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December 3, 2004

Certified Mail #70001670000485163503
Return Receipt Requested

Mr. Keith Ehlert
New Mexico Environment Department
Mining Environmental Compliance Section
P. O. Box 26110
Santa Fe, New Mexico 87502

Dear Mr. Ehlert:

Re: DP-27 Settlement Agreement, Condition 19, Elimination of Discharge to Tailing Impoundments, Municipal Sewage Sludge Report

As required under the New Mexico Environment Department (NMED) DP-27 Settlement Agreement, Condition 18, Phelps Dodge Tyrone, Inc. (Tyrone), submitted a work plan for "Discharge Elimination for Municipal Sewage Sludge." This original work plan was submitted to the NMED on January 12, 2004. Comments to the work plan were received by Tyrone from the NMED on June 12, 2004. Tyrone responded to those comments on July 2, 2004.

As required under the DP-27 Settlement Agreement, Condition 19, Tyrone hereby submits the attached evaluation report pertaining to "Discharge Elimination for Municipal Sewage Sludge."

Tyrone will continue communicating with the Town of Silver City to stay aware of the sludge management issues that they face in relation to the conclusions presented in this document. Tyrone will evaluate any opportunities for flexibility on timing that may be of benefit to the town in this transition.

If you need further information, please contact Mr. Chuck Thompson at (505) 538-7181.

Very truly yours,

E. L. (Ned) Hall, Manager
Environment, Land & Water
New Mexico Operations

ELH:ct
Attachment
20041203-102

c David Ohori, MMD
GRIP
CEGEP

ANALYSIS FOR DISCHARGE
ELIMINATION OF MUNICIPAL SEWAGE SLUDGE
TAILING DAM 3

DP-27 Settlement Agreement, Paragraph 18

Prepared by:
Phelps Dodge Tyrone, Inc.
Tyrone, New Mexico

December 2, 2004

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1.0 INTRODUCTION

Phelps Dodge Tyrone, Inc (Tyrone) is submitting this document in partial fulfillment of the requirements of Paragraph 18 (Elimination of Discharges to Tailing Impoundments) of the Settlement Agreement and Stipulated Final Order dated October 11, 2003 for Discharge Permit 27 (DP-27) for the Tyrone Mine tailing area. Specifically, this document addresses item number 5 of Paragraph 18 of the Final Order, which relates to sewage sludge (biosolids) from the Town of Silver City (Silver City). The objective of this document is to present Tyrone's preferred alternative for addressing the biosolids issue on Tailing Dam 3. The study reported herein was conducted in accordance with the *Discharge Elimination Work Plan for Municipal Sewage Sludge Tyrone Mine Facility* submitted by Tyrone (PDTI, 2004) and subsequent correspondence with the New Mexico Environment Department (NMED).

The selected alternative would need to be implemented before construction (reclamation) begins on the Tailing Dam 3. Construction (reclamation) is expected to begin in the second to third quarter of 2005. Therefore, each option would require that sludge deliveries cease or alternative sludge management options be incorporated in a time period ranging from the fourth quarter of 2004 to the first quarter of 2005.

1.1 Background

Tyrone was authorized by the NMED, through DP-27, to place biosolids from Silver City on Tailing Dam 3. The biosolids were to be placed on the tailing dam in conjunction with closure studies for the tailing impoundments.

Tailing Dam 3 covers an area of approximately 440 acres, of which about 12 to 20 acres have received biosolids applications. Silver City began delivering digested municipal sewage sludge in June of 1992 and continues through the present. Biosolids deliveries over the last five years have ranged from about 670 to 1,050 cubic yards per year. The sludge application area is secured from public access and runoff is contained on the tailing impoundment top surface.

The sludge is tested by Silver City to ensure that Environmental Protection Agency (EPA) standards for land application of sewage sludge are met. The test data revealed that while the metals copper, cadmium, molybdenum, zinc, lead, nickel and mercury were present, they were within the limits allowed by EPA in the Silver City permit for land application.

Tyrone understands that the NMED would require additional studies if the sludge is applied to the reclaimed lands. At a minimum, this requirement would involve changes to the approved test plots program scheduled for construction in the summer of 2005 (Letter from Keith Ehlert/NMED May 27, 2004).

1.2 Response of Native Ecosystems to Sewage Sludge and Fertilizers

Sewage sludge contains important fertilizer elements for plant growth and its use has been demonstrated in agricultural contexts. The response of native vegetation to inorganic fertilizers (N and P) has been documented for selected species and environments (Smika et al., 1965; Power and Alessi, 1971; Aldon et al., 1975; McGinnies and Nicholas, 1980; Halvorson and Bauer, 1984). Much of this research has emphasized grass production under pasture and greenhouse conditions. Thus, fertilizer-response of non-commodity species in semi-arid ecosystems is generally lacking (Turner, 1979).

Biomass production generally increases with the addition of fertilizers, though the response is species-specific, and may occur only in combination with environmental manipulation (e.g., thinning or irrigation). Positive responses to fertilizers are typically realized only when soil moisture levels are adequate to meet the increased growth associated with the fertilizer additions (Smika et al., 1965; Carpenter and West, 1987). Mixed element formulations (N, P, and S) [e.g. sludge] are more likely to produce an increase in biomass than single or double element formulations. The magnitude of the response depends on a large number of factors including soil chemical and physical properties, fertilizer formulation, weather conditions, and plant composition and growth stage.

Concentrating solely on biomass may obscure the subtle impacts of fertilization, since the additions of N, P, K, and S have been implicated in shifts in plant community species composition, differences in winter hardiness and seed production, forage quality, soil microbial activity, and disease and pest resistance (Black and Wight, 1979; Ebelhar et al., 1982; Halvorson and Bauer, 1984).

While fertilization may increase productivity in established stands, the efficacy of fertilization to promote diverse, self-sustaining stands of native vegetation is equivocal (Goodman, 1973; Stark and Redente, 1985; Carpenter and West, 1987; McGinnies and Crofts, 1986). In general, pre-emergence fertilization is not recommended for the rehabilitation of disturbed lands since it does not improve plant emergence and tends to promote the growth of weedy annuals that compete

with the desired perennial species (Huffine and Elder, 1960; Goodman, 1973; McGinnies and Crofts1986). Shifts in species composition have been noted in grassland fertilization studies (Kipple and Retzer, 1959; Cosper and Thomas, 1961; Huffine and Elder, 1960; Lorenz and Rogler, 1972 and 1973; Rauzi et al. 1968). Cool season grasses and forbs are generally favored by fertilization at the expense of warm season grasses in environments where soil moisture levels are high early in the growing season. Native salt-desert shrubs are typically adapted to soils with low inherent fertility and may not respond to fertilization (Goodman, 1973). Thus, competitive relationships may operate in grass-shrub communities since N fertilizers tend to promote grass production and have little apparent affect on native shrubs.

Long-term studies of sewage sludge applications to reclaimed lands indicate that the effects are short-lived. According to Benefeldt et al. (2001) the use of organic amendments, like sewage sludge, initially improved organic matter content, total N, potentially mineralizable N, aggregate stability, and other soil properties. However, after 16 years, there were no apparent lasting soil quality improvements due to sewage sludge amendments compared to the control treatment, which received no organic amendments. Thus, they concluded that applying sludge is difficult to justify considering the cost of transporting and applying these materials based on the lack of evidence for permanent improvements in soil quality compared with that achievable with vegetation alone (Benefeldt et al., 2001).

2.0 ALTERNATIVE ANALYSIS

Tyrone identified three alternatives for eliminating the discharge of biosolids and/or managing biosolids from Silver City including, 1) terminate sludge deliveries from Silver City, 2) land application for mine reclamation, and 3) land application/disposal at other Tyrone sites (PDTI, 2004). The following paragraphs describe the sludge management alternatives proposed by Tyrone in more detail.

Alternative I: Terminate Sludge Deliveries

This alternative involves terminating the agreement with Silver City to accept sludge deliveries at Tyrone. This option would require Silver City to develop alternative plans for managing the municipal sludge.

Alternative II: Land Application for Mine Reclamation

The EPA Biosolids Rule (40 CFR Part 503) allows land application of biosolids for beneficial uses on mine reclamation lands (EPA, 1993). Under this alternative, biosolids would be used as an amendment for the covers on the tailing impoundments and stockpiles.

Alternative III: Land Application/Surface Disposal at Other Tyrone Sites

The EPA Biosolids Rule allows five options for surface disposal of biosolids which may or may not have beneficial uses. This alternative would involve the surface disposal of biosolids in the mine pit(s), on the stockpiles or tailing impoundments, or land application on rangelands outside the mine area.

2.1 Feasibility Assessment

Tyrone compared the feasibility of the biosolids disposal alternatives with respect to the five major criteria including closure schedule, environmental considerations, permitting requirements, reclamation success, and costs. These criteria are discussed below for the three alternatives. Sludge was originally land applied at Tyrone with the intent of promoting revegetation of reclaimed lands. The criteria are viewed hierarchically, with greatest weight given to the potential impacts on vegetation success and Tyrone's ability to meet the reclamation schedules required by DP-27 and DP-1341. The alternatives analysis discussed below is summarized in Table 1.

2.1.1 Reclamation Success and Subsequent Bond Release

Alternative I:

Terminating sludge applications will have no impact on reclamation success or bond release.

Alternative II:

As discussed in Section 1.2, shifts in species composition may occur in reclaimed plant communities as a result of the competitive interactions associated with differential response of species to fertilizer elements. Under this scenario the trajectory of short- and mid-term plant community development may be negatively affected by fertilizer or sludge applications. These effects are likely to negatively affect the ability to meet plant diversity requirements for bond release. Furthermore, pre-plant applications tend to promote the growth of weedy annuals (i.e., Russian thistle), which compete with perennial species and threatens reclamation success.

Alternative III:

Implementing a surface disposal option, where sludge is applied directly to the stockpiles or tailing impoundments, will not benefit vegetation because the sludge would be buried during regrading and subsequent covering of the facilities. Deep burial for the fertilizer components of the sludge are not expected to affect vegetation responses as discussed above, thus, this option will not impact bond release.

2.1.2 Permitting Requirements

The continued application or disposal of sludge will increase regulatory permitting and reporting requirements and coordination activities. In general, changes in the location of sludge application will result in the need for Tyrone to modify applicable discharge permits. In all cases, Silver City will be required to change its existing permit for sludge management in addition to the permitting requirements discussed below.

Alternative I:

Termination of sludge applications at Tyrone will not result in any additional permitting requirements for Tyrone. Silver City will incur additional permitting requirements to accommodate a change in sludge management depending on options it would pursue.

Alternative II:

This alternative would require modification of one of Tyrone's existing discharge plans. In addition, Silver City will incur additional permitting requirements associated with a change in disposal location. For example, if the application is to an area of a stockpile, which is covered by an existing discharge plan, that plan would need to be modified accordingly. The modification process, from Tyrone's experience, would take a considerable amount of time. It is not clear that the NMED would approve a modification without additional information indicating that the discharge of the sludge would not cause an exceedance of groundwater standards. Providing the type of information that NMED may need could take a considerable amount of time. According to NMAC 20.6.2.3106, a discharge plan modification would require a public notice period, technical and administrative review by the NMED Groundwater Bureau and public review. The public review could potentially include a public hearing and comment period before a final determination.

Land application of biosolids on reclaimed areas, as indicated by the NMED in the May 27, 2004 letter, would also require a modification of the scope of the test plot work plans and the designs that have been submitted for the test plots at Tyrone under DP-1341 and Tyrone's Mining Act permit GR010RE. The estimated time to obtain meaningful data from the test plot studies is about 5 to 10 years. Tyrone has started construction of the test plots for the tailing impoundments and will not be able to defer construction to accommodate additional plots to evaluate biosolids.

The time constraints associated with the modification of an existing discharge plan and the test plot work plans would present delays that would adversely affect the timing of reclamation activities associated with the accelerated reclamation plan under DP-27. As mentioned previously, the selected alternative would need to be implemented before construction (reclamation) begins on the Tailing Dam 3. Construction (reclamation) is expected to begin in the second to third quarter of 2005. Therefore, there is insufficient time to modify an existing discharge plan permit and remain on schedule with the current reclamation project. Ultimately, the application of sludge would increase regulatory reporting requirements and coordination activities.

Alternative III:

Because DP 27 was denied renewal by NMED, Tyrone does not believe that it can get a permit from NMED to discharge biosolids to another tailing dam as an interim measure. There is not a provision under the DP 27 settlement agreement to transfer placement of biosolids to another

tailing impoundment on a temporary basis. Placing biosolids on another tailing impoundment is dismissed as being infeasible for these reasons.

Tyrone considered other locations such as pits or stockpiles. Examples of potential land disposal sites for biosolids at Tyrone are the No. 1 Leach Stockpile, the South Rim Pit and the 1C Waste Stockpile. All of these areas are subject to one or more discharge permits. Tyrone does not believe that land application at any of these mine areas would be approved in a timely manner under discharge permit requirements. Additionally, Tyrone has concerns about how disposal of biosolids at these sites would affect mine operations and be accomplished safely.

Tyrone considered land application of sewage sludge to surrounding range lands. This option is more attractive from an operational perspective, since it wouldn't interfere with mine operations; however, Tyrone expects that this would require the creation of a new discharge permit and possibly a new stormwater permit. The timing for application for and approval of new permits to accomplish this alternative is expected to be even longer than a modification of an existing discharge permit.

Again, the time constraints associated with the modification of an existing or development of an application for a new discharge plan, and revisions to work plans (if a land application option is selected) would present delays that would adversely affect the timing of reclamation activities associated with the accelerated reclamation plan under DP-27.

2.1.3 Closure Schedule

Reclamation activities are scheduled to begin on Tailing Dam 3 in early 2005 with final cover and reseeding scheduled for the summer of 2006. Sludge applications to Tailing Dam 3 must be terminated prior to construction in the sludge application area.

Alternative I:

Implementation of Alternative I will not hinder progress towards meeting the accelerated reclamation schedule required by DP-27.

Alternative II:

As discussed above, changing the location or form of sludge application would require modifying or revising the discharge permit for the area of application. The time involved in modifying the permit is likely to result in delays in the construction progress for Tailing Dam 3 and/or other

facilities. In addition, NMED has requested that studies be conducted if sludge is land applied to the reclamation areas and Tyrone understands these comments to also apply to other mine areas in Alternative III. Tyrone assumes that the land application of sludge would not be authorized by NMED until the test plots yield meaningful results. Based on the current schedule, test plots results are not expected until about 2011. Thus, the schedule for permitting and demonstration of the sludge effectiveness is inconsistent with the accelerated reclamation schedule for DP-27.

Alternative III:

Surface disposal of sludge on the stockpiles or other tailing impoundments would require modification of an existing discharge permit, whereas, surface disposal to rangelands would likely require the development of a new discharge permit. As indicated above, a significant amount of time is expected to be required for permitting, which may affect Tyrone's ability to meet the accelerated reclamation schedule for DP-27.

2.1.4 Environmental Considerations

Biosolids can be safely applied if implemented according to the EPA Biosolids Rule and applicable State regulations. The EPA Biosolids Rule specifies allowable loading rates and provides guidance on the use of sludge in land application and disposal scenarios. Recent studies indicate that the risk guidance for land applications are conservative and provide for safe application of the sludge (Granato et al., 2004).

Alternative I:

Environmental considerations are minimal under the implementation of Alternative I.

Alternative II:

Environmental considerations associated with surface water runoff and groundwater impacts are expected to be minimal if sludge is applied in a manner consistent with the EPA Biosolids Rules.

Alternative III:

Surface disposal can be safely implemented if conducted in accordance with the EPA Part 503 Biosolids Rules. The rules specify loading rates, consider groundwater conditions, and require surface water, pathogen, and vector controls. Furthermore, public and livestock access is restricted to disposal sites.

2.1.5 Cost of Implementation

The application of sludge to the reclaimed lands will result in increased costs associated with additional studies required by NMED, increased regulatory coordination, and the actual application of the materials. Detailed engineering designs and costs of the three alternatives were not prepared because the evaluations for other criteria indicated that the detailed costs were not required to reach a conclusion. Thus, cost issues are discussed only from a general perspective.

Alternative I:

The costs for Tyrone associated with implementation of Alternative I are minimal and mainly involve coordination with Silver City to facilitate the transition of sludge management to another facility. Clearly, termination of the biosolids deliveries to the tailing may result in increased costs for the town of Silver City and Tyrone is aware of and sensitive to this issue.

Alternative II:

The costs associated with Alternative II are substantial and involve time and resources for permitting and additional studies. Additional costs beyond what Tyrone experiences now in biosolids management would be associated with the application and incorporation of the sludge on the reclaimed lands.

Alternative III:

The costs associated with Alternative III are substantial and involve time and resources for permitting, site selection studies, and long-term record-keeping to meet the requirements of EPA Biosolids Rule for surface disposal.

For disposal of biosolids in operational areas, Tyrone would have to consider the costs of loss stockpile capacities and increased safety management requirements to accommodate biosolids disposal areas. The permitting costs are significant also in relation to this issue because mine plans change so much that it is likely that Tyrone would have to request repeated modifications of permits to move the disposal area.

3.0 CONCLUSION

Tyrone has evaluated three alternatives for the management of Silver City sludge at the Tyrone mine. This analysis was based on five criteria, which considered 1) vegetation performance, 2) permitting requirements, 3) ability to meet closure schedules, 4) environmental impacts, and 5) costs. Vegetation performance, permitting issues, and the ability to meet the required reclamation schedules are the primary determining factors. The schedule of implementation of the alternatives is strongly influenced by permitting requirements. Environmental considerations and costs were considered more casually because the overriding factors resulted in a determination that the best available alternative was to work with Silver City to find another location for sludge management.

Tyrone rejected alternatives II and III, which involve the land application or disposal of sludge at Tyrone. Alternative II was rejected primarily because it is not likely to benefit revegetation in the long-term and may result in negative impacts associated with achieving plant diversity requirements and subsequent bond release. Secondarily, the sludge application would result in increased regulatory coordination and costs. Alternative III was eliminated primarily because permitting requirements are expected to result in conflicts with meeting the accelerated reclamation schedule prescribed by DP-27. Thus, the preferred alternative for biosolids management is to terminate deliveries from Silver City. Tyrone has notified the Silver City utility director of these conclusions. Tyrone understands that Silver City is evaluating alternatives for sludge management.

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TABLE 1: SUMMARY OF ALTERNATIVES ANALYSIS FOR SEWAGE SLUDGE DISPOSAL OPTIONS

Alternative	Reclamation Success and Bond Release	Impact on Closure Schedule	Permitting Requirements	Environmental Considerations	Cost
I. Terminate Deliveries	None	Not expected	None	None	Minimal
II. Land Application	Decreases in reclaimed plant community diversity may jeopardize meeting diversity standard for bond release. Increase of weedy annuals may impact perennial plant establishment. No long-term benefits for revegetation are likely.	Delay the construction schedule tailing dam closure. 5 to 10 year delay associated with land application demonstration to gain approval for biosolid application.	Modification of Discharge Permit required.	None	Moderate
III. Surface Disposal	Eventual burial of sludge during construction should not affect reclaimed plant community.	Tailing Dams – conflicts with accelerated closure schedule of DP-27. Stockpiles – no foreseen impact on closure schedule.	Modification of Discharge Permit required or new Discharge Permit may be required for range land application.	None	High