as appropriate.

**EXECUTIVE OFFICER'S RECOMMENDATIONS:** The Executive Officer recommends that the SMGB reject Alternative 5 as an acceptable slope mitigation strategy, as it does not meet the minimum requirements of SMARA and the SMGBs regulations. The Executive Officer further recommends that the Committee direct the operator to prepare an amended reclamation plan for the site that describes how the slope will be reclaimed to a stable condition with a factor of safety appropriate for the proposed end use(s), and adjust the financial assurance, as appropriate.

**SUGGESTED MOTION LANGUAGE:** The SMGB may consider the following motion language:

To accept Option No. 1:

*Mr. Chairman, I move that the SMGB, in light of the evidence presented before the Board today, direct this matter back to the Geohazards Committee, in order to further review and discuss the additional trench information provided, and its implications.*

To accept Option No. 2:

*Mr. Chairman, I move that the SMGB, in light of the evidence presented before the Board today, request that the operator conduct further study, which would include adequate trenching and geological documentation across the shear zone, before further consideration. Regardless of such studies, the overall unstable nature of the cut slope remains an issue.*

To accept Option No. 3:

*Mr. Chairman, I move that the SMGB, in light of the evidence presented before the Board today, direct this matter to the Policy and Legislation Committee, as recommended during its May 14, 2009, regular business meeting, to pursue potential regulatory and possibly legislative change, in order for SMARA to incorporate avoidance and/or accommodation as a viable strategy under SMARA.*

To accept Option No. 4:

*Mr. Chairman, I move that the SMGB, in light of the evidence presented before the Board today, reject Alternative 5, and approve Alternative 1, 2, 3 or 4, or any combination thereof, as adequate to meet the requirements of SMARA and the Board's regulations, and direct the operator to prepare an amended reclamation plan for the site that describes how the slope will be reclaimed to a stable condition with a factor of safety appropriate for the proposed end use(s), and adjust the financial assurance, as appropriate.*

Respectfully submitted:

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Stephen M. Testa  
Executive Officer