HOMESTAKE MINING COMPANY

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September 15, 1989

TRACKING NO. 1185 3208 557

Mr. Ray Hall, Director
Uranium Recovery Field Office
U.S. Nuclear Regulatory Commission
730 Simms Street, Suite 100
Lakewood, Colorado 80225

Re: License No. SUA-1471
Amendment Request

Dear Mr. Hall:

Homestake Mining Company of California (Homestake) takes this opportunity to request an amendment to their Radioactive Materials License No. SUA-1471. Along with this request, also please find a check for $150.00, pursuant to the NRC regulations, for your review of Homestake's proposal.

Homestake hereby requests an amendment to License Condition No. 35 concerning their ground water protection and restoration program. During the Homestake/NRC meeting of August 17, 1989 concerning this same subject, you indicated that, if Homestake could provide you with a legal means of allowing NRC not to have to set the "point of compliance" at the toe of the tailing pile and some site specific reasons why the point of compliance could be further away than the immediate toe of the pile, you would have your staff seriously consider our request for an amendment.

The following discussion is a brief summary of two basic reasons why the NRC has the flexibility to locate the point of compliance beyond the toe of the pile.

First, as the NRC has noted, EPA's uranium byproduct regulations at 40 C.F.R. 192 do not provide any definition of the term "point of compliance." Nor do these regulations incorporate by reference any definition of the term "point of compliance." See 48 Fed. Reg. 45926, at 45942 (Oct. 7, 1988): see also 52 fed. Reg. 43553 at 43555, 43557 (November 13, 1987). Therefore, the NRC is not required to use any specific definition for point of compliance in its own implementing regulations at 10 C.F.R. Part 40, Appendix A. In fact, the NRC's regulations provide their own definition of point of compliance as " the site specific location where the groundwater protection standard must be met" (10 C.F.R. Part 40,

Appendix A). Furthermore, these regulations allow the NRC to "adjust" the point of compliance in accordance with site specific data regarding the presence and flow of contaminants. Id. at Criterion 5.

Second, Section 84(c) of the Atomic Energy Act, as amended (42 U.S.C 2114(c)) specifically authorizes the NRC to approve licensee proposed, site specific alternatives to both the EPA and the NRC regulations. Furthermore, these site specific exemptions from the EPA and NRC regulations need not achieve a level of protection equivalent to the EPA and NRC regulations when doing so would not be practicable. As explained by the NRC Office of General Counsel in a 1985 Memorandum to the Commissioners:

> ....EPA is incorrect in asserting that licensee proposed alternatives approved by the NRC must provide the same level of containment, stabilization and protection of health and the environment as provided by existing NRC requirements and EPA standards. Section 84c explicitly states that NRC may approve alternatives which, to the extent practicable, would achieve safety levels equivalent to those which would be achieved by compliance with NRC's requirements and EPA's standards. Thus the NRC is authorized to approve an alternative which does not provide the same level of protection of public health which would be achieved if EPA's standards were complied with fully."

Memorandum from Herzel Plaine, General Counsel, U.S. NRC, to the NRC commissioners re: Uranium Mill Tailings -- Jurisdictional Bases for EPA's Standards. SECY-85-125 (April 10, 1985). (Emphasis added.)

This interpretation of Section 84(c) was confirmed by the United States Court of Appeals for the 10th Circuit in Environmental Defense Fund v. United States Nuclear Regulatory Commission, No. 86-1235 (Jan. 27, 1989). The courts ruling is directly on point:

> We hold only that AEA 84(c), 42 U.S.C. 2114(c), allows the NRC to approve licenses containing site specific alternatives to EPA's general standards; that the power to approve such licenses exists when literal compliance with the EPA's general standards is not practicable; and that in approving such licenses the NRC need not obtain EPA's concurrence. id. at p. 16.

Thus, it is clear that the NRC may approve site specific, licensee proposed alternatives to the EPA and NRC requirements.

Regardless of the content of either EPA or NRC regulations, the Commission retains the authority to approve licensee proposed site specific alternatives. This authority exists independent of the NRC's obligation to promulgate regulations that "conform" to the EPA standards. Thus, the NRC has the authority under AEA Section 84(c) to approve a point of compliance at some other location than the toe of the tailing pile.

We have examined this question of NRC's flexibility regarding the point of compliance in considerable detail. Should you have any further questions regarding this issue, we would be glad to provide you with a more detailed response.

The main purpose of the point of compliance for the Homestake site is not to detect new seepage, because the hazardous constituent migration at this site is already well defined. The purpose that these points of compliance will serve is to determine if any significant concentrations are migrating down-gradient of the site after restoration. Points of compliance that account for some of the natural cleaning that occurs in ground water is reasonable to be used for this particular site. For example, a small amount of selenium should be able to seep from the reclaimed tailings as long as the selenium is naturally tied up by the alluvium prior to reaching the points of compliance. If the point of compliance is very near the tailings, the benefit of the natural cleansing process cannot be used. Homestake's proposed point of compliance would allow for several years to initiate additional remediation if the points of compliance demonstrate a hazardous constituent movement.

The area near the tailing piles will be greatly disturbed as surface reclamation occurs. Maintaining wells in the area will take additional significant effort. A large part of the area, just south of the tailing pile, will likely be used for lined evaporation ponds. Wells in the area of the ponds will be difficult to maintain and sample. It is Homestake's opinion that the points of compliance should be same during and after aquifer restoration. We, therefore, propose wells WR11, WR7, B, PM, Y and CW4 because they should be adequate points of compliance for the long term.

Pursuant to the regulatory and statutory right and the site specific reasons cited above, Homestake hereby formally requests that their Radioactive Materials Licence Condition No. 35 be amended to read as follows:

35. The licensee shall implement a compliance monitoring program containing the following:

A. Sample wells WR11, WR7, PM, B, Y and CW4 on a quarterly frequency for water level, SO4, uranium and selenium, and sample wells WR11, WR7, B, PM, Y, P and CW4 on a semi-annual frequency for chromium, molybdenum, radium-226 and

228, selenium, thorium-230, uranium, vanadium, TDS, pH, S04, C1, HC03, C03, Na, Ca, MG, K and N03. Additionally, the volumes of water injected and recovered as part of the ground-water cleanup program shall be monitored and the values documented quarterly.

B. Comply with the following ground-water protection standards at point of compliance wells WR11, WR7, B and PM for the alluvium and CW4 for the Upper Chinle for the Active Tailings and well Y for the alluvium and Well CW4 for the Upper Chinle for the Inactive Tailings with background recognized in Well P.

Chromium = 0.06 mg/l, molybdenum = 0.03 mg/l, selenium = 0.10 mg/l, vanadium = 0.02 mg/l, uranium = 0.04 mg/l, radium-226 and 228 = 5.0 pCi/l and thorium-230 = 0.30 pCi/l.

The average of the concentrations among the point of compliance wells will be used in compliance determination.

C. Implement the September, 1989 Corrective Action Program (included in letter of September 15, 1989) with the objective of returning the concentrations of chromium, molybdenum, selenium, thorium-230, uranium and vanadium to the concentration limits specified in Subsection (B). The corrective action program shall be fully operational by November 1, 1990.

D. Determine the extent and concentration of hazardous constituents in the uppermost aquifer. An areal extent evaluation shall be submitted to the NRC by January 31, 1990.

Pursuant to your letter of May 18, 1989, please find included in this submittal two copies of Homestake's proposed Corrective Action Program for ground water protection and restoration pursuant to 10 CFR 40, Appendix A, Criteria 5. This Corrective Action Program includes an extensive ground water monitoring program that has been designed to be sufficient to characterize the entire site.

An evaluation of the areal extent and concentration of hazardous constituents that meets with the intent described in Criterium 5B (2)(a,b and c) shall be submitted to the Uranium Recovery Field Office by January 31, 1990 pursuant to our agreement reached at the meeting of August 17, 1989.

In Homestake's March 15, 1989 submittal to the NRC, an apparent analytical incongruence with chromium was evident. Further analysis indicates that the analyses performed by Barringer Laboratories are suspiciously high. Homestake conducted a second set of comparative analyses for chromium with a different outside

contract laboratory. Below, please find the results of comparative analyses performed by Homestake's analytical laboratory and the contract laboratory, Controls for Environmental Pollution (CEP):

Chromium Concentration (mg/l) 7-17-89

Well	HMC	CEP
DB	0.03	0.04
DE	0.02	0.04
DG	0.03	0.04
SA	0.03	0.01
SB	0.02	0.02
SV	<.01	0.05

In previous discussions, the NRC has recommended that Homestake evaluate the potential for removing some of the hazardous constituents from their recycle water to enhance the ground water cleanup effort. Since the meeting held in Santa Fe earlier this year, Homestake has been working toward that end. Homestake's ion exchange system has recently been modified to divert the back-wash water, carrying brine solutions and some heavy metals (molybdenum and vanadium), to a lined evaporation pond rather than back into the tailings system.

In addition, Homestake is currently evaluating a new experimental water treatment pilot plant where, under triple-point vacuum pressurization, tailing solutions may be able to be stripped of significant portions of salts and heavy metals. If found to be economically viable, this system may provide a good means of reducing hazardous constituent concentrations in Homestake's recycle waters.

We take this opportunity to thank you in advance for your consideration of this proposal. If you have any questions or comments concerning this matter, please don't hesitate to contact me.

Very truly yours,

HOMESTAKE MINING COMPANY

Edward E. Kennedy

Edward E. Kennedy
Director of Environmental
Affairs

EEK/bgl

xc: F.R. Craft
~~M.D. Hiles~~
G.L. Hoffman
D.B. Crouch
D. Slifer (EID)

CORRECTIVE ACTION PLAN

FOR

HOMESTAKE'S TAILINGS

PREPARED FOR:

HOMESTAKE MINING COMPANY

BY:

HYDRO-ENGINEERING

September, 1989

GEORGE L. HOFFMAN, P.E.

HYDROLOGIST

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Two ground-water systems (San Mateo alluvium and Upper Chinle) have been affected by seepage from the Homestake site. The extent of some of the hazardous constituents in these two aquifers have been defined in the past. Sampling of all of the hazardous constituents identified for the Homestake site is scheduled to be completed this Fall and is due for submittal to the NRC by January 31, 1990. Site standards have been set for the alluvial aquifer and are presented in Homestake's License Condition No. 35. These same site standards are proposed for the Upper Chinle because this aquifer is recharged by the alluvial aquifer in this area.

Wells WR11, WR7, PM and B are proposed as the points of compliance for the alluvial aquifer for the Active Tailing. The alluvial point of compliance for the Inactive Tailing is well Y. The point of compliance for the Upper Chinle aquifer for both the Active and Inactive Tailings is well CW4. These wells were selected because they are between the injection and collection systems and are appropriate to demonstrate whether the ground water is being restored. They are also located where detection of hazardous constituents would occur nearly three years prior to reaching Homestake's property boundary after all corrective actions have stopped. These points of compliance are therefore adequate for early detection of constituent migration at this site.

The collection of elevated concentrations and the injection of fresh water are the main corrective actions to restore the

ground-water in the San Mateo alluvium and the Upper Chinle. The collection wells adjacent to the Active Tailing Pile are used to collect the present day seepage from the Active tailings and used in conjunction with the fresh water injection system to intercept constituents that are between the injection and collection systems. Collection to the northeast of Murray Acres and south of the Inactive Tailings area will occur until the elevated concentrations in these areas are removed.

Injection at Murray Acres has reversed the gradient all the way back to the tailing collection wells and probably will be operated at this location for the life of the Murray Acres injection system. Some of the injection just north of Broadview Acres will be moved to wells GW1 and GW3 in the near future to increase heads in this area of the alluvial aquifer which will reverse the gradient farther to the north. After concentrations in wells E, Z, and JC are reduced to low levels, injection will be moved to this area. A horizontal drain will likely be used along with the injection wells. Injection will probably be moved farther to the north near the K line of wells at the south edge of the Inactive Tailing Pile when concentrations have been lowered to increase the gradient father to the north.

The Upper Chinle injection into well CW5 has reversed the gradient between Broadview Acres and the tailing collection wells. This injection should be adequate to restore the concentrations in the Upper Chinle aquifer.

The monitoring program for the State (EID) has been modified herin to account for the NRC hazardous constituent monitoring. Homestake will attempt to get the EID to accept these changes in their monitoring program after the NRC approval, so that both programs are identical.

2.0 INTRODUCTION

This report presents the corrective action plan for the Homestake tailings facilities, as required by the Nuclear Regulatory Commission (NRC) by license Condition No. 35. Two ground-water systems have been affected by seepage at this site and, therefore, corrective action is outlined herin for the San Mateo alluvial and Upper Chinle aquifers. Homestake started corrective action at this site in 1977. Drawing 2-1 presents the location of the corrective action system at this site.

The extent of hazardous constituents, site standards, proposed points of compliance and restoration methods are presented for each of these aquifers. The monitoring program approved by the New Mexico Environmental Improvement Division (EID), in their renewal of Homestake's ground water discharge plan (DP-200) was modified to account for the hazardous constituent monitoring and is proposed as the NRC monitoring plan (see Drawing 2-1 for well locations). The adjustments in monitoring will be proposed to the EID after agreement with the NRC is obtained.

3.0 SAN MATEO ALLUVIAL AQUIFER

The upper most aquifer at the Homestake site is the San Mateo alluvial aquifer. The hydrology of this system was defined in Hoffman (1976) and Hydro-Engineering (1988). Water level and water quality data has also been presented in numerous monitoring reports.

3.1 EXTENT OF HAZARDOUS CONSTITUENTS

Some of the hazardous constituents (molybdenum, selenium, uranium and radium-226) have been routinely defined at this site and the areal extent presented. Drawings 4.6-3, 4.6-4 and 4.6-5 of Hydro-Engineering (1988) present the concentrations and areal extent of the uranium, selenium and molybdenum concentrations, respectively. Figure 4.6-55 of Hydro-Engineering (1988) also presents the radium 226 concentrations.

These hazardous constituents and chromium, vanadium, radium 228 and thorium 230 will all be monitored in the fall of 1989 to define the areal extent of all of the hazardous constituents. These results will be presented in the annual report due on January 31, 1990.

3.2 SITE STANDARDS

The site standards for the hazardous constituents at the Homestake site are as follows:

Chromium	= 0.06 mg/l	Vanadium	= 0.02 mg/l
Molybdenum	= 0.03 mg/l	Uranium	= 0.04 mg/l
Selenium	= 0.10 mg/l	Thorium-230	= 0.3 pCi/l

Radium-226 + Radium-228 = 5.0 pCi/l

These site standards were established by averaging the December 1988, January 1989 and February 1989 concentrations from background well P. Higher natural concentrations exist in some of the other background wells. For example, the average uranium concentration from background well DD was 0.17 mg/l.

Restoration of uranium concentrations in Broadview Acres from the fresh water injection has greatly lagged behind the other constituents in declining to the injection concentration. For example, selenium concentrations at several wells have reached the injection concentration several years before the uranium concentrations. Uranium concentrations that were absorbed to the alluvium are being leached by the fresh water from the alluvial material. The lag in restoration of uranium may necessitate ACL's for this constituent.

3.3 PROPOSED POINTS OF COMPLIANCE

The proposed points of compliance for the active tailing pile are wells WR11, WR7, B and PM.

Well Y is proposed as the point of compliance for the Inactive tailing pile. These wells were selected to be points of compliance because they are between the fresh water injection systems and the tailing collection wells and are far enough from the property boundary to allow early detection.

Well B is the closest of these compliance wells to Homestake's property boundary. Well B is approximately 700 feet from Murray Acres. The present ground-water gradient is from Murray Acres toward the tailing collection wells. After ground-water

restoration the ground-water gradient is expected to return back to the southwest (B to Murray Acres) at a level similar to that observed prior to the implementation of the remediation systems. The ground-water velocity in this area was estimated to be 0.7 ft/day prior to the operation of the injection and collection systems. This indicates that it will take approximately three years for water to move from well B to the Homestake boundary. These points of compliance are far enough from Homestake's property that adequate time would be available to make adjustments in the corrective actions, if needed.

3.4 PROPOSED METHOD OF RESTORATION

The San Mateo alluvial aquifer is being restored by using collection wells to remove present day seepage while, at the same time, fresh water injection is being used to push constituents down gradient of the tailing back to the collection wells to be intercepted. Drawing 2-1 presents the locations of the collection well lines S and D. The S collection wells presently consist of wells SA, SB, SC, SD4, SE, SQ, SR, SS, ST, SU and SV, while wells DA2, DB, DE, DF, DG, DH, DS, DX and DV are the D collection wells presently being operated.

The collection wells which are being pumped vary with time due to well-specific operational problems. The collection wells are re-developed if their yields greatly decline and are replaced if the production is not recoverable. Additional collection is occurring away from the active tailing at wells WR3, WR5, E, J and JC. Collection at these wells will last until the concentrations

in these areas approach the site standards. Wells E, Z and JC will be switched to injection wells when their concentrations reach the site standards.

The injection systems are the other major component to the restoration of the alluvial aquifer. San Andres water from deep wells 1 and 2 is injected into the Broadview Acres injection wells to push the elevated concentration water in this area back toward the collection wells. The present Broadview Acres injection wells are G, GA, GB, GC, GD, GE, GF, GG, GI, GJ, GKL, GL, GM, GN, GO and GP. These wells have been re-developed several times to maintain their injection rates. This injection has effectively restored the alluvial aquifer to just south of wells E and Z but are limited in their ability to reverse the gradient farther to the north. Some of the Broadview Acres injection is being shifted to the north in wells GW1, GW2 and GW3 and, therefore, some of the injection into the wells just north of Broadview Acres will be decreased. Injection wells just north of Broadview acres which lose some of their injectivity will probably be acceptable in the future. Injection into wells GW1, GW2 and GW3 (see Drawing 2-1), will start in the near future if the concentrations in this area meet the State standards. The injection into wells GW1, GW2 and GW3 and the horizontal drain between the injection wells will be used to increase heads in this area to reverse the gradient farther to the north. This injection is expected to be moved to wells E, Z and JC after their concentrations reach the State standards. An additional step of this injection farther to the north near the K

line of wells may be necessary to develop an adequate reversal between the collection wells and this injection.

The Murray Acres injection system has been very effective in reversing the gradient between these collection wells and the tailing pile. The Murray Acres injection system currently consists of injection wells MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, WR2, WR12, WR13, WR14 and WR15. The last two samples from collection well AW indicate that concentrations are to the State standards and therefore this well will be shortly switched to a Murray injection well. The San Andres water from the #1 and #2 wells will be used if the ACW water is not able to be used for injection into AW.

3.5 RESTORATION PROGRAM AND SCHEDULE

The alluvial aquifer restoration will be restored by collection of the elevated concentrations with the aid of fresh water injection. A large portion of the uranium concentrations are removed from the collected water by ion exchange in the mill. This process also effectively removes a significant amount of the molybdenum because it concentrates on the resin and is pumped to the lined evaporation pond during the back washing of the resin. A review of the hazardous concentrations which have been routinely monitored at this site near the active tailing pile show that each of these constituents have declined since the collection system has been in operation.

4.0 UPPER CHINLE AQUIFER

The hydrology of the Upper Chinle aquifer near Homestake's tailing facilities was defined in Hydro-Engineering (1981) and Hydro-Engineering (1988). Water quality data for the Upper Chinle aquifer has been presented in numerous monitoring reports.

4.1 EXTENT OF HAZARDOUS CONSTITUENTS

Some of the hazardous constituents (molybdenum, selenium, uranium and radium-226) have been routinely defined at this site. Figures 5.5-8 and 5.5-12 of Hydro-Engineering (1988) present the uranium and selenium concentrations respectively for the Upper Chinle aquifer. These hazardous constituents and chromium, vanadium, radium-228 and thorium-230 will all be monitored in the Fall of 1989 to define areal extent of all of the hazardous constituents. These results will be presented in the annual report due on January 31, 1990.

4.2 SITE STANDARDS

The site standards for the hazardous constituents for the Upper Chinle aquifer at the Homestake site are the same as the alluvial standards because the alluvium recharges the Upper Chinle in this area.

4.3 PROPOSED POINT OF COMPLIANCE

Upper Chinle well CW4 is proposed as the point of compliance for the Active and Inactive tailings.

4.4 PROPOSED METHOD OF RESTORATION

The Upper Chinle aquifer is being restored by injecting into Upper Chinle well CW5 near Broadview Acres. The elevated Upper4-1 Chinle water is being collected by the D line of alluvial collection wells due to the direct connection between the alluvium and Upper Chinle in this area. Drawing 2-1 shows the location of injection well CW5.

5.0 MONITORING PROGRAM

The ground-water monitoring program for the Homestake mill is outlined in Table 5-1. This table defines the sites, parameters to be monitored, as well as the frequency of monitoring. Information will be submitted to the NRC annually (January 31). This monitoring program is basically the same as the EID program except for a few adjustments for the NRC site constituents and points of compliance. A request to adjust the EID monitoring program will be made after the NRC's approval of this monitoring program to make the two programs identical.

5.1 MONITORING SITES

The ground-water monitoring program consists of the point of compliance wells (WR11, WR7, B, PM, Y and CW4) on a quarterly basis for indicator parameters and semi-annually for all of the hazardous constituents. Upgradient wells (P, Q, R and DD) are included in this semi-annual list. Most of the remainder of the Homestake wells are proposed to be monitored less frequently (see Table 5-1). All active collection wells are included as monitoring sites. Deep well No. 1 and No. 2 are included in the monitoring program because water from these wells is injected into the alluvial system. An analysis of the tailing solution annually will be collected to define changes in the tailing water quality. Eight Homestake Chinle aquifer wells are included in the mill monitoring list. Several wells in the alluvium and Chinle are proposed for monitoring in Broadview, Felice, Murray Acres and Pleasant Valley Estates. Fewer wells are needed to be monitored in the subdivision

in the future because the main purpose of future subdivision monitoring is to demonstrate that the injection and collection systems are maintaining the water quality. Only four alluvial and two Chinle wells are proposed in Broadview Acres because the water quality in all of Broadview Acres has been restored. Well 434 is used to monitor the Middle Chinle aquifer in Broadview Acres, while well 446 is proposed to monitor the Upper Chinle aquifer. Some substitution may be necessary if an owner does not allow access or if a well becomes inoperable. Two alluvial and two Chinle wells are proposed to be monitored in Felice Aces. These wells will be useful in defining the small additional decrease in concentrations that are expected in the alluvium and Upper Chinle.

The Murray Acres wells that will be monitored are ACW, 802, 804, 815, 820, 844 and WCW. Wells 802, 815 and 844 need to be monitored to define when and how concentrations are affected in this area of the alluvium, by the injection systems. Well 804 is proposed to be monitored to determine whether its concentrations are maintained close to the injection concentrations. Wells ACW, 820 and WCW are proposed to monitor the Chinle aquifer.

Wells 835, 840 and 846 are proposed to monitor the alluvial aquifer in the Pleasant Valley area. These wells will be used to define the gradual changes in major constituents in the alluvium from the injection of fresh water upgradient. Well 832 is proposed to monitor the Chinle aquifer in this area.

Four regional alluvial wells, one upgradient and three downgradient, are proposed to monitor the water-quality changes in this aquifer in these areas with time. Drawing 1.0-1 of DP-200 shows the locations of these four wells.

Table 5-1 summarizes the wells in subdivisions which will be monitored as well as a few wells in the alluvial aquifer in the surrounding region.

5.2 FREQUENCY AND PARAMETERS

The main downgradient alluvial monitoring wells at the millsite WR11, WR7. B, PM and Y) are proposed to be monitored for key parameters on a quarterly basis (see Table 5-1). One Middle Chinle aquifer well (CW2) and two Upper Chinle aquifer wells (CW3 and CW4) are proposed to be monitored for the same parameters. Key parameters consist of water level, sulfate, uranium and selenium. Sulfate is included because it is the best major constituent that relates to seepage impacts and it is a State ground-water standard. Uranium and selenium were selected because they are the most mobile hazardous constituents at this site. Other parameters monitored on a semi-annually basis included pH, TDS, bicarbonate, carbonate, sodium, calcium, magnesium, potassium, nitrate, chromium, molybdenum, vanadium, radium-226 and radium-228, and thorium-230. Field pH does not relate to seepage at this site, therefore it is not needed on a normal high frequency. The major constituents are used primarily to check the valance charge balance of the analyses. A charge balance will be computed as part of the monitoring program for these samples. Radium-226 and -228, and thorium-230 are

measured on a semi-annual basis to show that these constituent are still not being transported at significant concentrations. The large adsorptive capability of the alluvial material makes it very unlikely that a significant concentration of these radionuclides will ever migrate downgradient of the tailing pile.

Nearly all remaining alluvial Homestake wells are included in a secondary list of wells which are proposed for sampling twice a year. Upper Chinle aquifer wells 931, 934, CW9 and CW10, are also included in this list. These wells are to be monitored annually because significant changes in these areas are not expected (see Table 5-1). All active collection wells will be monitored on a monthly basis for water level, sulfate and uranium. Twice per year these wells will be sampled for a longer parameter list (see Table 5-1). The collection wells are to be monitored for discharge on a weekly basis. Water-level management wells (DM, DN, DP, DQ, SO, SPF, S1 and S2) will be measured weekly for water levels. Semi-annual monitoring is proposed for Deep wells No. 1 and No. 2 to define the injection water quality. The State's ground-water regulation list plus bicarbonate, carbonate, sodium, calcium, magnesium and potassium will be determined for this water.

Selected wells in Broadview, Felice and Murray Acres and Pleasant Valley Estates subdivisions will be monitored on a semi-annual basis for the modified list and annually for the longer list (see Table 5-1). Semi-annual monitoring of the subdivision wells will be adequate because the future changes should be small and very slow. A few alluvial wells in the region are proposed to be

monitored on an annual basis for the long parameter list.

The Chinle wells which are monitored annually will be measured in the same quarter. All annual measurements for the alluvial wells in the subdivision will be measured during the same semi-annual period.

TABLE 5-1 HOMESTAKE GROUND-WATER MONITORING PROGRAM

WELL NUMBER	PARAMETERS TO BE MONITORED	FREQUENCY OF MONITORING
	MILL MONITORING WELLS	
WR11, WR7, B, PM, Y, CW2, CW3, CW4	W.L., SO4, U, Se	Quarterly
P, Q, R, DD, WR11, WR7 B, PM, Y, CW2, CW3, CW4	W.L., pH, TDS, SO4, C1, HCO3 CO3, Na, Ca, Mg, K, NO3, U, Cr, V, Se, Mo, Ra226, Ra228, Th230	Semi-Annually
	SECONDARY MILL MONITORING WELLS	
A1, BB2, BC, B1, BP, C, D1, DC, DM, DP, DZ, E, F, FB, J, JC, K2, KM, KZ, M4, N, NC, O, S, SO, T, W, WR9, WR5, X, Z, W2, GH, CW2-1	W.L., SO4, U, Se (only W.L. for wells J, CW2-1, GH and W2)	Semi-Annually
A1, BB2, B1, BC, BP, C, D1, DC, DM, DP, DZ, E, F, B, I, JC, K2, KM, KZ, M4, N, NC, ND, O, S, SO, S2, T, W, WR9, WR5, X, Z, 931, 934, CW9, CW10	W.L., pH, TDS, SO4, C1, HCO3, CO3, Na, Ca, Mg, K, NO3, U, Se, Mo, Ra226	Annually
Active Tailing Solution	pH, TDS, SO4, C1, HCO3, CO3, Na, Ca, Mg, K, NO3, U, Se, Mo, Ra226 (Monthly Average Volume of Tailing Discharge)	Annually
	COLLECTION WELLS	
All Active Collection Wells	W.L., SO4, U	Monthly
All Active Collection Wells	W.L., TDS, pH, SO4, C1, HCO3, CO3, Na, Ca, Mg, K, NO3, U, Se, Mo, Ra226	Annually
All Active Collection Wells	Discharge & Discharge Totalizer	Weekly
DM, DN, DP, DQ, SO, SP, S1, S2	W.L.	Weekly
Deep Wells No. 1 & 2	SO4, TDS	Quarterly

TABLE 5-1 HOMESTAKE GROUND-WATER MONITORING PROGRAM

WELL NUMBER	PARAMETERS TO BE MONITORED	FREQUENCY OF MONITORING
Deep Well No. 2 and Deep Well No. 1	Ground-water Req. List (except organics) plus HCO3, CO3, Na, Ca, Mg, K	Annually
	INJECTION WELLS	
All Active Injection Wells	Injection Rate & Injection Totalizer	Monthly
	BROADVIEW ACRES	
SUB1, SUB2, SUB3, 453	SO4, U, Se (W.L. in wells SUB1, SUB2, SUB3)	Semi-Annual
SUB1, SUB2, SUB3, 453, 434, 446	pH, TDS, SO4, C1, HCO3, CO3, Na, Ca, Mg, K, NO3, U, Se, Mo, Ra226	Annually
	FELICE ACRES	
490, 492, 493, 494	W.L., SO4, U, Se	Semi-Annually
490, 492, 493, 494	W.L., pH, TDS, SO4, C1, HCO3, CO3, Na, Ca, Mg, K, NOA3, U, Se, Mo, Ra226	Annually
	MURRAY ACRES	
802, 815, 844	W.L., SO4, U, Se	Semi-Annually
ACW, 802, 804, 815, WCW, 820, 844	W.L., pH, TDS, SO4, C1, HCO3, CO3, Na, Ca, Mg, K, NO3, U, Se, Mo, Ra226	Annually
	PLEASANT VALLEY	
835, 840, 846	SO4, U, Se (W.L. in well 846)	Semi-Annually
832, 835, 840, 846	pH, TDS, SO4, C1, HCO3, CO3, Na, Ca, Mg, K, NO3, U, Se, Mo, Ra226	Annually
	REGIONAL	
920, 942 (or replacement) 905, 910	pH, TDS, SO4, C1, HCO3, CO3, Na, Ca, Mg, K, NO3, U, Se, Mo, Ra226	Annually

6.0 REFERENCES

Hoffman, G.L., 1976, Ground-water Hydrology of the Alluvium at UN-HP Mill Near Milan, New Mexico, Consulting Report to Homestake Mining Company.

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