40-2259

MILL DECOMMISSIONING PLAN

LUCKY MC MINE

PATHFINDER MINES CORPORATION

SOURCE MATERIAL LICENSE SUA-672

DOCKET NO. 40-2259

MARCH 30, 1992

92-0375

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Pathfinder employees in a manner consistent with the existing requirements of the SUA-672 Source Materials License and the Lucky Mc radiation safety program as delineated by the standard operating procedures. Equipment destined for release from the restricted area will meet release criteria for residual contamination. In the alternative some materials may be destined to another licensed facility, and will simply require conformance with DOT regulations for shipment. Disposal of any remaining virgin chemicals or other process materials will be accomplished in a manner consistent with all applicable Federal and state regulations. Such remaining materials are not numerous since most useable chemicals were transferred to Pathfinder's Shirley Basin operation or sold to other entities. The one remaining material in significant quantities is the kerosene in solvent extraction which is discussed in this plan.

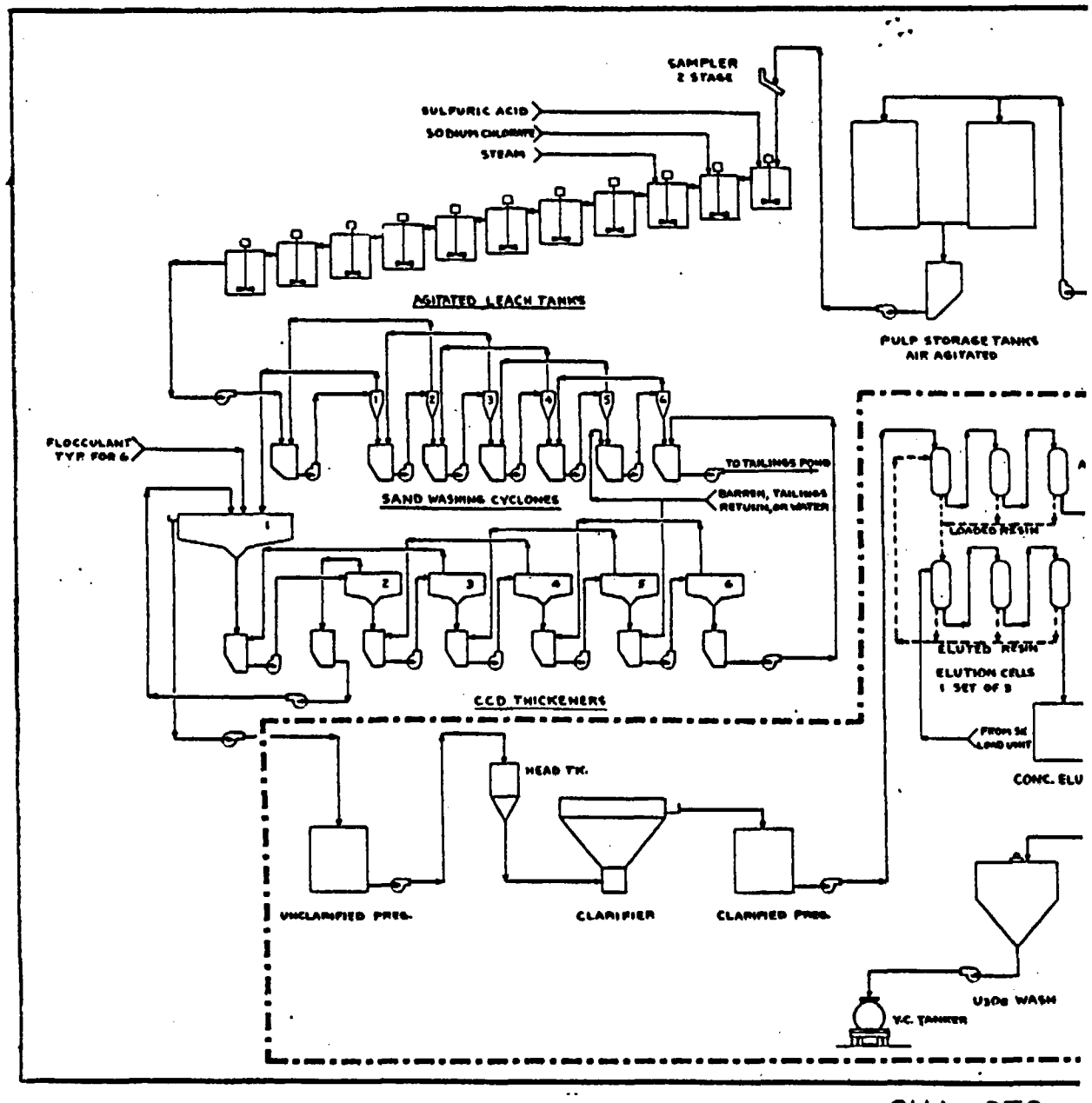
The demolition and disposal of mill materials will commence shortly after NRC approval of this plan. Pathfinder anticipates that the decommissioning will take approximately eighteen months. Demolition will be performed either by Pathfinder personnel or an outside contractor. In either case workers will receive radiation safety training as required by the materials license and the relevant SOP's. The demolition will involve the removal of any remaining tankage and other equipment that was deemed unsalvageable, and the subsequent razing of the buildings. An approximate sequence of the planned activities is provided with this plan.

Disposable materials will be placed at the southeast edge of the No. 2A tailings pond along the toe of the No. 2 tailings dam (see Exhibit 2-2.) This location will receive substantial fill, after placement of the mill rubble, to create acceptably flat slopes required in the grading plan that will be armored with riprap, ensuring long term stability as required by Appendix A of 10 CFR 40.

The external skin of some portions of the older sections of the mill consists of transite sheeting containing some asbestos. That material as well as any other asbestos within the mill will be removed in conformance with relevant regulations. Asbestos will be disposed of on site as byproduct material, generally in an area segregated from the other wastes. The specifics of asbestos disposal are addressed in the plan.

After removal and disposition of all mill materials, building foundations will be left in place with sufficient breaking of the concrete to allow adequate drainage, followed by the placement of an earthen cap. The mill site will then be reclaimed in conjunction with the tailings reclamation program. The mill site/tailings reclamation plan will include a description of contamination survey procedures and soil cleanup procedures. The specifics of the mill site reclamation will be addressed in the

tailings reclamation plan which is due for submittal to the NRC by July 1, 1992.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Part 2:

Decommissioning Program Description

The physical process of razing and burying the mill is described in this section. The attendant radiation safety program that will govern all aspects of the decommissioning is described in part 3 of this plan.

A. Salvage and Decontamination

Pathfinder anticipates that some portion of the mill equipment will have salvage value. Major examples of salvageable materials include the principal components of the grinding circuit including the feeder, the SAG mill, and pumps, as well as the relatively new tankage and equipment in CCD. The first phase of the project will involve the removal of equipment that may have potential for further off site use. Beginning in early April, 1992, PMC personnel will commence the removal of such equipment. Initial efforts will concentrate on the SAG circuit with the removal of the SAG mill discharge pumps and the DSM screens, and the preparation of the SAG mill for its removal. The actual removal of the SAG mill will occur when it has been sold. Removal of the long inactive dry crusher, sample tower and fine ore storage equipment will also be accomplished.

Salvage efforts will then move to the inactive resin-in-pulp (RIP) circuit where various pumps, tankage, and the Sweeco screens will be removed. The items removed from SAG and RIP will be temporarily stored on the mill ore pad or immediately east of the SAG/RIP building. Salvage operations will then move to the leach circuit for removal of motors, gear boxes, and agitator assemblies from the leach tanks. Salvage operations will then progress to the sand washing cyclones and then to CCD where pumps, motors, rake assemblies, and attendant piping will be removed. At a later date after crane access is established, CCD tanks will be partially disassembled and removed from the main mill building.

As noted in the summary introduction to this plan, the balance of the mill circuitry beyond CCD (excepting SX) will be preserved for the time being in consideration of its potential utilization in recovery operations for a possible in situ leach (ISL) project in the Gas Hills. The mill office building and the change room facility will also be preserved at least on an interim basis as part of a potential ISL project.

The items removed from the mill in the salvage phase will be stored within the restricted area adjacent to the mill site. Any equipment that is subsequently sold for release from the restricted area will undergo decontamination by washing, acid rinse, or sand blasting as required, prior to release. Release of equipment and materials to unrestricted use will be done in accordance with the attachment to license SUA-672 entitled "Guidelines for

Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials" dated September, 1984. Materials bound for another NRC licensed facility will not require such decontamination. The extent of the decontamination efforts will depend solely upon the marketability of the salvaged equipment. Salvaged contaminated equipment and materials (exclusive of the preserved circuits) that cannot be successfully sold within 48 months after NRC approval of this plan will be subject to disposal in the tailings area or alternate disposal area as described later in this plan.

B. Process Materials Handling

Very few process or laboratory chemicals remain onsite presently. The few remaining products that are not consumed (such as lubricants and paints) will be sold (subject to meeting release citeria.) Any unsold products will then be subject to disposal in conformance with all applicable Federal and state regulations.

The one process material remaining on the project in significant quantities is the kerosene in SX. The kerosene will be stripped of contamination by means of a sodium carbonate scrub in order to utilize it as a fuel.

C. Dismantling Operations

After the salvage of equipment that is perceived to have market value has been completed, and upon final approval of this decommissioning plan by the NRC, actual dismantling and disposal of the remaining mill equipment and the buildings will commence (excluding portions of the mill to be preserved.) The crusher building will be the first structure razed (see Exhibit 2-1 for the locations of various structures.) This will allow access to the below grade concrete vault within the crusher building that will be utilized for asbestos disposal. The crusher building does not contain any asbestos.

The next task involved in this phase will be the removal of all asbestos-containing materials from the buildings scheduled for near-term disposal. An outside contractor qualified for asbestos removal utilizing trained employees will be hired to do the asbestos removal in conformance with the radiation safety program. The removed asbestos will be placed in the below grade, concrete lined chamber that held the primary crusher (see Exhibit 2-1.) This chamber will provide isolation of the asbestos from the environment. The asbestos removed in the first phase of decommissioning will not represent a large volume. The asbestos in the crusher chamber will be covered by a minimum of two feet of fill material for the interim. Because a significant amount of remaining capacity in the chamber is anticipated, a weather proof cover will be placed over the chamber in order to preserve it for the future placement of the remaining asbestos waste on site.

Most of the asbestos is in the form of nonfriable asbestos-containing transite sheeting that forms the external skin of significant portions of the older parts of the mill building. The portions of the mill left intact for an interim period for potential ISL use contain most of this transite sheeting. Upon decommissioning of these preserved portions of the mill, this material would be placed in the crusher chamber. At that time any remaining void space in the chamber after placement of the asbestos will be eliminated by earthen fill. After filling the chamber the fill material will be compacted to preclude settling. The isolation then will be further enhanced by the placement of a one foot deep compacted clay (Cody shale) cap over the area. The final surface gradient in the area of the asbestos placement will be designed in conjunction with the forthcoming tailings reclamation plan to assure erosional stability and the requisite radon attenuation.

Upon completion of the first phase asbestos removal the rest of the mill materials will be removed or dismantled and hauled to the mill rubble disposal site. Equipment and materials removed from the mill that are destined for burial will be sufficiently dismantled such that void spaces are precluded when the items are buried. Exhibit 2-2 illustrates the proposed area for burial of mill materials. Waste material will be placed in two to three foot lifts with compaction of the material provided by the weight of dozers running over each lift. Tanks will be sufficiently cut up or flattened by the heavy equipment to preclude significant void space. Each materials lift will be covered by at least one foot of compacted subgrade ore from the mill ore pad or clean earthen fill prior to the placement of the next materials lift. All materials currently stored in the mill "boneyard" not destined for decontamination/release will also be buried in the same location.

The mill wastes disposal area is located below the pond 2 embankment in an area of elevated beach along the south edge of pond 2A that consists almost exclusively of coarse tailings sands. As such, there will be virtually no differential settlement that would disturb the mill rubble placed on top of the sands. The compaction of the rubble and elimination of voids within the material will assure no consolidation due to the wastes. Upon completion of the placement of the last of the mill wastes, an interim cover of at least four feet of clean fill will be placed over the mill waste disposal area. Cover thickness will be designed to meet the radon-222 release limit of Appendix A of 10 CFR 40.

During the final reclamation of the tailings the mill waste disposal area will receive substantial amounts of additional clean earthen fill to create the final reclaimed slope configuration off the crest of the pond 2 embankment. The exact slope configuration is under development with the overall tailings reclamation plan due for submittal to the NRC by July 1, 1992. A riprap layer to be specified in the tailings reclamation plan will then be placed over the outslope area. Since the erosional stability of the slope in

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this area must meet the requirements of Appendix A of 10 CFR 40, the burial site for mill wastes will remain isolated.

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The mill wastes disposal area is located below the pond 2 embankment in an area of elevated beach along the south edge of pond 2A that consists almost exclusively of coarse tailings sands. As such, there will be virtually no differential settlement that would disturb the mill rubble placed on top of the sands. The compaction of the rubble and elimination of voids within the material will assure no consolidation due to the wastes. Upon completion of the placement of the last of the mill wastes, an interim cover of at least four feet of clean fill will be placed over the mill waste disposal area. Cover thickness will be designed to meet the radon-222 release limit of Appendix A of 10 CFR 40.

During the final reclamation of the tailings the mill waste disposal area will receive substantial amounts of additional clean earthen fill to create the final reclaimed slope configuration off the crest of the pond 2 embankment. The exact slope configuration is under development with the overall tailings reclamation plan due for submittal to the NRC by July 1, 1992. A riprap layer to be specified in the tailings reclamation plan will then be placed over the outslope area. Since the erosional stability of the slope in this area must meet the requirements of Appendix A of 10 CFR 40, the burial site for mill wastes will remain isolated.

The recovery circuits to be preserved in the interim will be subject to disposal (after any salvage) in an alternate location on site due to the likelihood that the tailings reclamation will be complete, precluding use of the 2A location. However, if the 2A location is still available if and when a decision is made to dismantle the recovery circuits, then the waste will be placed in the 2A location. The alternate burial site for the recovery circuits is shown on Exhibit 2-1 and will consist of trenches that will allow placement of the materials in two to three foot lifts with heavy equipment compaction separated by one foot layers of compacted clean fill. At least four feet of compacted fill will be placed over the top of the burial site. See part 4 of this plan for the decommissioning schedule.

D. Disposal of Radioactive Source Gauges

All radioactive sources used in density gauges specifically licensed under Materials License 49-11869-02 (Docket No. 030-06807) have been returned to the manufacturer (Ohmart.) Generally licensed sources have been shipped to TN Technolgies, Inc. or PGT for disposal. Acknowledgements of transfer have been received, and Pathfinder is formally applying to the U.S.NRC, Region IV, to terminate the license.

E. Mill Site Decontamination

The best approach to reclamation of the mill site proper is presently undergoing field evaluation. The basic choices are to incorporate the mill site into the tailings reclamation plan and provide sufficient clean cover and erosion control to meet the criteria of Appendix A of 10 CFR 40, or to decontaminate the mill site grounds, including the ore pad, by hauling all of the contaminated material to the tailings area (or to the mine, in the case of residual ore on the ore pad) for disposal, exclusive of the alternate burial trench or contaminated asbestos. The selected approach will be fully addressed in the tailings reclamation plan due for submittal to the NRC by July 1, 1992. Ground contamination survey procedures and any decontamination methods for the mill site grounds will be explained in the tailings reclamation plan.

F. Concrete Foundations and Site Reclamation

After the razing and removal of the mill buildings, the concrete foundations will be left in place. The concrete left in place will be sufficiently fractured by blasting to allow water to drain. An interim clean fill cover (at least two feet thick) will be placed over the concrete. The required final cover thickness will be assessed as part of the general mill site reclamation to be addressed in the forthcoming tailings reclamation plan.

G. Site Security

There is a full time resident guard domiciled adjacent to the restricted area who will provide site security during the decommissioning process. The restricted area fence will continue to be maintained (including proper posting) with the entry gates locked after normal working hours. The removal of equipment and materials will be closely supervised by the RSO to assure no contaminated materials leave the project (except those specifically bound for another restricted area.)

Part 3:

Radiation Safety Program

The radiation safety program utilized during the mill decommissioning will be based upon the existing program at the Lucky Mc Mill. The existing Standard Operating Procedures (SOP's) have been refined over the years to provide a sound radiation safety program based upon the ALARA principle that is well suited to the decommissioning task. Key radiation safety SOP's that will govern the radiation safety program during mill decommissioning are presented in Appendix B of this plan.

A. Predemolition Radiological Status of the Mill

Ample data have been collected over the years for the various parts of the mill, providing a good baseline of information concerning the anticipated radiological hazards that will be encountered in each area of the mill during decommissioning. Additional data was collected recently to augment the historical data. Production area wipe tests were recently performed, and the crusher circuit was sampled (direct alpha, beta/gamma, and wipes). The historical data beginning with 1986 as well as the most recent additional sampling data are presented in Appendix A. The data cover the last operational period (July, 1987 through May, 1988) for the mill immediately after the mill renovation and the inactive period after the final clean out of all mill circuits when milling was suspended. While the historical data provide some guidance in terms of anticipated radiological hazards, it does not replace the experience obtained from administering the radiation work permit (RWP) program in the past in assessing potential hazards presented by each task in the decommissioning program. Based upon the past data and that experience, a radiological assessment of the various circuits can be made.

The mill was thoroughly cleaned upon suspension of milling operations in 1988. All tanks were purged and allowed to dry out. Circuit pipes were drained of process materials. While there undoubtedly is some residual process material still present in some pipes, in general the mill has little source or byproduct process material present. This should facilitate the planned decommissioning activities. Preliminary to any decommissioning activity in a given area will be a thorough wash down of the work area with water. This precaution will minimize airborne concentration problems.

The crusher circuit exhibits an accumulation of ore dust that will be controlled by water washing prior to planned activities. The SAG area and building are relatively clean and should not present significant radiological hazards. A potential problem associated with the leach circuit is the fact that the wooden tanks have dried out, likely leaving some soluble uranium on the interior tank walls. The dismantling of these tanks will be done in

consideration of this potential hazard. Ample use of water prior to removal will mitigate the hazard. CCD was a new circuit that experienced only nine months of operation. As such it is expected to be relatively clean from a radiological standpoint. However, the rubber lining in the CCD tanks may have absorbed some radioactive material (especially radium-226.) Any removal of rubber liner and tank cutting will be done with due consideration of that potential hazard.

Deposits of uranium containing materials at various locations within SX are anticipated. Likewise any future decommissioning activity in the precipitation circuit must be done in recognition of the likely occurrence of concentrate, especially inside pumps and pipes that are removed. If the ion exchange circuit is removed the biggest hazard will likely be from a radium precipitate that tends to form inside pipes in IX. Care will be taken when removing pipes to assure no respiratory uptake of the precipitate. Much of IX would be removed with minimal dismantling in order to minimize exposures. The IX cells will require some disassembly before they can be flattened for burial. Any interior rubber liner removal prior to cutting the IX cells and the actual cutting would be carefully controlled by the RWP system. As an alternative, consideration will be given to the feasibility of placing unflattened IX cells in the burial area and then filling them with sand to preclude voids.

Portions of the original mill building are still intact in the vicinity of the original yellowcake dryer location (the old dryer was removed during the renovation.) Respiratory protection will be particularly important when dismantling the old walls in this area due to the possibility of encountering residual yellowcake deposits behind the interior walls. Note that this area will remain intact at least for the interim, as discussed previously.

The yellowcake dryer acquired from the Petrotomics mill is currently sitting in fenced storage adjacent to the mill. If the dryer is not sold and thus becomes subject to disposal, it will be transported to the 2A burial site with all openings sealed. A hole of sufficient size to contain the dryer upright will be excavated, and the dryer will be placed in the hole. The top will then be removed in order to fill the dryer with the excavated tailings to eliminate voids. Fill will then cover the dryer. All of these activities will be accomplished under the control of RWP's. In the event that the SAG mill or the high rate thickener tanks are not salvaged and removed from the property and are subject to burial in the tailings disposal site, these items will be buried in a manner similar to the dryer. That is, the items will be placed upright in an excavated area in the 2A burial site, and tailings will be used to fill void spaces in the items.

B. Employee/Contractor Training

Initial radiation safety training for newly hired decommissioning personnel will be conducted in conformance with the current license and SOP's. Besides the principles of radiation and radiation

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safety, respirator use and fit testing are also covered. The training will consist of eight contact hours with the RSO and will conclude with a test covering the material presented. Incorrect answers to test questions will prompt a review of the test items to insure worker understanding. Any outside contract help utilized during the decommissioning will also receive radiation safety training as specified in SOP 02.119. Supervisory and reinforcement training are also an integral part of the program. Section 3-K includes an itemization of the training SOP's that are relevant.

C. Area Radiation Monitoring

The routine area monitoring, consisting of generally quarterly air samples, quarterly penetrating radiation monitoring (TLD badges), quarterly wipe tests, and quarterly radon sampling will be continued during the decommissioning. Weekly surface contamination surveys will be conducted in the change room and the lunch room during the decommissioning. As the dismantling of each area of the mill is completed, that area will, of course, be dropped from the routine monitoring program. In addition, area air monitoring will be conducted on a daily basis with analysis for uranium (based upon alpha counting) in each area where active decommissioning activity is occurring.

D. Personnel Radiation Exposure Monitoring

The existing programs for personnel radiation monitoring will remain in effect during the decommissioning for both Pathfinder mill employees and any contractor personnel. Key elements of the program consist of TLD badge issuance to each individual on a quarterly basis, weekly and quarterly exposure calculations based upon airborne concentrations of uranium and time spent in different areas, routine and nonroutine urinalysis for uranium uptake, and personnel lapel air sampling when appropriate. Bioassays (urinalyses) will be conducted on a monthly basis for all mill employees. In addition, a baseline urinalysis will be performed for all new mill employees prior to the start of their work in the mill. When the employment of any mill personnel terminates, efforts will be made to obtain a final, exit urine sample from such individuals. Continued maintenance of these programs and the utilization of the RWP program will assure that personnel exposures will be kept as low as is reasonably achievable. The existing exposure record maintenance program will continue, assuring no cumulative high exposures. Previous exposure records, if any, are obtained for any newly hired or contractor personnel. The relevant SOP's for personnel exposure monitoring and control are listed in section 3-K.

E. Radiation Work Permit Program

The existing radiation work permit (RWP) program at Lucky Mc will be integral to the radiation safety aspect of the mill decommissioning. Weekly documented meetings will be held involving the mine manager or his designee, the mill foreman, and the RSO to plan the coming week's activities. This will allow a good discussion of

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anticipated hazards, enabling the RSO to plan in advance the radiation safety needs for the various tasks. Prior to the beginning of each shift the RSO will review the planned activities for the day in order to ascertain any late changes in activities. Required RWP's will be issued at that time (recognizing that additional RWP's could be necessitated as the day progresses, depending upon the development of unanticipated conditions.) The potential for nonradiological hazards to the worker will also be considered when issuing RWP's.

Typically, the RWP will specify that at least 25% of the personnel

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The yellowcake dryer acquired from the Petrotomics mill is currently sitting in fenced storage adjacent to the mill. If the dryer is not sold and thus becomes subject to disposal, it will be transported to the 2A burial site with all openings sealed. A hole of sufficient size to contain the dryer upright will be excavated, and the dryer will be placed in the hole. The top will then be removed in order to fill the dryer with the excavated tailings to eliminate voids. Fill will then cover the dryer. All of these activities will be accomplished under the control of RWP's.

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Typically, the RWP will specify that at least 25% of the personnel

be equipped with lapel air samplers during the planned activity. If prior experience in a particular mill area indicates minimal radiological hazard for the activity being conducted, the extent of lapel air sampling may be reduced. The key to the entire RWP program is good communication between the mill staff and the RSO so that he can utilize his best professional judgement in designating the radiation safety requirements for a given activity. The RSO or his representative will routinely monitor the progress of the activity to assure no unanticipated exposure problems are developing. As noted previously, prior to commencing decommissioning activity in a given area, the area will be thoroughly washed down with water to minimize airborne radiological hazards. SOP 02.131, controlling the issuance of RWP's, is included in Appendix B.

F. Respiratory Protection Program

Lucky Mc Mill has an approved respiratory protection program. All the requirements of that program will be maintained during the mill decommissioning. See SOP 02.100, Respiratory Protection Program, in Appendix B. Additional SOP's concerning the respiratory protection program are listed in section 3-K.

G. Change Room Facilities

The existing change room facilties at Lucky Mc will be modified to better suit the planned decommissioning activities. The women's side of the change room will be remodeled to serve as a radiation laboratory. This will provide a convenient location for the conduct of the radiation safety program that is very proximate to the activities. Restroom and shower facilities will continue to exist in the laboratory area in case there are any female mill employees. The men's side of the change room will be altered by partitioning the original "clean" side of the area into a lunch room and a smaller "clean" side locker area. An exit monitoring station with an alpha detector will be located adjacent to the locker area. Food consumption will be limited to the new change room area lunch room. The change room will continue to provide laundry facilties for coveralls. SOP 02.132, Change Room Procedures, will govern the operation of the change room facilities.

H. Release of Materials from the Restricted Area

Equipment destined for release from the restricted area for unrestricted use will be surveyed in conformance with SOP 02.040, Survey of Equipment Leaving the Restricted Area (see Appendix B.) Equipment requiring decontamination prior to release will be washed in a location where an existing sump can collect the wash water for pumping to the tailings system. Records will be maintained for materials released, consisting of the material identification, its destination, and the results of the final survey prior to release. Responsibility for the unrestricted release of any mill materials

rests solely with the Radiation Safety Department. A tagging system and isolation from other mill materials of uncontaminated material to be released (when feasible) will help assure that materials not cleared for release remain within the restricted area. The private vehicles of any workers are parked outside the restricted area, thus helping to control the unauthorized removal of materials. Any contaminated equipment or materials bound for another NRC licensed restricted area will be shipped in accordance with NRC and DOT regulations. Records will be maintained describing such materials and their destination(s). At this juncture very little of this sort of material bound for another restricted area is anticipated.

I. Records and Reports

All existing record maintenance and reporting requirements as specified in materials license SUA-672, the Lucky Mc Mill SOP's, and NRC regulations will be continued during the decommissioning. In addition a final decommissioning report will be sent to the NRC within six months of the conclusion of the mill decommissioning project as outlined in this plan.

J. Responsible Personnel

The position responsibilities for the administration of this decommissioning plan and/or the attendant radiation safety plan are as given in the submittal to the NRC dated September 17, 1991 (referenced in condition 11 of SUA-672.)

K. Standard Operating Procedures

Table 3-1 is a list of the SOP's which will form the basis of the radiation safety program during the decommissioning project. With one exception (tank entry), all of these SOP's have been in effect at Lucky Mc previously. As noted in Table 3-1, selected SOP's have been included in Appendix B of this plan.

Since it is anticipated that this decommissioning project will extend into 1993, the SOP's will be revised as appropriate to conform with the revised requirements of 10 CFR 20 which become effective on January 1, 1993. Pathfinder's adoption of the new requirements will take effect on that date.

Table 3-1. Lucky Mc Mill Radiation Safety Standard Operating Procedures

External Dosimetry

02.001	External Radiation Exposure Documentation*
02.002	Issuance and Control Procedures for TLD Badges
02.003	Exposure Estimates in the Event of Lost, Damaged or Contaminated Badges
02.004	Methodology for Completing NRC Form 4

Internal Dosimetry

02.016	Routine and Non-Routine Urine Sampling Program*
02.017	Interpreting Urine Analysis Results

Surveys

02.032	Surface Contamination Survey*
02.034	Personal Contamination Surveys*
02.035	Personnel Decontamination
02.036	Radon Daughter Surveys*
02.038	Beta-Gamma Surveys*
02.040	Survey of Equipment Leaving Restricted Area*
02.041	Airborne Particulate Survey*
02.042	Analysis and Q. C. Procedures of Airborne Particulates

Exposure Control

02.048	Assignments and Control of Airborne Exposures*

Calibrations

02.061	Calibration of EIC MS-2 Mini Scaler with either the SPA-1 or RD-14 Alpha Detector
02.062	Calibration of EIC MS-3 Mini Scaler with either the SPA-1 or RD-14 Alpha Detector
02.063	Calibration of EIC RM-19 Count Rate Meter Equipped with AC-3 Alpha Probe
02.064	Calibration of EIC PRM-6 Pulse Rate Meter with AC-3 Alpha Probe
02.065	LLD Determination for Unat and Radon
02.066	Calibration of Lapel Air Sampler Flow Rate Meters
02.067	Vendor Calibrations
02.068	Documentation of Instrument Calibration
02.069	Calibration of Sierra Misco 3000's

Inspections and Reports

02.076	Radiation Safety inspections
02.077	Quarterly Radiation Safety and Environmental Monitoring Status Report
02.078	Annual ALARA Audit

Table 3-1, Continued.

Respirators

02.100	Respiratory Protection Program*
02.102	Respirator Maintenance
02.103	Respirator Cleaning
02.104	Physical Qualification for Respirator Use*

Training

02.116	Orientation, Supervisory and Reinforcement Training*
02.117	Radiation Safety Training*
02.118	Employee Radiation Safety Handbook
02.119	Management of Contractor Personnel*

Miscellaneous

02.131	Radiation Work Permit*
02.132	Change Room Procedures*
02.137	Tank Entry Procedures*

* SOP included in Appendix B.

Part 4:

Schedule

Pathfinder estimates that the decommissioning of the Lucky Mc Mill including the removal of salvageable equipment will be complete within approximately eighteen months , subject, of course, to timely approval of the plan. The initial task will consist of the remodeling of the change room as discussed previously. This work will be initiated in March, 1992. Pathfinder intends to initiate actual equipment salvage operations, beginning in the grind circuit, during April, 1992. Assuming NRC approval of this plan before the completion of equipment salvage operations, the decommissioning will be completed by September, 1993. Delays in the plan approval will, of course, extend the completion of the planned activities beyond that date. It is Pathfinder's understanding that equipment salvage operations can be initiated prior to the approval of this plan by the U.S.NRC.

Presented below is the relative sequence of the planned decommissioning activities. No attempt has been made to estimate time frames for the individual elements of the plan. Modifications of this relative schedule are likely to occur due to such factors as the delivery requirements of buyers for specific pieces of salvage equipment. Changes in the sequence will be evaluated by the RSO beforehand to assure there is no compromise of the radiation safety provided for workers. The timing of the decontamination of salvaged equipment will be dictated by the sale of that equipment. Each piece of equipment will be stored within the restricted area, and generally will undergo decontamination at the time a buyer is found for it (assuming it is not destined for another NRC-licensed facility.)

Beginning Date: March, 1992.

1. Remodel change room facilities.
2. Salvage equipment in SAG.
3. Salvage equipment in RIP.
4. Salvage equipment from crusher building.
5. Salvage equipment from sample tower and fine ore storage building.
6. Salvage equipment from leach tanks (motors, gear reducers, and agitators.)
7. Salvage sand washing cyclones.
8. Salvage motors, rake assemblies, and all other attendant equipment from CCD, including outside thickener.
9. Prepare burial site in 2A to receive mill materials.
10. Remove balance of materials from SAG, RIP, and crusher buildings, exclusive of the SAG mill itself. The timing of the removal of the SAG mill will be dictated by its sale.
11. Dismantle, remove, and bury all leach tanks located inside.
12. Bury remaining nonsalvageable materials previously removed from SAG, RIP, crusher, sample tower, and fine ore storage buildings.

13. Disassemble pulp storage tanks and bury them.
14. Remove and bury any remaining materials (excepting boilers) from leach area.
15. Remove and bury any remaining materials from CCD area.
16. Raze crusher building, sample tower, rubber shop, and flammable materials storage building, burying materials.
17. Prepare below grade crusher vault to receive asbestos wastes.
18. Contractor removes transite siding and miscellaneous asbestos from building interiors. Asbestos is placed in crusher vault which is then temporarily covered.
19. Contractor encapsulates asbestos on boilers in preparation for their removal.
20. Remove boilers for burial in the 2A disposal site.
21. Raze and bury the ore storage building, the mill laboratory, the reagent shed, and the gallery to the outside leach tanks.
22. Salvage all tankage from CCD.
23. Remove and bury all tankage and non-saleable equipment from the SX building.
24. Raze and bury outside leach tanks.
25. Raze and bury SAG, RIP, and SX buildings, including the grizzly. The timing of the razing of the SAG building is dependent upon the timing of the sale of the SAG mill.
26. Salvage or raze (disassemble for burial) acid storage tanks, kerosene storage tanks, and ammonia storage tanks.
27. Raze and bury the mill shop/warehouse and mill laboratory.
28. Break up foundation concrete to allow drainage.
29. Place an interim earthen cap over the in-place concrete.

Ending Date: September, 1993.

At this point all demolition that is initially planned will be completed. The building for the inside leach, and the power room, as well as the mostly new building housing CCD, clarification, ion exchange, elution, and precipitation would be left intact as discussed in the plan. The mill office building and the change room/radiation safety laboratory facility would remain. If the decision is then made to proceed with the decommissioning of the balance of these facilities, the following sequence would be followed:

30. Excavate an alternate burial trench if the 2A site is no longer available. Note that a series of adjacent trenches may be required.
31. Salvage clarification, elution, and precipitation tankage that can be transferred to another NRC-licensed facility.
32. Remove, disassemble, and/or crush the remaining tankage for burial in the adjacent disposal trench. The IX cells will be disassembled and flattened or filled with earth prior to burial.
33. Raze and bury the remaining mill building. The transite siding would be placed in the asbestos storage vault which would then be sealed.

34. Salvage the mill office building (or raze and bury it if there is no market for the structure.)
36. Raze and bury the change room/radiation laboratory facility.
37. Backfill and compact over the final adjacent burial trench.
38. Break up the remaining foundation concrete to allow drainage.
39. Place an interim earthen cover over the building sites.

The mill site will then be ready for integration into the general mill site/tailings reclamation plan. As noted previously, the approach to the remaining tasks on the mill site (surveys, decontamination of the grounds and/or covering, and final surface cover form) will be presented with the overall tailings/mill site reclamation plan due for submittal to the NRC on July 1, 1992.

Part 5:

Decommissioning Cost Estimate

Table 5-1 presents a cost estimate summary for the accomplishment of the mill site decommissioning. Cost estimates are based upon the use of outside contractors to accomplish the work. The hourly rate for workers utilized in this estimate is representative of typical wages paid by contractors in Wyoming. Equipment hourly cost rates were derived from two sources: average owning and operating costs from Caterpillar Performance Handbook, 22nd Edition, published by Caterpillar, Inc., October, 1991, and 1991 Rental Rates and Specifications for Construction Equipment published by the Associated Equipment Distributors, March, 1991.

Salvage efforts for this cost estimate are based upon the assumption that only the SAG mill is saved, and that all other equipment is subject to disposal by burial. This approach was used to simplify the cost estimate even though it is Pathfinder's intent as noted previously in this document to utilize its own workers to accomplish more salvage than indicated here. Decontamination of the salvaged SAG equipment should not be difficult since there was no contact of the equipment with concentrated uranium product or an acid environment. Use of a water wash is anticipated to be sufficient for the SAG mill.

Costs for removal from the mill buildings of all equipment bound for disposal by burial as well as the razing of the buildings are included in the estimate on the assumption that all structures are decommissioned even though Pathfinder intends to at least temporarily preserve portions of the mill.

Not included in this decommissioning cost estimate is the restoration of contaminated areas such as the ore pad and adjacent mill site grounds. That cost will be accounted in the tailings reclamation cost estimate which will be included with the tailings reclamation plan due for submittal on July 1, 1992.

Information in support of Table 5-1 is provided in Tables 5-2 and 5-3. Table 5-3 summarizes the estimated volumes of rubble/material that will result from the decommissioning. Table 5-3 also provides the overall unit costs for removal/demolition and for the haulage/burial of the waste material.

Table 5-1. Pathfinder Mines Corporation, Lucky Mc Mine
Mill Decommissioning Cost Estimate Summary

MILDECOM.WK1

Activity:	Equip. Salvage (B)	Equip. Decon. (C)	Nonsalvaged Equip. Removal(D)	Structure Demolit. (E)	Material Haul and Burial (F)	Concrete Breakup & Covering (G)	Kerosene Cleaning (H)	Rad. Safety (I)
Hourly Labor Cost	$13.64 (A)	$13.64	$13.64	$13.64	$13.64	---	$13.64	$21.00
Labor Hours	800	200	2768	6920	1817	---	40	1600
Labor Cost	$10,912	$2,728	$37,756	$94,389	$24,784	$6,528	$546	$33,600
Hourly Equipment Cost	$32.84	$32.84	$59.34	$96.68	$245.50	---	---	---
Equipment Hours	200	20	692	346	519	---	---	---
Equipment Cost	$6,568	$657	$41,063	$33,451	$127,415	$10,855 ‡	$5,150	$10,000
Subtotal Cost	$17,480	$3,385	$78,819	$127,840	$152,198	$17,383	$5,696	$43,600

Total	$446,401
Mobilization	$45,000
	$491,401
Overhead (15%)	$73,710
	$565,111
Profit (10%)	$56,511
	$621,622
Contingency (15%)	$93,243
Grand Total ====>	$714,865

‡ Includes materials.

NOTE: For lettered footnotes see corresponding items on Table 5-2.

Table 5-2. Pathfinder Mines Corporation, Lucky Mc Mine
Supporting Information for the Mill
Decommissioning Cost Estimate

A. Hourly Labor Cost:

Based upon a laborer/operator pay rate of $11.00 per hour with a burden of 24 percent: $11.00 (1.24) = $13.64.

B. Equipment Salvage:

Salvage for purposes of this cost estimate is limited to removal of the SAG mill and attendant equipment only. Required equipment consists of a 45 ton capacity cable controlled crane, truck mounted, diesel engine powered. Hourly rate is based upon monthly rental rate of $4817 (AED 1991 rental rate):

$$\frac{\$4817/\text{month}}{173\ \text{hrs./mo.}} = \$27.84/\text{hr.}$$

$\$5.00/\text{hr.}$ fuel and lube

$\$32.84/\text{hr.}$

Removal of the SAG mill is estimated to require 800 man hours and 200 equipment hours.

C. Equipment Decontamination:

Because of the lack of an extractive acid environment in SAG it is anticipated that decontamination of the SAG mill can be accomplished with a water wash and scrub. The only equipment needed will be the crane to move separate parts of the equipment to facilitate the decontamination.

D. Equipment Removal (No Salvage):

It is estimated that a crew of four will require four months to strip the mill of all remaining equipment consisting of tanks, pumps, motors, pipe, and electrical wire/equipment:

4 laborers x 173 hrs./mo. x 4 mo. = 2768 hrs.

Equipment utilized for the equipment removal will consist of a mobile crane available 100 percent of the time and a Caterpillar 245B Series II backhoe utilized 50 percent of the time. Crane costs are based upon the rental rate in item B above while the Cat backhoe rate (as well as the balance of the equipment rates utilized in this table) is from the 1991 Cat performance handbook:

Table 5-2, Continued.

(D.)	Crane	$32.84/hr.
	Backhoe ($53/hr. x 50%)	$26.50/hr.
		$59.34/hr.

Equipment hours are based upon the four month work period for equipment removal:

173 hrs./mo. x 4 mos. = 692 hrs.

E. Structure Demolition:

It is estimated that a crew of twenty laborers will require two months to dismantle the empty mill buildings:

20 laborers x 173 hrs./mo. x 2 mos. = 6920 hrs.

Equipment utilized during the demolition of the buildings will consist of two 45 ton cranes (AED rental rate + fuel/lube), and one Cat D9 dozer (Cat manual) utilized 50 percent of the time:

Crane ($35.10/hr. x 2)	$65.68/hr.
Dozer ($62 x 50%)	$31.00/hr.
	$ 96.68/hr.

Equipment hours are based upon the two month demolition period:

173 hrs./mo. x 2 mos. = 346 hrs.

F. Material Haul and Burial:

A crew of 3.5 operators on average is projected for the haul and burial of mill demolition wastes and equipment requiring a total of three months:

3.5 operators x 173 hrs./mo. x 3 mos. = 1817 hrs.

Required equipment for the haul and burial will consist of a Cat 245 backhoe for 50 percent of the time, two Cat 777B haul trucks, one Cat D9 dozer, and one Cat 623E self loading scraper utilized 50 percent of the time:

Backhoe ($53/hr. x 50%)	$ 26.50/hr.
Trucks ($64/hr. x 2)	128.00/hr.
Dozer	62.00/hr.
Scraper ($58.hr. x 50%)	29.00/hr.
	$245.50/hr.

(F.) Equipment hours for the haul and burial will consist of the following:

173 hrs./mo. x 3 mos. = 519 hrs.

G. Concrete Breakup and Covering:

It is estimated that a two man crew setting explosive charges for the breaking of the concrete will require two weeks to complete the work:

2 workers x 40 hrs./wk. x 2 wks. = 160 hrs.

Based upon a quote from a explosives supply firm, contract blasting labor will cost $35/hr. The total labor cost for blasting will be:

160 hrs. x $35/hr. = $5600

Cost of the materials for blasting are based upon the following:

Using a charge placement grid with twenty foot centers, nine charges will blast 1600 sq. ft. of concrete surface. The number of charges required will be:

110,000 sq. ft./1600 sq. ft. x 9 charges = 620 charges

Materials for each charge shot will consist of one shaped charge, one blasting cap, and twenty feet of primer cord. the current price of all materials per charge is $9.83. Total materials cost is:

620 charges x $9.83/charge = $6,095.

The haul and placement of cover material will involve the covering of 110,000 sq. ft. of concrete. The required cover material consists of the following:

(110,000 sq. ft. x 2 ft.) / 27 cu. ft./CY = 8150 CY.

At a production rate of 250 CY/ scraper hour it will take 33 hours to haul and place the two feet of cover material:

8150 CY / 250 CY/scraper hr. = 33 scraper hrs.

(G.) Utilizing two Cat 651E scrapers and two Cat D9 dozers, 17 crew hours will be involved to complete the task. The following total operator cost and equipment cost will result:

4 Operators x 17 hrs. x $13.64/hr. = $ 928.

Equipment costs will be as follows:

Scraper ($78/hr. x 2)	$156.00
Dozer ($62 x 2)	124.00
	$280.00

17 hrs. x $280/hr. = $4,760.

Summarizing the concrete breakup and covering costs,

Labor: $5600 + $ 928 =	$6,528
Materials:	6,095
Equipment:	4,760
	$17,383

H. Kerosene Cleaning:

An estimated 40 man hours will be required to set up and run the treatment for the SX kerosene. Treatment will consist of running the kerosene through a ten percent aqueous solution of sodium carbonate which will remove uranium as confirmed by previous bench tests. Treatment requires three gallons of the sodium carbonate solution for each gallon of kerosene treated. There are 37,000 gallons of kerosene stored in SX. Materials costs are derived as follows:

Treatment of 37,000 gal. of kerosene requires 103,000 pounds of sodium carbonate. Using $0.05 per pound for the sodium carbonate,

103,000 lbs. x $0.05/lb. = $5150.

I. Radiation Safety:

A radiation safety technician is estimated to cost $21.00 per hour including a thirty percent burden. With an estimated 40 weeks to accomplish the work as outlined in this cost estimate the cost of the technician is as follows:

40 weeks x 40 hrs./wk. x $21.00/hr = $33,600.

Table 5-2, Continued.

Cost of supplies/analytical services for the support of the radiation safety program are projected to be $1,000 per month, including maintenance of the change room (based on previous costs at Lucky Mc.) Total cost is:

10 mos. x $1,000/mo. = $10,000.

Table 5-3. Lucky Mc Mill Rubble Volume* and Unit Disposal Cost

AREA	Volume (CY)
SAG Mill Building	9,000
Piping, MCC, motors, grating, etc.	2,500
	11,500
RIP Building	8,500
Top floor equipment	1,800
Mid floor	1,200
First level above concrete	650
Block powerhouse	300
Slurry tanks	14,450
Mill Laboratory	2,500
Old Crusher Building	4,500
Decking, stairs, motors	300
	4,800
Galley Way - (Conveyor Route)	
Crusher to SAG	2,000
Crusher to fine ore	1,800
	3,800
Sample Tower	1,500
Iron, stairs, equipment	1,500
	3,000
Fine Ore Bins	5,000
Piping, motors, equipment	750
	5,750
Main Mill Building	
Power room area	2,200
Tanks, boilers, MCC	225
	2,425
Leach Area	6,000
Miscellaneous decking framing and piping	800
Adjacent shop, etc.	250
Leach tanks at 125 cy each	1,375
	8,425

*Includes all mill buildings and equipment such as tanks, pipe, pumps, motors, etc., excluding SAG mill.

Table 5-3. Continued

AREA	VOLUME (CY)
MAIN MILL BUILDING (cont.)	
CCD	10,000
Enviro-Clear	625
Lower tanks and motors	250
Precip, clarecone, etc.	400
Piping	100
	11,375
IX	8,000
IX cells, resin traps, decking, tankage, and control house.	3,500
Block power room, piping, conduit, etc.	250
	11,750
SX Building	7,500
Tankage, decks, pumps, etcetera	3,500
	11,000
Outside Thickener	350
Galley way, steel, tankage	350
	700
Bone Yard	
Materials, equipment, pipes, tanks, motors pumps, drives, wood and etcetera	12,500
Mill Shop and Warehouse	3,500
Rubber Shop	
Rubber shop and pressure vessels	800
GRAND TOTAL	108,275 CY

Unit Costs (Exclusive of Mobilization, Overhead, Profit)

Removal/Demolition:

$206,659/108,275 cy = $1.91/cy

Haul and Burial:

$152,198/108,275cy = $1.41/cy

APPENDIX A

PATHFINDER MINES CORPORATION - LUCKY MC MINE

PENTRATING RADIATION
(TLD BADGES)

----------MR/HR----------

AREA	1986 AVG.	1987 AVG.	1988 AVG.	1989 AVG.	1990 AVG.	1991 AVG.
SAG	.02	.03	.03	.03	.04	.03
RIP	.02	.03	.03	.02	.02	.02
LEACH	.02	.03	.04	.02	.04	.03
CCD	.02	.02	.11	.14	.16	.17*
IX	.72	.75	.79	.98	.92	.90
SX	.06	.03	.04	.04	.04	.04
PRECIP.	.01	.01	.11	.03	.03	.04
RAD. LAB	.02	.02	.02	.01	.02	.02
LUNCH ROOM	.04	.05	.04	.05	.04	.05
WAREHOUSE	.01	.01	.01	.01	.01	.01
MILL SHOP	.01	.01	.01	.00	.00	.00
RUBBER SHOP	.02	.02	.02	.02	.02	.02
MILL LAB	.03	.02	.03	.03	.03	.03
SHIFT OFFICE	.03	.03	.02	.02	.02	.02
MTCE. OFFICE	.03	.03	.03	.03	.03	.03
CHANGE ROOM	.01	.01	.01	.01	.01	.01
MILL OFFICE	.02	.02	.01	.01	.02	.01
ELECT. SHOP	.02	.02	.02	.03	.03	.02

*Will decrease because sealed sources were removed on January 9, 1992.

PATHFINDER MINES CORPORATION - LUCKY MC MINE

URANIUM CONCENTRATION x E-11 MICROCURIES/ML
(Soluble and Insoluble)

LOCATION	1986 AVG.	1987 AVG.	1988 AVG.	1989 AVG.	1990 AVG.	1991 AVG.
SAG	.30	.15	.40	.16	.11	.10
LEACH	.28	.28	.23	.16	.10	.10
CCD	.30	.38	.35	.12	.09	.09
IX	.37	.24	.19	.11	.10	.09
SX	.21	.42	.38	.19	.14	.18
PRECIP.	.26	.33	.37	.12	.09	.08
RUBBER SHOP	.30	.16	.18	.10	.05	.06
MILL SHOP	.18	.10	.26	.10	.08	.07
PIPE SHOP	.31	.11	.12	.12	.08	.08
ELECT. SHOP	.29	.28	.20	.14	.10	.06
SHIFT OFFICE	.34	.15	.24	.11	.07	.07
WAREHOUSE	.11	.36	.14	.11	.06	.04
LUNCH ROOM	.16	.12	.08	.10	.08	.06
RAD LAB	.21	.25	.12	.08	.07	.09
MILL LAB	.30	.31	.41	.15	.09	.12
BOILER AREA	.23	.22	.09	.12	.07	.09
CHANGE ROOM	.21	.22	.09	.08	.09	.09
LUBE BAY	.18	.24	.16	.16	.08	.09
MILL OFFICE	.18	.19	.12	.09	.07	.08
MTCE. OFFICE	.26	.53	.21	.09	.07	.08

PATHFINDER MINES CORPORATION - LUCKY MC MINE

RADON DAUGHTERS - W/L'S

LOCATION	1987 AVG.	1988 AVG.	1989 AVG.	1990 AVG.	1991 AVG.
SAG	.006	.005	.007	.010	.010
LEACH	.007	.005	.009	.006	.009
CCD	.007	.006	.010	.008	.010
IX	.008	.006	.010	.010	.012
SX	.008	.017	.034	.015	.013
PRECIP.	.007	.006	.010	.007	.010
RUBBER SHOP	.007	.006	.006	.008	.011
MILL SHOP	.005	.003	.006	.008	.008
PIPE SHOP	.006	.002	.008	.010	.009
ELECT. SHOP	.008	.003	.009	.010	.010
SHIFT OFFICE	.005	.004	.005	.007	.005
MTCE. OFFICE	.006	.004	.006	.006	.006
WAREHOUSE	.008	.012	.011	.008	.006
LUNCH ROOM	.019	.010	.020	.009	.018
RAD LAB	.011	.006	.020	.008	.029
MILL OFFICE	.011	.006	.020	.008	.029
BOILER AREA	.006	.005	.007	.007	.012
CHANGE ROOM	.006	.005	.018	.006	.009
LUBE BAY	.007	.002	.009	.007	.012
MILL LAB	.012	.007	.030	.014	.017

PATHFINDER MINES CORPORATION - LUCKY MC MINE

SURFACE CONTAMINATION SURVEY - 2/21/92

LOCATION	FIXED ALPHA DPM/100cm^2	REMOVABLE ALPHA DPM/100cm^2
CRUSHER BOTTOM FLOOR	2,500	522
CRUSHER BOTTOM HANDRAIL	1,800	230
CRUSHER BOTTOM BELT COVER	1,800	66
CRUSHER BOTTOM WALL	2,300	341
CRUSHER BOTTOM BELT ROLLER	1,500	49
CRUSHER 2ND FLOOR ELECTRIC MOTOR	3,000	169
CRUSHER 2ND WALL	3,500	255
CRUSHER 2ND I BEAM	1,800	66
CRUSHER 2ND FLOOR	1,500	271
CRUSHER 2ND ELECTRICAL CONDUIT	600	230
CRUSHER GROUND LEVEL BIN	1,200	16
CRUSHER GROUND LEVEL WALL	2,400	218
CRUSHER GROUND LEVEL I BEAM	800	78
CRUSHER GROUND LEVEL FLOOR	2,200	255
CONVEYOR BELT	2,600	822
ORE BIN	1,500	243
HAND RAIL MID-LEVEL	600	255
FLOOR MID-LEVEL	1,800	259
EXHAUST PIPE TOP LEVEL	800	436
MOTOR COVER TOP LEVEL	2,500	567

PATHFINDER MINES CORPORATION - LUCKY MC

RADON DAUGHTER SURVEY - 2/19/92

LOCATION		WL'S
1.	RUBBER SHOP	0.002
2.	MILL WAREHOUSE	0.003
3.	MILL MAINTENANCE SHOP	0.006
4.	CRUSHER - GROUND FLOOR	0.001
5.	CRUSHER - LOWER LEVEL	0.000
6.	CRUSHER - EAST AREA	0.002
7.	SAG MILL - ALL LEVELS	0.001
8.	RIP - ALL LEVELS	0.011
9.	MILL LABORATORY	0.003
10.	MILL OFFICE - UPPER FLOOR	0.017
11.	MILL OFFICE - GROUND FLOOR	0.019
12.	MILL MAINTENANCE OFFICE	0.001
13.	MILL SHIFT OFFICE	0.002
14.	POWER ROOM	0.010
15.	CHANGE ROOM	0.046
16.	PIPE SHOP	0.003
17.	ELECTRICIAN'S OFFICE	0.000
18.	LEACH - GROUND FLOOR	0.005
19.	LEACH - TOP FLOOR	0.003
20.	CCD - TOP FLOOR	0.011
21.	CCD - GROUND FLOOR	0.008
22.	PRECIP. - TOP FLOOR	0.009
23.	PRECIP. - GROUND FLOOR	0.002
24.	IX - TOP FLOOR	0.007
25.	IX - GROUND FLOOR	0.003
26.	SX - BOTH LEVELS	0.024

PATHFINDER MINES CORPORATION - LUCKY MC

RADON DAUGHTER SURVEY - 2/21/92

LOCATION		WL'S
27.	SAMPLE TOWER	0.003
28.	ABOVE FINE ORE BINS	0.007
29.	BELOW FINE ORE BINS	0.033
30.	MILL LAB BASEMENT	0.013
31.	UNDER #1 THICKENER	0.009
32.	IX CONTROL ROOM	0.005
33.	CCD CONTROL ROOM	0.009
34.	MINE OFFICE BASEMENT	0.002
35.	MINE ADMINISTRATION BUILDING	0.000

PATHFINDER MINES CORPORATION - LUCKY MC MINE

PENETRATING RADIATION (GAMMA) FROM CONCRETE
FEBRUARY 24, 1992

LOCATION	MR/HR
IX	
SW Corner Floor	.21
Under Tank	.60
Center Floor	.95
NW Corner Floor	.35
NSide Floor	1.00
Center Floor	1.20
SSide Floor	.37
SE Corner	.18
Center	.90
NE Corner	.25
LOADED STRIP	.12
Precip	.06
NEUTRAL STRIP	.20
DRIVE THRU	.08
Drive Thru Between IX & Precip	.13 AVG.
CCD	.05 AVG.

APPENDIX B

Number: 02.001.00	PATHFINDER MINES CORPORATION Lucky Mc Mill
Date: MAY 14 '82	MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Page 1 of 3	

Title: External Radiation Exposure Documentation

1. Purpose:

The purpose of this procedure is to establish standards for construction of individual, external radiation exposure history files.

2. Scope:

The scope of this procedure shall include all individuals for whom monitoring is provided in compliance with 10 CFR 20.202[a].

3. Equipment:

A. Pendaflex hanging file folders.
B. 11 point, single top, manila file folders.
C. Microfiche/film jackets.
D. Microfiche/film jacket labels.
E. Two-prong fasteners.

4. Procedure:

A. File Construction: Each individual radiation exposure history file shall consist of:

(1) One Pendaflex hanging file folder.

(2) One manila file folder, equipped with two 2-prong fasteners located at the opposite of the cutaway label tab (one on each side of the folder).

(3) One microfiche/film jacket affixed to the label tab (jackets are provided with adhesive on the back) of the manila folder.

(4) One microfiche/film jacket name label affixed (labels are provided with adhesive on the back) to the top of the microfiche/film jacket. The label shall contain employee's last name, first name, middle initial; social security number and employee number.

B. Each radiation exposure history file shall contain the following information, in the order shown (top to bottom), on the right hand side of the manila file folder:

(1) Form NRC-5 or equivalent (see Attachment 1), including:

(a) Name (last, first, middle initial)

(b) Social security number

(c) Birthdate

(d) Age at last birthday (N)

(e) Recorded, calculated or assigned penetrating dose for each calendar quarter of the current year.

(f) Recorded, calculated or assigned non-penetrating dose for each calendar quarter of the current year.

(g) Recorded, calculated or assigned extremity (penetrating + non-penetrating) dose for each calendar quarter of the current year.

(h) Year-to-date penetrating dose, as of the current quarter.

(i) Year-to-date non-penetrating dose, as of the current quarter.

(j) Year-to-date extremity dose, as of the current quarter.

(k) Life-to-date penetrating dose, as of the current quarter.

(l) Permissible Accumulated Dose (PAD). PAD = 5(N-18), where N = age at last birthday (see paragraph 4B(1)(d)).

(m) Unused portion of PAD = PAD - life-to-date penetrating dose.

(2) Form 5 backup information and data shall be kept as a vendor report, separate from employee exposure file.

(3) Form NRC-4 completed in accordance with SOP 02.004.00[b].

(4) Form NRC-4 backup information, including:

(a) A copy of the letter to previous employer(s) requesting radiation exposure history (see SOP 02.004.00) and the letter(s) received from previous employer(s).

(5) Completed medical release form.

(6) Training records, arranged in chronological order.

C. Filing of Radiation Exposure History Folders: Radiation exposure history folders shall be inserted into Pendaflex hanging file folders, and filed alphabetically (last name, etc.) in a lockable file cabinet. Each drawer of the file cabinet used for this purpose should be labeled "Exposure History Records." If more than one drawer is used, include the alpha breaks between drawers (i.e., A-M, N-Z). A clear differentiation (via drawer labels) should be made between four separate classifications of individuals:

(1) "Active Employees"
(2) "Inactive Employees"
(3) "Active Contractors and Visitors"
(4) "Inactive Contractors and Visitors"

D. Filing of Vendor Badge Reports: Vendor badge (whole body, extremity, etc.) reports should be placed in a manila file folder and located in a Pendaflex hanging file holder in front of the first individual history file.

E. Records Retention Requirements:

(1) See SOP 02.132.00, "Record Retention and Microprocessing Radiation Safety Records."

References

a. Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation."

b. Standard Operating Procedure Number 02.004.00, "Methodology for Completing the Occupational External Radiation Exposure History Record (Form NRC-4)."

Attachment 1

FORM NRC-5 AND EQUIVALENT

Form NRC-5
(6-76)
10 CFR 20

U. S. NUCLEAR REGULATORY COMMISSION

Approved by GAO
B-180225 (R004;
Expires – 4-30-77

CURRENT OCCUPATIONAL EXTERNAL RADIATION EXPOSURE

See Instructions on Back

IDENTIFICATION

1. NAME (PRINT – Last, first, and middle)	2. SOCIAL SECURITY NO.
3. DATE OF BIRTH (Month, day, year)	4. NAME OF LICENSEE

5. DOSE RECORDED FOR (Specify: Whole body; skin of whole body; or hands and forearms, feet and ankles.)	6. WHOLE BODY DOSE STATUS (rem)	7. METHOD OF MONITORING (e.g., Film Badge – FB; Pocket Chamber – PC; Calculations – Calc.) X OR GAMMA _____ BETA _____ NEUTRONS _____

8. PERIOD OF EXPOSURE (From – To)	DOSE FOR THE PERIOD (rem)				13. RUNNING TOTAL FOR CALENDAR QUARTER (rem)
	9. X OR GAMMA	10. BETA	11. NEUTRON	12. TOTAL	

LIFETIME ACCUMULATED DOSE

14. PREVIOUS TOTAL (rem)	15. TOTAL QUARTERLY DOSE (date / rem)	16. TOTAL ACCUMULATED DOSE (rem)	17. PERM. ACC. DOSE 5(N-18) (rem)	18. UNUSED PART OF PERMISSIBLE ACCUMULATED DOSE (rem)

MAY 14 '82

INSTRUCTIONS FOR PREPARATION OF FORM NRC-5

The preparation and safekeeping of this form or a clear and legible record containing all the information required on this form is required pursuant to Section 20.401 of "Standards for Protection Against Radiation," 10 CFR 20, as a current record of occupational external radiation exposures. Such a record must be maintained for each individual for whom personnel monitoring is required under Section 20.202. Note that a separate Form NRC-5 is to be used for recording external exposure to (1) the whole body; (2) skin of whole body; (3) hands and forearms; or (4) feet and ankles, as provided by Item 5 below.

Listed below by item are instructions and additional information directly pertinent to completing this form.

Identification

Item 1. Self-explanatory.
Item 2. Self-explanatory except that, if individual has no social security number, the word "none" shall be inserted.
Item 3. Self-explanatory.
Item 4. Self-explanatory.

Occupational Exposure

Item 5. "Dose to the whole body" shall be deemed to include any dose to the whole body, gonads, active blood-forming organs, head and trunk, or lens of eye. Unless the lenses of the eyes are protected with eye shields, dose recorded as whole body dose should include the dose delivered through a tissue equivalent absorber having a thickness of 300 mg/cm^2 or less. When the lenses of the eyes are protected with eye shields having a tissue equivalent thickness of at least 700 mg/cm^2, dose recorded as whole body dose should include the dose delivered through a tissue equivalent absorber having a thickness of 1,000 mg/cm^2 or less.

Dose recorded as dose to the skin of the whole body, hands and forearms, or feet and ankles should include the dose delivered through a tissue equivalent absorber having a thickness of 7 mg/cm^2 or less. The dose to the skin of the whole body, hands and forearms, or feet and ankles should be recorded on separate forms unless the dose to those parts of the body has been included as dose to the whole body on a form maintained for recording whole body exposure.

Item 6. This item need be completed only when the sheet is used to record whole body exposures and the licensee is exposing the individual under the provisions of Paragraph 20.101(b) which allows up to 3 rems per quarter to the whole body. Enter in this item the unused part of permissible accumulated dose taken from previous records of exposure, i.e., Item 18 of the preceding Form AEC-5 or NRC-5 or Item 13 of Form AEC-4 or NRC-4 if the individuals's exposure during employment with the licensee begins with this record.

Item 7. Indicate the method used for monitoring the individual's exposure to each type of radiation to which he is exposed in the course of his duties. Abbreviations may be used.

Item 8. Doses received over a period of less than a calendar quarter need not be separately entered on the form provided that the licensee maintains a current record of the doses received by the individual which have not as yet been entered on the form. The period of exposure should specify the day the measurement of that exposure was initiated and the day on which it was terminated. For example, if only quarterly doses are entered, the period of exposure for the first calendar quarter of 1962 might be taken as running from Monday, January 1, 1962, through Friday, March 30, 1962, and would be indicated in this item as Jan. 1, 1962-Mar. 30, 1962. If weekly doses are entered, a film badge issued Monday morning, January 1, 1962, and picked up Friday, January 5, 1962, would be indicated as Jan. 1, 1962-Jan. 5, 1962.

Items 9, 10 and 11. Self-explanatory. The values are to be given in rem. All measurements are to be interpreted in the best method known and in accordance with Paragraph 20.4(c) Where calculations are made to determine dose, a copy of such calculations is to be maintained in conjunction with this record. In any case where the dose for a calendar quarter is less than 10% of the value specified in Paragrapl 20.101(a), the phrase "less than 10%" may be entered in lieu of a numerical value.

Item 12. Add the values under Items 9, 10 and 11 for each period of exposure and record the total. In calculating the "Total" any entry "less than 10%" may be disregarded.

Item 13. The running total is to be maintained on the basis of calendar quarters. Paragraph 20.3(a) (4) defines calendar quarter. No entry need be made in this item if only calendar quarter radiation doses are recorded in Items 9, 10, 11 and 12.

Lifetime Accumulated Dose (Whole Body)

NOTE: If the licensee chooses to keep the individual's exposure below that permitted in Paragraph 20.101(a), Items 14 through 18 need not be completed. However, in that case the total whole body dose for each calendar quarter recorded in Item 13 (or Item 12 if quarterly doses are entered in Item 12) should not exceed 1 1/4 rem.

If an individual is exposed under the provisions of Paragraph 20.101 (b), complete Items 14 through 18 at the end of each calendar quarter and when the sheet is filled. Values in Item 13, when in the middle of a calendar quarter, and values in Item 18, must be brought forward to next sheet for each individual.

Item 14. Enter the previous total accumulated dose from previous dose records for the individual (e.g., from Item 16 of Form AEC-5 or NRC-5 or Item 11 of Form AEC-4 or NRC-4). The total occupational radiation dose received by the individual must be entered in this item, including any occupational dose received from sources of radiation not licensed by the Commission. If the individual was exposed to sources of radiation not licensed by the Commission during any calendar quarter after completing Form AEC-4 or NRC-4 and personnel monitoring equipment was not worn by the individual, it should be assumed that the individual received a dose of 1 1/4 rems during each such calendar quarter.

Item 15. Enter the total calendar quarter dose from Item 13 (or from Item 12 if quarterly doses are entered in Item 12) and the date designating the end of the calendar quarter in which the dose was received (e.g., March 30, 1962).

Item 16. Add Item 14 and Item 15 and enter that sum.

Item 17. Obtain the Permissible Accumulated Dose (PAD) in rem for the WHOLE BODY. "N" is equal to the number of years of age of the individual on his last birthday. Subtract 18 from N and multiply the difference by 5 rem (e.g., John Smith, age 32; N = 32, PAD = 5(32-18) = 70 rem.)

Item 18. Determine the unused part of the PAD by subtracting Item 16 from Item 17. The unused part of the PAD is that portion of the Lifetime Accumulated Dose for the individual remaining at the end of the period covered by this sheet.

PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e) (3), enacted into law by section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the Nuclear Regulatory Commission on Form NRC-5. This information is maintained in a system of records designated as NRC-27 and described at 40 Federal Register 45344 (October 1, 1975).

1. AUTHORITY Sections 53, 63, 65, 81, 103, 104, 161(b), and 161(o) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2073, 2093, 2095, 2111, 2133, 2134, 2201(b), and 2201(o)). The authority for soliciting the social security number is 10 CFR Part 20.

2. PRINCIPAL PURPOSE(S) The information is used by the NRC in its evaluation of the risk of radiation exposure associated with the licensed activity and in exercising its statutory responsibility to monitor and regulate the safety and health practices of its licensees. The data permits a meaningful comparison of both current and long-term exposure experience among types of licensees and among licensees within each type. Data on your exposure to radiation is available to you upon your request.

3. ROUTINE USES The information may be used to provide data to other Federal and State agencies involved in monitoring and/or evaluating radiation exposure received by individuals employed as radiation workers on a permanent or temporary basis and exposure received by monitored visitors. The information may also be disclosed to an appropriate Federal, State, or local agency in the event the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding.

4. WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION It is voluntary that you furnish the requested information, including social security number; however, the licensee must complete Form NRC-5 on each individual for whom personnel monitoring is required under 10 CFR 20.202. Failure to do so may subject the licensee to enforcement action in accordance with 10 CFR 20.601. The social security number is used to assure that NRC has an accurate identifier not subject to the coincidence of similar names or birthdates among the large number of persons on whom data is maintained.

5. SYSTEM MANAGER(S) AND ADDRESS Director, Office of Management Information and Program Control, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555

MAY 14 '82

Number: 02.016.03	PATHFINDER MINES CORPORATION Lucky Mc Mill MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Date: 1-14-88	
Page: 1 of 2	

Title: Routine and Non-routine Urine Sampling Program

1. Purpose:

The purpose of this procedure is to establish methodology for obtaining and processing urine samples and recording the analytical results.

2. Scope:

The scope of this procedure is limited to urine sampling for the purposes of determining urinary uranium concentrations and applies to all mill personnel.

3. Equipment:

A. Plastic liquid sample bottles.

B. Labels (see Attachment 1).

4. Procedure:

The employee should, through verbal or posted instructions, be advised to avoid contaminating the sample.

A. Individuals shall be sampled in accordance with the following:

(1) New employees shall be sampled prior to work in the mill. All new and transferred employees shall provide a baseline urine sample during their initial radiation training class. Samples shall be collected from employees prior to leaving the site upon their termination, if possible.

(2) Urinalysis sampling for yellowcake workers shall be performed biweekly and monthly for all other mill employees utilizing an LLD of 5 ug/l.

(3) Specimens should be turned in when the workers return to the mill. The specimens should be collected at home, at least 36 hours after the most recent occupancy in the mill.

(4) All non-routine samples will normally be obtained within 48 to 96 hours of a calculated over-exposure, but by no means more than 14 days after the date of the calculated over-exposure.

(5) A minimum of 125 milliliters of urine should be collected from each individual.

B. The RSO shall:

(1) Provide properly labeled bottles for distribution to employees as necessary.

(2) Send all samples to a qualified laboratory to be analyzed for natural uranium in a timely manner.

(3) Evaluate the results and take any necessary action required by SOP 02.017[c].

(4) Post the results of urine analysis in the employee's exposure file on the form provided in Attachment 2. Spiked sample results shall be posted with the vendor reports.

C. Quality control shall be accomplished as follows:

(1) Submit at least one blank (uncontaminated) control sample and one spiked control sample, in 4 oz. bottles, with each batch of urine samples.

(2) The natural uranium spiked sample shall be prepared using uncontaminated urine (i.e., urine from persons known to have no lung or systemic uranium burden other than that from natural background) or distilled water, as directed in Attachment 3.

(3) Spiked and blank control samples shall be submitted as controls with each batch of urine.

(4) At least 25% of the monthly (routine) samples shall be split and sent to a second laboratory for quality control purposes. All non-routine samples and control samples must be split. One-half of the monthly splits must be obtained from yellowcake operators. The remainder shall be chosen at random.

References

a. USNRC Regulatory Guide 8.22, "Bioassay at Uranium Mills," July 1978.

b. USNRC Source Material License SUA-672, Condition 42.

c. Standard Operating Procedure number 02.017, "Interpreting Uranium Urinalysis Results."

d. Proposed Revision 1 to Regulatory Guide 8.22.

Attachment 1

Label

PATHFINDER MINES CORPORATION
Lucky Mc Mill

Sample: Urine
Assay for: Nat Uranium

Sample No.

Sample Date:

Attachment 2

Employee Bioassay Record

PATHFINDER MINES CORPORATION
Lucky Mc Mine
P. O. Box 831
Riverton, Wyoming 82501

Name:____________________________

Social Security No.______________

Payroll No.______________________

Sample Collection Date	Sample Type	Results	Routine=R Non-Routine=NR	Comments

02.016

Attachment 3

Preparation of Urine Sample Spikes

Using a distilled water and spiked solution of 30 micrograms/liter, prepare spike solutions as follows.

	Target	Use
Control 1	0 ug/l	Distilled H_2O (100 ml)
Control 2	15 ug/l	50 ml distilled H_2O and 50 ml spike solution
Control 3	30 ug/l	100 ml spike solution

Number: 02.032.02	PATHFINDER MINES CORPORATION Lucky Mc Mill
Date: 3-1-88	MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Page: 1 of 4	

Title: Surface Contamination Surveys

1. Purpose:

   The purpose of this procedure is to provide criteria for performing surface contamination surveys.

2. Scope:

   The scope of this procedure shall include all routine surface contamination surveys to include both production and non-production surveys, and special surveys.

3. Definitions:

   A. Production Areas. Those shops and areas/circuits in which ore is processed and yellowcake is produced and prepared for shipment. The following table identifies the production areas.

   SAG
   RIP (when operating)
   Leach
   CCD
   Sand/Slime
   Solvent Extraction
   Ion Exchange
   Precipitation
   Barrel Storage
   Mill Lab

   B. Non-Production Areas. Those areas in which support activities are conducted (i.e., offices, lunch rooms, change room and laboratories).

   Change Room
   Electrical Shop & Office
   Mill Shop
   Rubber Shop
   Maintenance Office
   Mill Office
   Radiation Office
   Shift Office
   Radiation Lab
   Warehouse
   Lunch Room & Designated Eating Areas

C. Special Surveys. Those surveys deemed necessary by the RSO.

4. Frequency of Surveys:

A. Production Areas: Quarterly.
B. Non-Production Areas: Biweekly.

5. Equipment:

A. Portable Alpha Counter.
B. Mini-scaler with RD-14 or equivalent.
C. Whatman 41 paper or equivalent.
D. Surface Contamination Survey Form (Attachment 1).

6. Procedure:

A. General Procedures:

(1) Ensure that all equipment is calibrated.
(2) Review previous surveys to identify problem areas.

B. Check area for visible yellowcake and, if found, have it cleaned immediately.

C. Obtain a direct measurement utilizing the portable alpha counter at each location, and record the results (production areas and occasional spot checks of non-production areas).

D. Obtain a wipe sample utilizing the Whatman 41 paper with fingertip pressure, and cover approximately four (4) square inches. Fold the paper with the contaminated surface covered. Ensure that the paper is adequately identified.

E. After all wipe samples and direct readings have been taken, evaluate the wipe test paper with the mini-scaler/RD-14.

(1) Center the wipe test paper under the RD-14 and count for two (2) minutes.

(2) Compute the activity for the wipe sample according to the following equation, and log it on the survey form.

$$DPM/100\ cm^2 = (CPM_W - CPM_B)(eff)$$

where: CPM_W = The counts for minute observed from the wipe.

CPM_B = The background CPM taken from the control chart.

eff = The detector's efficiency as taken from the control chart in D/C.

(3) Compute the activity for the direct measurement according to the following equation, and log it on the survey form.

$$DPM/100\ cm^2 = (CPM_D)(eff)(A_S/A_P)$$

where: CPM_D = Counts per minute from direct measurement.

eff = Efficiency in disintegration per count.

A_P = Area of probe (59 cm^2).

A_S = Area of survey (100 cm^2).

F. Review the completed form and determine what action is required as follows.

(1) Production Area:

(a) Concentrate circuits - clean all visible yellowcake.

(b) Non-concentrate circuits:

(i) Wipe results greater than 1,000 DPM/100 cm^2 - clean area.

(ii) Direct Measurement (fixed) 15,000 DPM/100 cm^2 maximum, 5,000 DPM/100 cm^2 average - clean area.

(2) Non-Production Areas/Special Surveys:

(a) Any visible yellowcake - clean immediately.

(b) Direct measurement (fixed) greater than 1,000 DPM/100 cm^2 - determine if it is removable.

(c) Removable contamination - if greater than 1,000 DPM, decontaminate the area.

7. Records:

A record of all surveys shall be completed and maintained. See Attachment 1 for production area surveys, and Attachment 2 for non-production surveys.

8. References:

A. USNRC License SUA-672, Condition 40.

Attachment 1

Surface Contamination Survey

Non-Production _____ (date)

Instrument _____ (portable)

Production _____ (date)

Corr Fac D/C _____

Analyst _____ (name)

Instrument _____ (MS/detector)

Corr Fac D/C _____

No.	Location	Fixed CPM	Fixed DPM	Removable CPM	Removable DPM	Comments

02.032

Attachment 2

Number: 02.034.02	PATHFINDER MINES CORPORATION Lucky Mc Mill
Date: 3-2-92	MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Page: 1 of 3	

Title: Personal Contamination Surveys

1. Purpose:

The purpose of this procedure is to provide methodology for performing and documenting personal contamination surveys.

2. Scope:

The scope of this procedure is applicable to all individuals listed in item 4.C.(2).

3. Equipment:

A. Eberline Instrument Corporation Model PRM-6 Pulse Rate Meter, with a Model AC-3 Alpha Scintillation Probe, or equivalent; or

B. Eberline Instrument Corporation Model RM-19 Count Rate Meter, with a Model AC-3 Alpha Scintillation Probe, or equivalent; or

C. Eberline Instrument Corporation Model RM-20 Count Rate Meter, with a Model AC-3 Alpha Scintillation Probe, or equivalent.

4. Procedure:

A. All individuals for which this procedure is mandatory (see 4.C.(2) below) shall not be allowed to leave the restricted area when alpha contamination exceeds 1,000 dpm/100 cm^2 removable contamination on their skin or clothing.

B. A survey instrument shall be located in the radiation laboratory, in the men's and women's change rooms. The instrument shall be set to alarm at 1,000 dpm/100 cm^2 by using the following equation:

$$R_a = (1{,}000 \text{ dpm})(Ap/100 \text{ cm}^2)(E) + R_b$$

Where R_a = The meter reading equivalent to 1,000 dpm/100 cm^2 alarm setting or red line point, in counts per minute (cpm).

A_p = The area of the alpha scintillation probe, in cm^2 (59 cm^2 for the AC-3 probe).

E = The counting efficiency of the probe in counts per disintegration (c/d).

R_b = The background counting rate, in counts per minute (cpm).

C. Personal contamination surveys shall be performed by:

(1) Individuals who suspect that they may be contaminated, prior to leaving the restricted area.[a]

(2) The following individuals:

(a) All mill employees prior to departing the restricted area at the end of shift.

(b) All visitors (including contractors) to any mill circuit.

(c) Employees requested to do so by the radiation protection staff or any supervisor.

(3) Individuals at the completion of a Radiation Work Permit.

D. The radiation officer or radiation technician shall perform and document spot checks of the monitor and at least one employee not less than weekly. The RSO shall conduct a quarterly spot check of workers after they have monitored out. He shall keep a record of such spot checks in his log book.

E. Survey instructions, such as those shown in Attachment 1, shall be conspicuously posted near the survey instrument.

F. Monitoring shall be recorded on either the personnel alpha contamination monitoring form (Attachment 2), or the personnel rosters maintained in the change room and mill office.

G. Individuals with skin or clothing contamination in excess of 1,000 dpm/100 cm^2 shall be decontaminated in accordance with SOP 02.035.[b]

H. An evaluation shall be made by the radiation staff, and the findings documented, for each case where decontamination is required beyond step 4 of Attachment 1. When complete, this documentation shall be filed in the individual's exposure history file.

(1) Documentation shall include:

(a) An evaluation to determine the contamination source,

(b) Steps taken to achieve decontamination, and

(c) Steps taken to prevent recurrence.

Title: Personal Contamination Surveys

References

a. Source Material License SUA-672, January 19, 1978.

b. Standard Operating Procedure Number 02.035, "Personnel Decontamination."

c. Standard Operating Procedure Number 02.132, "Change Room Procedures."

Attachment 1

Self-Survey Instructions for
Determining Alpha Contamination

HOW TO PERFORM A SELF-SURVEY

FOR ALPHA CONTAMINATION

1. Grasp the probe (detector) by the handle.

2. Position the detector face very close (about ¼ inch) to the location to be surveyed, and wait 2 to 5 seconds.

   CAUTION: The probe face is very fragile. Do not set it down on rough surfaces! Avoid touching the probe face with sharp objects!

   NOTE: Survey <u>all</u> areas subject to contamination: hands, face, hair, shoes, pants, etc.

3. If the alarm does not sound, sign the personnel alpha contamination monitoring form thus indicating that you monitored.

4. If the alarm sounds, thoroughly wash the contaminated area and resurvey yourself.

   If the alarm does not sound after decontamination, sign the form.

5. If, after washing the contaminated location, the alarm sounds again, CONTACT YOUR IMMEDIATE SUPERVISOR OR A MEMBER OF THE RADIATION STAFF IMMEDIATELY!

<u>The RM-19/RM-20 Meter and Probe are very delicate instruments:</u>

Do not drop or hit the probe.

Do not tap the face of the meter.

Do not touch any of the controls.

If the equipment does not appear to be working property, contact a member of the radiation staff or your immediate supervisor at once!

Number: 02.036.02	PATHFINDER MINES CORPORATION Lucky Mc Mill
Date: 1-29-88	MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Page: 1 of 5	

Title: Radon Daughter Surveys

1. Purpose:

The purpose of this procedure is to provide methodology for performing radon daughter surveys utilizing the modified Kuznetz method.

2. Scope:

The scope of this procedure shall include the survey for radon daughters within the mill area.

3. Equipment:

A. Eberline Instrument Corporation mini-scaler, Model MS-2 or MS-3, equipped with a Model SPA-1 scintillation detector or equivalent.

B. Portable air sampler - either Fixt Flo or Model G/S, or equivalent, calibrated for 2 LPM minimum.

C. Gelman type A/E filter media or equivalent.

D. Stop watch.

E. Tweezers.

F. Alpha check source.

4. Frequency of Sample:

Frequency of sampling will be determined using the following concentration levels.

Concentration	Frequency
Less than 10% MPC	Quarterly
11% through 25% MPC	Monthly
Greater than 25% MPC	Weekly

5. Locations:

Surveys shall be conducted in the following locations.

	No. Samples
Leach	3
Mill Lab	2
IX	4
Precipitation	3
Solvent Extraction	1
Counter Current Decantation	4
SAG Mill	5
Electrical Shop	1
Rubber Shop	1
Mill Shop	1
Warehouse	1
Shifters Office	1
Maintenance Office	1
Lunch Room	1
Radiation Office	1
Change Room	1
Sand/Slime	1
Pipe Shop	1
Radiation Lab	1

6. Procedures:

A. Pre-sample procedures.

(1) Verify calibration of air sampler.

(2) Verify calibration of scaler and alpha detector, and check operability with alpha check source.

(3) Record air sampler ID and counter ID on control sheets.

(4) Test the reliability of detector by taking background count for ten (10) minutes and a calibrated check source count for ten (10) minutes. Compare the efficiency against the calibrated efficiency. Tolerances of ±20% are acceptable. Log the efficiency on the log sheet.

B. Precautions.

(1) Use only open face filter holders.

(2) Protect filter media from external contamination with filter covers (red caps).

C. Sampling Procedures.

(1) On arriving at sampling location, secure filter holder to pump, avoiding contamination.

(2) Place sampler in a location representative of where workers could be exposed to radon daughters. Place sample 4' to 6' above ground.

(3) Start the stop watch and the sampler simultaneously. Record the start time on the sample collection data sheet. Also log operational status of the area/circuit.

(4) Sample for five (5) minutes based on stop watch. Record the stop time on the data sheet. Record sample volume in units of liters on the record sheet.

(5) Remove the filter holder from the sampler. Place the filter cover on the holder to protect the sample.

(6) Proceed to the next station and repeat steps (1) through (5) above.

D. Sample Counting Procedures.

(1) Zero the scaler, set count timer to five (5) minutes.

(2) Using tweezers, place the filter into the counter tray with the exposed side up. Close the tray.

(3) Start the counter and record the starting time on the sample analysis data sheet.

(4) When the counter stops, record the end time and the counting duration on the sample analysis data sheet. Also record the cumulative number of counts and the number of counts per minute (cumulative counts divided by count duration) corrected for background.

(5) Remove the filter from the sample counter tray, and place the next filter in the tray.

(6) Repeat steps D(1) through D(5) for all samples.

(7) Check information recorded on the sample analysis data sheet for legibility and completeness.

E. Calculation of Working Levels.

(1) Using the data on the work sheets, a working level can be calculated for each location using the following equation.

$$WL = \frac{CPM \times E}{Vol \times TF}$$

Where:

WL = Working level associated with radon daughter activity.

CPM = The average count rate for a sample in units of counts per minute. This quantity is available from the sample analysis data sheet column H.

E = Detector efficiency factor (1 ÷ Eff) as determined during calibration, and logged on the sample analysis sheet.

Vol = The total volume of air which was pulled through the filter during sampling and logged in column I of the sample analysis sheet.

TF = A time factor determined from Attachment 3 based on the time decay between the end of sample collection and the midpoint of the sample counting (see Attachment 3).

(2) Determine the time factor for a sample. Record the delay time and TF value on the sample analysis data sheet.

(3) Calculate and record the working levels for each sample as described above.

(4) Recheck math, initial and date in the appropriate column.

7. Limits/Action Required:

   A. In excess of maximum permissible concentration (.33 WL):

      (1) Designate as "Airborne Radioactivity Area."

      (2) Increase surveillance to weekly and identify source.

      (3) Increase ventilation (i.e., open doors, use draft fans) to lower concentration.

      (4) Require use of respirators.

   B. From .08 WL to .32 WL:

      (1) Increase sampling to weekly.

      (2) Designate as "Airborne Radioactivity Area."

      (3) Determine cause and mitigate cause.

   C. From .03 WL to .08 WL:

      (1) Investigate the cause.

      (2) Attempt to mitigate the cause.

      (3) Increase sampling to weekly.

   D. .03 WL or less:

      (1) No action required.

8. References:

   A. Source Material License SUA-672, Condition 58, January 14, 1988.

   B. NUREG/CR-3598, "Occupational Radiological Monitoring."

Attachment 1

PATHFINDER

Pathfinder Mines Corporation
Lucky Mc Mine
P.O. Box 831
Riverton, Wyoming 82501
(307) 457-6626

Mill Radon Sampling Data Record

Date_____ Sampler_____ DT_____ TF_____ BKGND_____

Area	Sample Time	Count Time	Ct/ 5 Min	Net CPM	WL
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					

Date_____ Sampler_____ DT_____ TF_____ BKGND_____

Area	Sample Time	Count Time	Ct/ 5 Min	Net CPM	WL
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					

Attachment 2

Radon Daughter Concentration Form

Date	Area			Working Levels	Area No.
	SAG	SM-1	Dis Box		8
	SAG	SM-2	DSM		8
	SAG	SM-3	Feed Chute		8
	SAG	SM-4	Ops-Panel		8
	SAG	SM-5	Sala Pump		8
	RAD	R-1	Rad Off		27
	RAD	R-2	Rad Lab		27
	LR	-	Lunch Room		26
	LAB	ML-1	Buck Room		28
	LAB	ML-2	Main Area		28
	CR	CR-1	-		31
	MAO	-	Maint Office		24
	SHO	-	Shift Office		23
	CCD	CCD-1	Top		10
	CCD	CCD-2	Top CR		10
	CCD	CCD-3	Mid		10
	CCD	CCD-4	Btm		10
	SS	SS-1	-		9
	ES	-	Elect Shop		21
	PS	-	Pipe Shop		20
	IX	IX-1	Lab		11
	IX	IX-2	Vault/Floc		12
	IX	IX-3	Cell		13
	IX	IX-4	Tank		14
	SX	-	-		15
	Precip	PRE-1	Top		16
	Precip	PRE-2	Mid		16
	Precip	PRE-3	Bottom		16
	Leach	LE-1	Bottom		9
	Leach	LE-2	Mid		9
	Leach	LE-3	Top		9
	Rubber Shop	-	-		18
	Warehouse	WH-1	-		25
	Mill Shop	-	-		19
	-	-	-		19
	-	-	-		19

Attachment 3

Time Factor for Delay Time
(Modified Kuznetz)

Delay Time Min.	Time Factor	Delay Time Min.	Time Factor	Delay Time Min.	Time Factor
40	150	57	116	74	84
40.5	149	57.5	115	74.5	83.5
41	148	58	114	75	83
41.5	147	58.5	113	75.5	82.5
42	146	59	112	76	82
42.5	145	59.5	111	76.5	81.5
43	144	60	110	77	81
43.5	143	60.5	109	77.5	79.5
44	142	61	108	78	78
44.5	141	61.5	107	78.5	77.5
45	140	62	106	79	76
45.5	139	62.5	105	79.5	75.5
46	138	63	104	80	75
46.5	137	63.5	103	80.5	74.5
47	136	64	102	81	74
47.5	135	64.5	101	81.5	73.5
48	134	65	100	82	73
48.5	133	65.5	99	82.5	72
49	132	66	98	83	71
49.5	131	66.5	97	83.5	70
50	130	67	96	84	69
50.5	129	67.5	95	84.5	68.5
51	128	68	94	85	68
51.5	127	68.5	93	85.5	67
52	126	69	92	86	66
52.5	125	69.5	91	86.5	65.5
53	124	70	90	87	65
53.5	123	70.5	89.5	87.5	64
54	122	71	89	88	63
54.5	121	71.5	88	88.5	62
55	120	72	87	89	61
55.5	119	72.5	86	89.5	60.5
56	118	73	85	90	60
56.5	117	73.5	84.5		

Number: 02.032.02	PATHFINDER MINES CORPORATION Lucky Mc Mill
Date: 3-1-88	MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Page: 1 of 4	

Title: Surface Contamination Surveys

1. Purpose:

   The purpose of this procedure is to provide criteria for performing surface contamination surveys.

2. Scope:

   The scope of this procedure shall include all routine surface contamination surveys to include both production and non-production surveys, and special surveys.

3. Definitions:

   A. Production Areas. Those shops and areas/circuits in which ore is processed and yellowcake is produced and prepared for shipment. The following table identifies the production areas.

   SAG
   RIP (when operating)
   Leach
   CCD
   Sand/Slime
   Solvent Extraction
   Ion Exchange
   Precipitation
   Barrel Storage
   Mill Lab

   B. Non-Production Areas. Those areas in which support activities are conducted (i.e., offices, lunch rooms, change room and laboratories).

   Change Room
   Electrical Shop & Office
   Mill Shop
   Rubber Shop
   Maintenance Office
   Mill Office
   Radiation Office
   Shift Office
   Radiation Lab
   Warehouse
   Lunch Room & Designated Eating Areas

C. Special Surveys. Those surveys deemed necessary by the RSO.

4. Frequency of Surveys:

A. Production Areas: Quarterly.
B. Non-Production Areas: Biweekly.

5. Equipment:

A. Portable Alpha Counter.
B. Mini-scaler with RD-14 or equivalent.
C. Whatman 41 paper or equivalent.
D. Surface Contamination Survey Form (Attachment 1).

6. Procedure:

A. General Procedures:

(1) Ensure that all equipment is calibrated.
(2) Review previous surveys to identify problem areas.

B. Check area for visible yellowcake and, if found, have it cleaned immediately.

C. Obtain a direct measurement utilizing the portable alpha counter at each location, and record the results (production areas and occasional spot checks of non-production areas).

D. Obtain a wipe sample utilizing the Whatman 41 paper with fingertip pressure, and cover approximately four (4) square inches. Fold the paper with the contaminated surface covered. Ensure that the paper is adequately identified.

E. After all wipe samples and direct readings have been taken, evaluate the wipe test paper with the mini-scaler/RD-14.

(1) Center the wipe test paper under the RD-14 and count for two (2) minutes.

(2) Compute the activity for the wipe sample according to the following equation, and log it on the survey form.

$$DPM/100\ cm^2 = (CPM_W - CPM_B)(eff)$$

where: CPM_W = The counts for minute observed from the wipe.

CPM_B = The background CPM taken from the control chart.

eff = The detector's efficiency as taken from the control chart in D/C.

(3) Compute the activity for the direct measurement according to the following equation, and log it on the survey form.

$DPM/100\ cm^2 = (CPM_D)(eff)(A_S/A_P)$

where: CPM_D = Counts per minute from direct measurement.

eff = Efficiency in disintegration per count.

A_P = Area of probe (59 cm^2).

A_S = Area of survey (100 cm^2).

F. Review the completed form and determine what action is required as follows.

(1) Production Area:

(a) Concentrate circuits - clean all visible yellowcake.

(b) Non-concentrate circuits:

(i) Wipe results greater than 1,000 DPM/100 cm^2 - clean area.

(ii) Direct Measurement (fixed) 15,000 DPM/100 cm^2 maximum, 5,000 DPM/100 cm^2 average - clean area.

(2) Non-Production Areas/Special Surveys:

(a) Any visible yellowcake - clean immediately.

(b) Direct measurement (fixed) greater than 1,000 DPM/100 cm^2 - determine if it is removable.

(c) Removable contamination - if greater than 1,000 DPM, decontaminate the area.

7. Records:

A record of all surveys shall be completed and maintained. See Attachment 1 for production area surveys, and Attachment 2 for non-production surveys.

8. References:

A. USNRC License SUA-672, Condition 40.

Attachment 1

Surface Contamination Survey

Non-Production _____ (date)

Production _____ (date)

Analyst _____ (name)

Instrument _____ (portable)

Corr Fac D/C _____

Instrument _____ (MS/detector)

Corr Fac D/C _____

No.	Location	Fixed CPM	Fixed DPM	Removable CPM	Removable DPM	Comments

02.032

Attachment 2

02.032

PATHFINDER

Pathfinder Mines Corporation
Lucky Mc Mine
P.O. Box 831
Riverton, Wyoming 82501
(307) 857-6626

Mill Bi-Weekly Wipe Survey:

Date: _____ Surveyed By: _____

Scaler: MS-2 Serial No. 236 Detector: RD-14 Serial No. 187
Correction Factor -

Designated Eating Areas:	** Status	Area wiped	CPM/DPM 100 cm^2		
Lunch Room:					
Table 1					
Table 2					
Table 3					
Coffee					
Floor					
SAG:					
Table					
Stool					
Floor					
IX:					
Table					
Bench					
Coffee					
Floor					
CCD:					
Table					
Bench					
Chair					
Floor					
Electric Shop:					
Desk 1					
Desk 2					
Bench 1					
Bench 2					
Floor					
Chem Lab:					
Office 1					
Office 2					
Floor					

**Status 1-in use 2-not in use 3-secured

Number: 02.038.00	PATHFINDER MINES CORPORATION Lucky Mc Mill
Date: 03-02-92	MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Page: 1 of 3	

Title: Beta-Gamma Surveys

1. Purpose:

   The purpose of this SOP is to outline the beta-gamma survey programs conducted at the Lucky Mc Mill.

2. Scope:

   The scope of this procedure includes routine beta-gamma surveys.

3. Frequency:

   A. Routine surveys shall be conducted quarterly.

4. Locations of Surveys:

   A. Routine surveys shall be conducted at the locations listed on the External Radiation Data Recording Sheet (Attachment 1).

5. Equipment:

   A. RO-2 Ionization Chamber or equivalent.

   B. Performance check source CS 137 or equivalent.

   C. Data recording sheet (Attachment 1).

6. Procedures:

   A. Precautions:

      (1) Ensure that the instrument is calibrated.

      (2) Check position of window. To measure for beta and gamma, window must be open. To check for gamma only, close window.

      (3) Check operating condition of mill and log on the data sheet.

      (4) Care should be taken not to contaminate the instrument.

(5) Surveys should be taken in locations normally occupied by workers.

(6) Areas where hands-on work is frequently performed should be checked for both beta and gamma.

(7) Check condition of battery.

(8) Verify that the instrument reads zero.

(9) Using a check source, test the performance reliability of the instrument.

(a) Check the calibration form to determine the reading obtained from the source at calibration.

(b) Place the source under the window, with the window open.

(c) The instrument response to the performance check source must not differ more than ±20% of the reference reading. If the instrument exceeds ±20%, do not use it until recalibration is accomplished.

(10) Check the response of the instrument. In a zero contamination area, check the background reading of the instrument. If the reading is not as anticipated, check for contamination. If contamination is found, clean the area and perform another response check. If the response is abnormal, obtain a different instrument and repeat the check.

B. Routine Survey Procedures:

(1) Upon arriving at the designated location, open the beta window.

(2) Check the instrument reading at zero.

(3) Perform survey as follows.

(a) Hold instrument 1 to 2 feet from body; take a dose rate reading 1 foot from the surface.

(b) If the survey is conducted near several pieces of equipment within a general area, note the highest reading and the location.

(c) Record the data, making comments on visible contamination or other conditions which may affect the measurement.

7. Data Analysis:

A. Review data to ensure that adequate protection of workers is accomplished and that NRC posting requirements are met.

B. Posting Requirements:

Post as "Radiation Area" when:

(1) An individual could receive 5 mRem in 1 hour.

(2) Or a dose of 100 mRem in any 5 consecutive days.

Note: If a dose rate of 2.5 mR/hr is noted, either post as a radiation area or conduct occupation studies to ensure that no single worker would exceed the 100 mR/week limit.

8. References:

A. NUREG CR 3598.

B. Source Material License SUA-672.

Attachment 1

External Radiation Data Recording Sheet

Instrument Calibrated and Checked_____

A Location Number	B Location Description	C Operating Yes	 No	D Dose Rate B/G-B	E Date	F Instrument	G Surveyor	H Comments
ML-1	Bucking Room							
-2	Metler Bench							
-3	Lunch Room							
-4	Main Lab							
-5	Conc Room							
EO-1	Electrician Office							
-2	Electrician Shop							
LE-1	Leach #1 Tank							
-2	Leach #3 Tank							
-3	Leach							
-4	Leach							
CCD-1	CCD Top							
-2	CCD Bottom Floor							
-3	CCD							
-4	CCD							
-5	CCD							
-6	CCD							
-7	CCD							
-8	CCD							
IX-1	IX Lab							
-2	Above Adsorption Cells							
-3	Above Elution Cells							
-4	IX							
-5	IX							
-6	IX							
-7	IX							
-8	Near Shower							
-9	IX							
-10	Below Adsorption Cells							
-11	Below Elution Cells							
SX-1	Ops Bench							
-2	Gnd Floor							
-3	Second Floor							
Precip-1	Top Deck							
-2	Precip							
-3	Precip							
SO-1	Shift Office							
MO-1	Maintenance Office							
LAT-1	Latrine							
BB-1	Badge Board							
CR-1	Change Room (Men)							
-2	Change Room (Women)							
BS-1	Boiler							
RS-1	Rubber Shop							
MS-1	Mill Shop							
-2	Mill Shop							
-3	Mill Shop							
-4	Mill Shop							
WHSE-1	Warehouse-Main Area							
-2	Warehouse-Office							
M.OF.-1	Mill Office-R. Lab							
-2	Mill Office-R. Off.							
-3	Mill Off.-Coffee Rm							
RIP-1	Ops Rm							
-2	Gnd Floor							
-3	2nd Level							
-4	3rd Level							
-5	4th Level							
SAG-1	Dist Box							
-2	DSM							
-3	Feed Chute							
-4	Op Bench							
-5	Gnd Floor							
SP-1								
-2								
-3								
-4								

Number: 02.040.00	PATHFINDER MINES CORPORATION Lucky Mc Mill MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Date: 3-20-85	
Page: 1 of 4	

Title: Surveys of Equipment Leaving the Restricted Area

1. Purpose:

   The purpose of this procedure is to provide criteria and methodology for performing equipment release surveys.

2. Scope:

   The scope of this procedure shall include all equipment transferred from the mill to outside the restricted area fence.

3. Equipment:

   A. Gross alpha counter such as the Eberline PAC-7 or PRM-6WAC-3 probe.

   B. Beta-gamma survey meter such as the Eberline RO-2 or equivalent.

   C. Whatman 41 paper or equivalent.

   D. Equipment Release Survey Sheet (Attachment 1).

4. Policy:

   A. All equipment released from the mill area shall be surveyed for both fixed and transferable contamination.

      Exception: Equipment received by the warehouse from vendors and stored in the warehouse need not be surveyed prior to release to the unrestricted area. However, any material issued for use outside of the warehouse and within the mill area must be surveyed prior to its release to the unrestricted area.

   B. The survey results shall be documented on a form such as that shown in Attachment 1.

   C. Release limits shall be as outlined in Attachment 2 (Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials).

D. Materials exhibiting contamination levels greater than those listed in Attachment 2 shall be decontaminated to acceptable levels. Items which cannot be decontaminated shall not leave the restricted area.

5. Procedure:

A. The warehouse personnel shall notify the radiation office whenever there is equipment to be released to the unrestricted area.

B. Pre-survey checks:

(1) Verify that the instruments are calibrated. Conduct constancy checks using a gross alpha check source on the PAC-7/PRM-6WAC-3 probe and a beta-gamma source on the RO-2.

(2) Compare the constancy results against calibration data. A constancy check greater than ±20% of the calibration results indicates that the instrument is unreliable and requires repair.

(3) Record the equipment used on the Equipment Release Survey Form (Attachment 1).

C. Direct Alpha Determination:

(1) Obtain a background reading.

(2) Locate the face of the instrument as close to the surface as possible and allow the reading to stabilize (5-15 seconds).

(3) Repeat the survey on the tops, sides and bottom (if possible).

(4) Compute and record the DPM/100 cm^2 as follows.

$$DPM/100\ cm^2 = (CPM_D - CPM_B)(\text{Eff factor})(.59)$$

where DPM/100 cm^2 = the net activity per 100 cm^2.

CPM_D = the highest count per minute observed from a direct reading.

CPM_B = the background counts per minute.

Efficiency Factor = the detector efficiency in disintegrations per count.

.59 = the correction of detector surface area, 59 cm^2, to 100 cm^2 $\left(\frac{59\ cm^2}{100\ cm^2}\right)$.

(5) Compare the results with the 1,000 DPM/100 cm^2 limit. If greater than the limit, decontaminate the equipment and resurvey.

(6) Record the results.

D. Removable Alpha Determination:

(1) Choose a representative location on the equipment. Using the Whatman 41 paper, rub the surface area (approximately 4 square inches). Use moderate pressure.

(2) Place the paper under the detector of the PAC-7 and assess the level of contamination as follows.

$$DPM/100\ cm^2 = (CPM_W - CPM_B)(\text{Eff factor})$$

where CPM_W = counts per minute from the wipe.

CPM_B = counts per minute background.

Efficiency Factor = the disintegrations/count.

(3) Compare results with the 1,000 DPM limit. If greater than 1,000 DPM, decontaminate the equipment and resurvey.

(4) Record the results.

E. Direct Beta-Gamma Determination:

(1) With the beta shield open, obtain a measurement approximately 12 inches from the equipment. Survey the tops, sides and bottom.

(2) Compare the results with the .2 mR/hr limit. If greater than .2 mR/hr, decontaminate and resurvey.

(3) Record the results.

Title: Surveys of Equipment Leaving the Restricted Area

6. Records:

   A. The original shall be maintained on file in the radiation safety office.

   B. Two (2) copies shall be left with warehouse personnel.

7. References:

   A USNRC License SUA-672, Condition 18.

Attachment 1

PATHFINDER MINES CORPORATION
LUCKY Mc MINE
P. O. Box 831
Riverton, WY 82501
(307) 457-6626

Alpha Instrument_____

Beta-Gamma Instrument_____

EQUIPMENT RELEASE SURVEY

Date:_____

Equipment Recipient:_____

_____

Equipment Description:_____

_____

Survey No.	Survey Area	Wipe CPM	Direct CPM	DPM/100 cm^2
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Surface Combined Beta-Gamma Survey:_____

Cleared for Release:_____

Signed:_____

Attachment 2

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT

PRIOR TO RELEASE FOR UNRESTRICTED USE

OR TERMINATION OF LICENSES FOR

BYPRODUCT OR SOURCE MATERIALS

U. S. Nuclear Regulatory Commission
Uranium Recovery Field Office
Region IV
Denver, Colorado 80225

SEPTEMBER 1984

The instructions in this guide in conjunction with Table I specify the radioactivity and radiation exposure rate limits which should be used in accomplishing the decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table I prior to applying the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table I. A copy of the survey report shall be filed with the Uranium Recovery Field Office, Region IV, P.O. Box 25325, Denver, CO 80225. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

Following review of the report, the NRC will consider visiting the facilities to confirm the survey. The licensee shall not release the premises for unrestricted use without the written approval of the USNRC staff.

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT OR SOURCE MATERIALS

U. S. Nuclear Regulatory Commission
Uranium Recovery Field Office
Region IV
Denver, Colorado 80225

SEPTEMBER 1984

Number: 02.041.05	PATHFINDER MINES CORPORATION Lucky Mc Mill MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Date: 1-30-88	
Page: 1 of 3	

Title: Airborne Particulate Surveys

1. Purpose:

The purpose of this SOP is to provide criteria and outline procedures for airborne particulate surveys throughout the mill.

2. Scope:

The scope shall include all routine and non-routine surveys for airborne particulate. It does not include airborne particulate surveys obtained during a radiation work permit.

3. Frequency of Samples:

The frequency of sampling will be determined by the following concentration levels.

Concentration	Frequency
Less than 10% MPC	Quarterly
11% through 25% MPC	Monthly
Greater than 25% MPC	Weekly

4. Sample Locations:

(A) Area sampling for natural uranium will be conducted in the following areas.

Area	Number of Locations
Change Room	1
CCD	4
Electrical Shop	1
IX	4
Leach	3
Lunch Room	1
Maintenance Foreman Office	1
Pipe Shop	1
Precipitation	3
Radiation Lab	1
Rubber Shop	1
SAG Mill	1
Sand/Slime	1
Solvent Extraction	1
Warehouse	1

(B) The following operators shall wear lapel samplers.

Countercurrent Decantation
Ion Exchange
Leach
Loader Operator
Precipitation
SAG Mill
Slurry Loader
Solvent Extraction

5. Equipment:

A. Air samplers such as the Sierra Misco Model 1000 calibrated to 10 LPM minimum shall be used for area sampling.

B. Filter media - Millipore AA or equivalent.

C. Filter paper holders - with caps.

D. Work sheets (Attachment 1).

E. Leather belt or equivalent.

F. Tubes or envelopes to hold filter paper.

6. Procedures:

A. Pre-survey Procedures/Precautions:

(1) Determine areas and/or operators to be surveyed.

(2) Check calibration of samplers. Periodically check samplers with a bubble check to insure that calibration is remaining constant.

(3) Samples should be obtained in areas which are representative of the conditions during worker exposure. The samples should be placed 4 to 6 feet above the ground (i.e., breathing zone).

(4) Care should be taken not to damage or contaminate filters and equipment. Filter paper should be covered during transportation. Filter papers should be handled with tweezers while being inserted and removed from the filter head.

(5) Tubes which hold the filter paper will be marked with area ID and date.

(6) Start and stop times shall be logged on the data sheet.

B. Survey Procedures:

(1) On arriving at sampling location, place the sampler at the desired position, remove filter cover, start sampler.

(2) Record the start time, sampler ID, operation condition of equipment in the area, name of operator (if applicable), and flow rate (if applicable).

(3) Samples shall be taken for a minimum of six (6) hours.

(4) At completion of the time period, note the flow rate (if applicable) and record the off time. After turning off the instrument, place a filter cover over the filter head.

(5) Return to the radiation lab and place the filter paper (using tweezers) into the holding tubes. Identify the tubes with area and date.

(6) Record all appropriate data on the data sheet in the "Field Section".

7. Analysis:

For analysis procedures, see Standard Operating Procedure No. 02.042.

8. References:

A. Source Material License SUA-672, Condition 58, January 14, 1988.

B. NUREG/CR-3598, "Occupational Radiological Monitoring at Uranium Mills."

Attachment 1

PATHFINDER MINES CORPORATION
Lucky Mc Mine

Airborne Particulate Data Sheet

Field Data							Lab Data						Results	
Date	Area ID	Mill Status	Sampler ID	Time On/Off	Vol	Analyst Initials	Counter Probe	Back-Ground	Eff C/D	Date Counted	Analyst	Counts Time	Conc. $uCi \times 10^{-11}/ml$	Comments
	SAG													8
	Leach													9
	Leach													9
	Leach													9
	CCD													10
	CCD													10
	CCD													10
	CCD													10
	IX-Cont Room													11
	IX-Vault/Floc													12
	IX-Cells													13
	IX-Tank													14
	SX													15
	Precip													16
	Precip													16
	Precip													16
	RIP*													17
	Rubber Shop													18
	Mill Shop													19
	Pipe Shop													20
	Elect Shop													21
	Mill Of/Rad Of													22
	Shift Office													23
	Maint Office													24
	Warehouse													25
	Lunch Room													26
	Rad Lab													27
	Mill Lab-1													28
	Mill Lab-2													28
	Boiler Area													29
	Lube Bay Area													30
	Change Room													31
	Sand/Slime													-

*When operating

02.041

PATHFINDER MINES CORPORATION
Lucky Mc Mine

Airborne Particulate Data Sheet

Field Data								Lab Data						Results	
Date	Area ID	Operator	Mill Status	Sampler ID	Time On/Off	Vol	Analyst Initials	Counter Probe	Back-Ground	Eff C/D	Date Counted	Analyst	Counts Time	Conc. $uCix10^{-11}/ml$	Comments
	CCD												/10		
	IX/SX												/10		
	Lea/Pre												/10		
	Loader												/10		
	SAG												/10		
	Slurry												/10		
													/10		
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Number: 02.048.04	PATHFINDER MINES CORPORATION Lucky Mc Mill MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Date: 1-30-88	
Page: 1 of 3	
Title: Assignment and Control of Exposures to Airborne Concentrations of Radioactive Materials	

1. Purpose:

The purpose of this procedure is to provide methodology for computing, controlling and documenting individual exposures to airborne concentrations of radioactive materials, in accordance with the provisions of 10 CFR 20[a].

2. Scope:

The scope of this procedure shall include all exposures to measured concentrations of airborne radioactive materials within the confines of the mill.

3. Equipment:

None.

4. Procedure:

A. Individual exposures shall not be in excess of the following quantities.

(1) Soluble Uranium: 40 MPC-hours in any 7 consecutive day period - one work week.

(2) Natural Uranium: 520 MPC-hours in any consecutive 13 week period - calendar quarter.

(3) Radon Daughter: 4.0 WLM in any 12 consecutive months - calendar year.

B. Individual exposures to airborne concentrations of radioactive materials shall be computed as follows:

$$E = \sum_{i=1}^{N} (C_i \times T_i)$$

Where E = The total exposure to a given radioactive material, in MPC-hours, or WLMs.

C_i = The concentration of a given radioactive material in the ith Job Function Area, in uCi/ml or in WL.

T_i = The total time that the individual spends in the ith Job Function Area, in hours or in days.

N = Number of exposure periods during the week or quarter.

C. Exposures shall be summed over the following period.

(1) Nat Uranium (Soluble + Insoluble) - Each work week and quarterly.

(2) Radon Daughters - Each week, and quarterly.

D. Any individual whose exposure exceeds the following values shall be assigned a job function where continued exposures shall not occur.

(1) Natural Uranium - 40 MPC Hours/Week.

(2) Radon Daughters - 4 WLM/Year.

E. An investigation shall be conducted when any weekly or quarterly exposure exceeds 25% MPE. The investigation shall be documented on a form as shown in Attachment 1.

F. Any exposure in excess of the 40 hour limit for soluble uranium or 40 hour control for Natural Uranium shall result in the following actions.

(1) A urine sample shall be taken with 48 to 96 hours after the calculated overexposure. Sampling must be completed within 14 days. Three consecutive samples will be taken, with samples split and sent to separate labs for analysis.

(2) The radiation office shall prepare an investigative report to the Environmental Coordinator outlining the cause for exceeding the control measure, the corrective actions that have been taken and any further recommended corrective action that should be taken to prevent recurrence.

(3) The Environmental Coordinator in conjunction with the Operations Manager and Mill Superintendent shall take any appropriate further corrective action necessary to prevent recurrence.

(4) All reports and investigations shall be maintained on file for review by the Nuclear Regulatory Commission.

G. Each exposure in excess of the limits stated in Paragraph 4.A(1) shall be reported to the NRC Regional Inspection and Enforcement Office[b] and the Director of Inspection and Enforcement[c], within 30 days or as required by 10 CFR 20.403 and 20.405[a]. Exception: A calculated exposure in excess of the 40 hour control measure for soluble uranium need not be reported if a timely (within 48 to 96 hours after exposure) urinalysis has been completed and the results confirm that an overexposure did not occur.

5. Records:

A record of weekly, quarterly and annual exposures shall be maintained for all mill department employees. The record shall be filed in the individual's folder and retained for the duration of employment. At termination of employment, the record shall be placed in the retired files and retained for future reference. Forms such as those in Attachments 2 or 3 are acceptable for documenting exposures. As an alternative, an IBM compatible computer may be used for recordkeeping. See Attachment 4 for computer instructions.

6. References:

a. Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation," as currently amended.

b. Director, Region IV, USNRC Office of Inspection and Enforcement, 611 Ryan Plaza Drive, Suite 1000, Arlington, Texas 76012.

c. Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555

Attachment 1

Report of Exposure Exceeding 25% MPE

PATHFINDER

Pathfinder Mines Corporation
Lucky Mc Mine
P.O. Box 831
Riverton, Wyoming 82501
(307) 457-6626

Report of Exposure Exceeding 25% MPE

Name_____

SSN/ID#_____

Nature of Exposure: Sol U, Insol U, Pen Rad

% MPE_____

Period of Exposure:_____

Records checked and verified: Yes No

Unusual work conditions:_____

_____

_____

_____

Co-worker exposures checked:_____

_____

_____

_____

Cause:_____

_____

_____

Corrective/follow-up action:_____

_____

_____

_____

_____
Signature of Radiation Safety Officer

02.048

Attachments 2 and 3

Exposure to Airborne Radioactive Materials

PATHFINDER

Pathfinder Mines Corporation
Lucky Mc Mine
P.O. Box 831
Riverton, Wyoming 82501
(307) 457-6626

CONCENTRATION CONTROL DATA SHEET

Quarter_____; Week No._____; From_____ To_____

	Conc Nat U	Sample Date	Working Level	Sample Date
8. SAG				
9. Leach				
10. CCD				
11. IX Control Rm				
12. IX - Vault/Floc				
13. IX - Cells				
14. IX - Tanks				
15. SX				
16. Precip				
17. RIP				
18. Rubber Shop				
19. Mill Shop				
20. Pipe Shop				
21. Elect Shop				
22. Mill Office				
23. Shift Office				
24. Maint Office				
25. Warehouse				
26. Lunch Room				
27. Rad Lab/Office				
28. Mill Lab				
29. Boiler/Barrel Storage				
30. Lube Bay				
31. Change Room				
32.				
33.				

Changes from Last Week: Yes_____ No_____

02.048

PATHFINDER

Pathfinder Mines Corporation
Lucky Mc Mine
P.O. Box 831
Riverton, Wyoming 82501
(307) 457-6626

WEEKLY TIME STUDY

Name:_____ Qtr_____, Week_____

From _____ to _____

Work Areas: Put a check mark for days not worked	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total	Comments
8 SAG									8
9 Leach									9
10 CCD									10
11 IX - Cont Rm									11
12 IX - Vault/Floc									12
13 IX - Cells									13
14 IX - Tanks									14
15 SX									15
16 Precip									16
17 RIP									17
18 Rubber Shop									18
19 Mill Shop									19
20 Pipe Shop									20
21 Elect Shop									21
22 Mill Office									22
23 Shift Office									23
24 Maintenance Office									24
25 Warehouse									25
26 Lunch Room									26
27 Rad Lab/Office									27
28 Mill Lab									28
29 Boiler/Barrel Storage									29
30 Lube Bay									30
31 Change Room									31
32									32
33									33
Out of Area (explain location on reverse)									

02.048

Attachment 4

Computer Instructions

A. Assumptions:

1. That a computer literate person familiar with IBM compatible computers and the Lotus 1-2-3 program will accomplish the postings.

2. That the RSO will ensure that at least one other person is qualified to run the program.

B. Equipment:

1. IBM compatible computer with printer.

2. Floppy disk loaded with data program.

3. Time study sheets (attached).

4. Concentrations.

C. Procedures:

1. Time studies (copy attached):

(a) The RSO will complete the heading and pass out the sheets each Monday morning. At the same time, he will collect the previous week's time sheets.

(b) The RSO will total the hours for each circuit, and the total of all circuits will normally be 42.5 hours (40 hours routine work and 2½ hours lunch time). Personnel on swing and graveyard shift will be credited for 40 hours total.

(c) Any hours that are less than the anticipated number shall be accounted for (i.e., vacation, day off, working outside of area).

(d) Log any training or physical dates.

2. Computer application:

(a) Obtain time on the computer, load the Lotus program and the PersExp floppy disk.

(b) Update the dates of the report.

(c) Update the concentrations.

(d) Input the data from the time study sheets.

(e) Input exposures from RWP's.

(f) Obtain a hard copy of the concentrations and the weekly exposure summary.

(g) Quarterly, print out the quarterly summary.

D. Quality Control:

1. Select one individual and manually calculate his/her exposure to ensure that the computer is properly functioning.

2. Maintain the results on a form as shown in Attachment 3.

E. Retain all input and output data on file. RWP's will be retained with the individuals time study sheet.

Number: 02.100.00	PATHFINDER MINES CORPORATION Lucky Mc Mill MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Date: 1/11/85	
Page: 1 of 2	

Title: Respiratory Protection Program

1. Purpose:

The purpose of this standard operating procedure is to outline the Lucky Mc Mill Respiratory Protection Program.

2. Scope:

This standard operating procedure covers the use of respirators for the protection of workers from airborne radionuclides and applies to all mill department workers.

3. Policy Statement:

A. Engineering Controls: In keeping with the ALARA concept, it is the policy of Lucky Mc to limit the amount of suspended airborne radionuclides through the use of engineering controls. Those controls include containment, scrubbers and ventilation systems. Additional controls will be used as required.

B. Decontamination: When engineering controls do not reduce the level of contamination adequately, then decontamination of equipment shall be accomplished prior to placing the equipment in operation or prior to maintenance on the equipment. Decontamination shall be accomplished by using either dilute acid and/or water. Decontamination shall be conducted at the direction of the Radiation Safety Officer (RSO) and under the control of a Radiation Work Permit (RWP).

C. Routine, non-routine and emergency use of respirators shall be governed by the use of the respirator selection guide (Attachment 1).

D. Relief From Respirator Use: Personnel wearing respirators are authorized to leave the area for relief from the respirator under the following conditions.

(1) If the respirator fails or malfunctions.

(2) If the person experiences physical or psychological distress.

(3) If there is a procedural or communication failure.

(4) If there is a significant deterioration of operating conditions.

4. Training:

All personnel required to wear a respirator shall receive training prior to initial qualification, and annually thereafter. See Attachment 2 for training outline.

5. Fit Test:

Each individual required to utilize a respirator in the performance of duties will be qualitatively fit tested with each type of respirator they may use. The qualitative fit test will be conducted prior to use of the respirator and annually thereafter.

6. Physicals:

New employee physical and annual physical requirements are outlined in SOP 02.104.

7. Maintenance Cleaning and Storage of Respirators:

Procedures for maintenance cleaning and storage of respirators are outlined in SOP 02.101 and SOP 02.102.

8. Approved Equipment:

Only respirators and HEPA filters approved by NIOSH shall be utilized.

9. Other Limitations:

A. Air purifying respirators are not to be used in oxygen deficient atmospheres.

B. Air purifying respirators will not be used in atmospheres hazardous to life or health.

C. Knitted cloth covers (facelets) shall not be used on respirators.

References

SOP 02.102 - Respirator Maintenance.
SOP 02.103 - Respirator Cleaning.
SOP 02.104 - Physical Qualifications for Respirator Use.

Attachment 1

Respirator Selection Guide

Condition	Respirator	Protection Factor
Routine Dryer Operation	Half-face - negative pressure respirator	No protection factor
Dryer Operations when concentration exceeds 100% MPC	Full-face - negative pressure or 1/2-F.F. - positive pressure	P.F. 50(1) P.F. 1,000
Maintenance Activity requiring RWP	1/2 or F.F. - positive pressure or As directed by RSO	P.F. 1,000
Emergency Conditions	1/2 or F.F. - positive pressure or Air line constant flow full face or SCBA - pressure demand	P.F. 1,000 P.F. 2,000 P.F. 10,000
All Airborne Radiation Areas	1/2 face - negative pressure	No protection factor
Mill Lab - Bucking Room and Mettler Room (when weighing yellowcake)	1/2 face - negative pressure	No protection factor

(1) Do not use when concentration exceeds 50 times the designated MPC.

Attachment 2

Respirator Training Outline

1. Types of Hazards

2. Areas Where Hazards May Occur

3. Biological Effects

4. Types of Respirators Available

5. Use of Respirators

Number: 02.104.00	PATHFINDER MINES CORPORATION Lucky Mc Mill MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Date: AUG 25 1983	
Page 1 of 2	

Title: Physical Qualifications for Respirator Use

1. Purpose:

The purpose of this procedure is to specify the program necessary to physically qualify individuals for respirator use.

2. Scope:

The scope of this procedure is applicable to all individuals who may be required to use respirators within the restricted area.

3. Equipment:

A. Comfo II respirators or equivalent.
B. Ultra Twin respirator or equivalent.
C. Irritant gas tubes.
D. Spirometer or equivalent, as part of physical examination.

4. Procedures:

A. Medical Examination:

(1) All mill employees shall undergo a physical examination prior to the use of a respirator and at least annually thereafter.

(2) The content of the physical examination shall be left to the discretion of the company appointed physician, but shall include a pulmonary function test to help determine the worker's ability to work in a respirator. Current protocol includes annual chest X-ray and electrocardiogram as well as sputum cytology.

B. Training and Fit Testing:

(1) Prior to commencement of work in the restricted area, all new employees shall receive adequate training to ensure that he knows how to wear respiratory protection devices and when devices are required.

(2) A qualitative fit test shall be administered by the radiation department prior to using the respirator and annually thereafter.

Title: Physical Qualifications for Respirator Use

5. Restrictions and Limitations:

   A. Individuals who are restricted from use of a respiratory protection device shall not be allowed to wear any such device. Furthermore, restricted personnel shall not be assigned to work areas wherein airborne concentrations of uranium and/or radon daughters exceed, or may exceed the maximum permissible concentrations when averaged over a 40 hour period.

   B. Individuals who are limited to the specific types of respirators or are limited to a specific usage duration, shall not be allowed to exceed these limitations.

6. Responsibilities:

   A. The Health Services Department shall administer a physical examination and forward certification to RSO.

   B. The Radiation Office shall conduct respirator training and fit testing.

   C. The Mill Superintendent shall assure that the individual is notified of all restrictions and limitations, and that the individual is not assigned to a task which will cause the individual to violate a limitation or restriction.

Number: 02.116.03	PATHFINDER MINES CORPORATION Lucky Mc Mill
Date: 11-21-87	MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Page: 1 of 3	

Title: Orientation, Supervisory, Reinforcement Training

1. Purpose:

The purpose of this procedure is to provide criteria for Radiation Safety and Respiratory Protection Training.

2. Scope:

The scope of this procedure shall include all individuals who are assigned duties within the milling operation.

3. Policy:

It is the policy of the Lucky Mc Mill to maintain exposures to radiation and radioactive materials to levels as low as is reasonably achievable. This policy is enacted in part through training in sound radiation safety practices. The training requirements are outlined below.

4. Procedures:

A. Orientation Training:

Each employee who is assigned routine duties within the mill shall receive orientation training prior to assuming duties. Orientation training shall be comprised of the following minimum items.

(1) A description of the mill and milling processes as they relate to radiation hazards.

(2) Radiation Safety Training and Respiratory Protection Training (SOP 02.117[a]).

(3) All female employees shall receive a copy of USNRC Reg. Guide 8.13[b].

B. All contractors whose services may result in the performance of duties in the mill without a trained Lucky Mc employee present will receive orientation training. The scope of the training will be commensurate with their activities and background.

(1) Mill operations and procedures.

(2) Description of types and sources of radiation found within mill and locations.

(3) Respiratory devices available and their uses.

(4) TLD badge issuance and control procedures.

(5) Urinalysis sample and urinalysis program description.

C. Refresher Training:

All individuals who are assigned routine duties within the confines of the mill shall receive refresher training annually. Refresher training shall include Radiation Safety and Respiratory Protection instruction.

(1) Radiation safety refresher training subject content may include the following.

(a) Relevant information which has become available during the past year.

(b) A review of radiation safety problems.

(c) Changes in Standard Operating Procedure's license conditions.

(d) Exposure trends.

(e) Current issues/topics.

(2) The respiratory protection refresher training shall include:

(a) A review of respiratory hazards within the mill.

(b) Types of respiratory devices available.

(c) Proper fitting and care.

(d) A practical or written test.

(3) Tool Box Safety Meetings shall be conducted every other month. Each individual shall attend at least six (6) meetings per year. Subjects to be covered are at the discretion of the Radiation Safety Officer and shall include pertinent radiation safety items.

D. All individuals in supervisory capacities in the mill shall receive training annually. The training shall include a review of:

(1) Exposure trends.

(2) RSO Safety Inspection Reports.

(3) New and revised Standard Operating Procedures.

(4) ALARA Program requirements.

(5) Requirements for RWP's.

E. Documentation:

All training will be documented and posted to the individual's exposure history file.

5. References:

[a] Standard Operating Procedure Number 02.117, "Radiation Safety Training."

[b] NRC Reg. Guide 8.13, "Instructions Concerning Prenatal Radiation Exposure," November, 1975.

[c] NUREG-1159 Training Manual for Uranium Mill Workers on Health Protection from Uranium.

Number: 02.117.02	PATHFINDER MINES CORPORATION Lucky Mc Mill MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Date: 10-30-86	
Page: 1 of 2	

Title: Radiation Safety Training

1. Purpose:

The purpose of this procedure is to provide guidelines for initial training of individuals assigned to work in radiation and radioactive materials areas.

2. Scope:

The scope of this procedure includes all individuals who may be required to work in the mill.

3. Equipment:

A. At least one respirator of each type used in the mill.

B. Alpha, beta and gamma radiation sources.

C. An alpha scintillation detector/meter.

D. A beta-gamma detector/meter.

E. A TLD badge that can be used for demonstration.

F. Irritant smoke generator; stannic chloride (titanium tetrachloride) smoke tubes and bulb.

G. A cleaning/sanitizing solution (e.g., alcohol).

H. A lapel air sampler.

4. Procedure:

A. Scheduling:

(1) Individuals who may be required to work within the confines of the mill, or on contaminated equipment, shall receive orientation training prior to initial work, and refresher training annually thereafter.

(2) Classes should be scheduled such that a minimum of four (4) hours is available for training.

B. Instruction Procedures:

(1) The instruction shall be given as outlined in the Lesson Plan (Attachment 1) or NUREG 1159.

(2) A written test (consisting of 15 to 20 questions taken from the list given in Attachment 2) shall be administered at the end of the instruction period.

(a) Individuals shall be required to score at least 70% to successfully complete the course.

(b) Individuals scoring less than 70% shall be rescheduled for a subsequent class.

(c) The test may be given orally, if an individual experiences reading difficulty.

(3) Examination results shall be entered on an individual training record and posted to the individual's radiation exposure history file.

(4) Each employee shall receive a copy of the Employees Radiation Safety Handbook.

5. References:

a. USNRC Regulatory Guide 8.29, "Instructions Concerning Risks From Occupational Radiation Exposure," July 1981.

b. USNRC Regulatory Guide 8.13, "Instructions Concerning Pre-Natal Radiation Exposure," November 1975.

c. NUREG 1159, "Training Manual for Uranium Mill Workers on Health Protection from Uranium."

d. SOP 02.118, "Employees Radiation Safety Handbook."

Attachment 1

Lesson Plan for Radiation Safety Training

PREFACE

Introduction

This Lesson Plan contains guidelines for giving instruction in radiation safety, and respiratory protection and if followed in its entirety will qualify an inexperienced individual for radiation work in an uranium mill.

Instructor Qualifications

The instructor shall be a member of the radiation office.

Classroom Environment

Training shall be accomplished in a professional but relaxed atmosphere. Training shall be conducted in the Safety Department's training room. The professional environment helps to assure the employee that the instruction is seriously regarded by his employer. A walking tour of the mill and radiation lab to outline procedures and hazards shall be accomplished.

Employee Attitude

The instructor should attempt to gain acceptance from all employees. This can be accomplished by observing a few basic rules:

* Be open and friendly, yet professional.
* Be polite.
* Be positive at all times. Negative statements by the instructor tend to provoke negative thinking by the employee.
* Encourage the employee to ask questions.
* Consider all questions seriously. NEVER laugh at, or shrug off, any question seriously put forward by the employee.
* Always be honest. If you don't know the answer to a question - say so! Promise to obtain the answer - then do it!

SUBJECTS TO BE COVERED

1. Introduction

   A. Introduce yourself.

   B. State reason why training is necessary: to assure that the employee receives adequate protection in performing of his job.

   C. Outline the course.

      (1) Origin and characterization of radiation and radioactive decay.

      (2) Radiation hazards.

      (3) Sources of radiation in the mill.

      (4) Federal standards and regulations.

      (5) Radiation and radioactive material monitoring programs.

      (6) Radiation protection programs.

      (7) Federal Regulations requirements.

      (8) Conduct of radiation workers.

      (9) Written examination.

      (10) Respirator fit test, if applicable.

2. Radiation

   A. Origin

      (1) Many origins of radiation.

         (a) Nuclear Radiation

         (b) Fire - heat is a form of radiation.

         (c) Radio - transmitter - radio waves are a form of radiation.

         (d) Microwave ovens - microwaves are a form of radiation.

         (e) Sun - ultra-violet rays are a form of radiation.

         (f) Even light from a light bulb is a form of radiation.

      (2) Nuclear Radiation Sources

         Point out that "nuclear radiation" is much the same as many other forms, except that instead of coming from a fire, radio station, oven, the sun, or a light bulb, it comes from the center or nucleus of an atom - hence nuclear radiation.

(3) Instructional Point

At this point it would be well to ask for questions. More than likely someone will ask about the safety of microwave ovens, color TV sets, or medical X-Rays. Although not particularly germain to this course of instruction, questions of this type are excellent stimulants to class participation and interest, and should be encouraged.

(4) The Atom

In order for the employee to be able to visualize" radiation, he must first understand the concept of the atom:

(A) Atom comparable to solar system:

(1) Sun is "nucleus".

(2) Planets are orbital electrons.

(B) Nucleus is composed of two basic elements:

- Protons: +1 charge; mass = 1.673×10^{-24} grams

- Neutrons: 0 charge; mass = 1.675×10^{-24} grams, are actually a combination of a proton and electron.

- Electron - The electron has a "-1" charge, and orbits around the nucleus.

(B) Type of Radiation

(1) Beta Particles: An electron produced when a neutron disintegrates (comes apart), travels a few meters in air, will not penetrate to internal organs (can be stopped with a few centimeters of plastic).

(2) Gamma Rays: A bundle of energy (0 Mass - 0 charge) and is emitted from an atom's nucleus when it ejects an electron, travels several hundred meters in air, extremely penetrating.

NOTE: If employee seems to have difficulty understanding the 0 mass -0 charge concept, use visible light or medical X-Ray examples.

(3) Alpha Particles: A combination of 2 neutrons and 2 protons emitted from atoms' nucleus, +2 charge, travels a few centimeters in air, (not very penetrating will not penetrate dead layer of skin, etc.)

NOTE: In the foregoing explanation of the atom and radiation, use diagrams and demonstrations e.g. draw the atom, indicating individual nucleons - use simple atom - diagram each radiation type being ejected from atom, then demonstrate with a uranium source and radiation detector. It is particularly useful to demonstrate gamma penetration of a part of the body. This can be accomplished by placing a vial of yellowcake on one side of your hand, and the probe of a geiger counter on the other.

C. Radiation Decay

(1) When particulate radiation is ejected from the nucleus, the atom changes because it has lost mass.

Example
92 Uranium -238 has 92 protons and 146 neutrons in its nucleus. When an alpha particle is ejected from the nucleus, the atom loses 2 protons and 2 neutrons. Hence it is no longer 92-Uranium - 238.

(2) Use isotopic designation (e.g. $^{238}_{92}U$) to help demonstrate what happens during nuclear decay, i.e.

238 nucleons - 4 nucleons = 234 nucleons
and 92 protons - 2 protons = 90 protons.

In other words Uranium has now decayed to Thorium through alpha decay

(3) Explain beta particle decay, i.e..

(a) Neutron breaks up in nucleus..

(b) The electron produced in neutron decay is ejected from nucleus, proton remains, therefore total mass is not changed significantl but atom gains a proton in nucleus.

(c) Again use isotopic designation demonstrate. 90 Thorium - 234 emits a beta particle: i.e.

$$^{234}_{90}Th + \beta$$

and gains a proton. The result is: 90 +1 (proton); 234 + 0 (mass), or

$$^{234}_{90}Th + iX = {}^{234}_{91}Pa$$

Through beta decay therefore, Thorium has decayed to Protoactini

NOTE: It may be necessary to explain that the total mass is not changed appreciably. (i.e. electron mass is 1/1836 of the proton mass, therefore, mass change of atom during beta decay is insignificant; just the number of protons has changed!).

Although nuclear decay explained in terms of nucleon balance is relatively simple and straight forward, the trainee may have difficulty understanding it simply because it is "nuclear". Repeat the explanation until you are confident that the trainee (s) grasp the concept.

3. Radiation Hazards

A. Mechanism of Radiation Damage.

(1) Simple explanation of ionization, i.e. radiation interacts with atoms in tissue cells, stripping away orbital electrons. If necessary make comparison with run-away planet (e.g. radiation) interacting with solar system (e.g. atom).

(a) Sufficient ionization will result in changes in molecular structure of cell.

(b) Sufficient molecular (chemical) change will result in cell death or mutation.

(c) Cell death OK if held to reasonable levels, i.e. cell death is a normal body process, body is equipped to handle cell death, etc. Massive radiation doses result in massive cell death, results in fatality.

(d) Cell mutation is also OK if held to a minimum. Body is not as well equipped to handle cell mutation as it is cell death. Proliferation of mutant cells results in genetic damage, tumor production, etc.

(e) Past experiences -

- Early radiation workers, i.e. Roentgen, Curies, etc. dying from excessive exposure.

- Early radiation industry, i.e. some Radium dial painters dying from bone cancers, etc.

- Victims of atomic bombs, i.e. some Japanese showing first generation birth defects, but did not show in 3rd and 4th generation.

- Radiation accidents.

- Human experiments. Injections of uranium in blood to study toxic effects on kidney.

- Animal experiments. Dose tolerance studies, chronic exposure experiments, inhalation studies, etc.

(f) Results of all the above have given us a good idea of the short term doses necessary to produce physiological damage:

- 100 rem/few days: Some blood changes - no injury.

- 100 - 300 rem/few days: injury with recovery.

- 400 - 500 rem/few days: 50% death in 30 days.

- 600 rem/few days: 100% death.

(g) Genetic damage and tumor induction are much harder to predict than acute exposure effects. Predictions of such injury are made with massive numbers, just like insurance companies predicting mortality rates. The basic conclusion of most studies is that a working life time (50 years) of exposure to the maximum permissit annual dose will have a life shortening effect of about 250 days.

4. Sources of Radiation in the Mill

A. Terminology

(1) Radioactive material: is simply that material which emits radiation (e.g. uranium).

(2) Radiation: was previously defined in detail.

(3) Contamination: is simply radioactive material that is someplace where it isn't supposed to be, i.e., on the floor (surface contamination), on skin (personnel contamination), etc.

It is helpful to use chalk dust to physically demonstrate the contamination concept. The use of an analogy is also helpful, i.e., "If a cow pasture contains manure, it might be likened to a radioactive material because it gives off an odor (radiation), and it is located where it belongs. If the farmer walks through the pasture and gets some of the manure on his boots, he has become contaminated, because the material is now in a location where it doesn't belong, or isn't wanted."

B. Sources of Radiation in Mill

(1) Direct radiation: Natural uranium and its' daughter (decay) products emit all three types of radiation. Alpha, beta and gamma radiations are emitted from material throughout the entire process.

(2) Airborne contamination: The primary concern is the inhalation and deposition of uranium and it's daughters.

(a) Radiation exposure to the lung for insoluble forms of uranium.

(b) Chemical damage to the kidney (nephrotoxicity) for soluble forms of uranium.

Break:

5. Federal Standards and Regulations.

A. Background to Standards

(1) Individual research - (2) ICRP recommendations (3) NCRP recommendations (4) NRC regulations and (5) finally specific licenses.

B. Nuclear Regulatory Commission sets limits for:

(1) Maximum permissible radiation exposures.

(a) 1.25 rem/qtr.

(b) 5(n-18) rem accumulated dose.

(c) 0.5 rem/9 months for pregnant women.

(2) Maximum permissible exposures.

(a) 520 mpc - hrs per quarter (insoluble uranium).

(b) 40 mpc-hrs (soluble uranium).

(c) 4 WL - months/year. (radon and radon progeny).

3. Maximum permissible concentrations:

(a) For release of effluents to the environment.

(b) For levels at which employees may be exposed to.

NOTE: Emphasize these levels in comparison with levels necessary to produce damage, i.e. 5 rem/yr vs 300 - 400 rem over a very short period of time, or essentially continuous exposure to MPC (3×10^{-10} uCi/ml) vs exposure to a concentration of about 1.4×10^{-8} uCi/ml for 8 hours to cause severe damage to the kidneys, and potentially fatal.

6. Radiation and Radioactive Material Monitoring Programs:

A. Purpose

(1) To limit exposures to the standards established by the NRC.

(2) To continuously evaluate methods for reducing exposures to levels as low as is reasonably achievable.

B. Programs

(1) TLD Badge Program

(a) Purpose: To record the amount of external radiation received by an individual.

(b) Method: Show TLD badge, and TL material. State requirements for wearing badge.

(c) Limits: Reiterate dose limits.

(2) Area Dose Rate Surveys

(a) Purpose: To assess radiation levels to which individuals are exposed.

(b) Method: Briefly demonstrate RO-1 and it's use, or how TLD badges might be used.

(c) Limits: Limits based on personnel exposure limits of 10 CFR 20. There are requirements for posting areas with radiation levels greater than 5 and 100 mrem/hr.

(3) Bioassay Program

(a) Purpose: To assess the amount of radioactive material deposited in the body.

(b) Method: Urine sampling for soluble uranium, and in-vivo analysis for radioactive materials.

(c) Limits: 30 ug/l for uranium in urine, and 16.0/nanoCuries (25 mg.) of uranium in pulmonary lung.

(4) Air Sampling

(a) Purpose: To assess the concentrations of airborne radioactive materials to which employees are exposed.

(b) Method: Demonstrate function and use of lapel air sampler.

If time and conditions permit, demonstrate "counting" of filter paper and calculation of concentration (A PRM - 6/AC-3 may be used for demonstration if necessary).

(c) Limits: 40 hours of exposure to MPC in any 7 consecutive days.

(5) Contamination Surveys

(a) Purpose: To assess the amount of contamination on facility equipment and personal surfaces.

(b) Method: Using PRM-6 or RM-19 and AC-3 probe, demonstrate how surveys are performed.

(c) Limits: Production areas - 2,200 dpm/100cm^2, or 0.0015 grams/100 cm^2, or 0.0000034 ounces/$inch^2$ - skin, clothing. Clean areas, or equipment, released to unrestricted areas, etc. 1,000 dpm/100cm2 (0.0000015 ounces/inch2).

(d) Other programs such as stack monitoring, ambient air samples, etc. may be reviewed time permitting.

7. Radiation Protection Program

A. Purpose

Explain that protection programs are, in some cases, extensions of monitoring programs, for example:

B. TLD Badges

Badge results are entered into the individual's exposure history file, summed over the appropriate period, and compared with NRC limits (show a typical, or dummy exposure history file with NRC Form 5 equivalent). Individuals may be restricted from radiation work if recorded exposures threaten to exceed pertinent limits.

C. Bioassay Program

Bioassay results (urinary excretion rates, and lung burdens, if any) are posted to individual exposure history files (show a typical bioassay record form). Individuals who exceed limits will be rotated to areas of lesser exposure entirely, depending on the magnitude of the bioassay result.

D. Exposure Assignment

Records are kept (show computer sheet) of individual's time spent in various mill areas. These times (in hours) are multiplied by measured concentrations (In MPC units - x 10^{-10} uCi/ml). The results (MPC-hours) are summed over pertinent periods, and compared to NRC limits (show exposure log sheet).

E. Respiratory Protection

In areas that have, or have the potential for concentrations to exceed the MPC values, employees are afforded the use of respirators.

F. Respirators - Show film "The Right to Breathe Safely" or similar respirator protection and usage film.

Demonstrate components and operating characteristics of a negative pressure respirator.

1. General Description

(a) Cartridge holders.

(b) Cartridges, types.

(c) Exhaust valves

* Exhalation causes small positive pressure. Positive pressure causes intake valves to close, and exhaust valves to open, forcing air out through exhaust valves.

(e) Intake valves.

* Inhalation causes small negative pressure. Negative pressure causes intake valves to open and exhaust valves to close, forcing air in through filter.

(e) Head bands, adjustment

2. Review types, applications, and limitations of various cartridges:

(a) Cartridges color-coded black are for use with organics only, e.g. paint vapors.

(b) Cartridges color-coded green are for use with ammonia fumes only.

(c) Cartridges color-coded magenta are for use with particulate radionuclide

(d) When in doubt, read label. Use restrictions will always be on the label. If there is no label, return to Radiation Safety Office. DO NOT USE!.

(e) Do not use one cartridge type for more than one purpose. Use example of respirator user with ammonia cartridges working in precipitation that has been transferred to barreling operation. Stress "0" protection, even though some unknown degree of protection may be afforded.

(f) Particulate filters are high efficiency particle absorbers (HEPA - 99.97% efficient for 0.3 micron - 0.0000118 inches DOP aerosol). Pass a sample around for trainees to look at.

3. Limitations of the various types of respirators

(a) Half-Masks: Wide variances in nose and chin structure (refer to those shown in film) preclude obtaining a good fit in large percentage of the population. Poor protection is also attributed to the ease at which the mask can be shifted about, or removed from, the face.

(b) Full-Face Masks: Negative pressure mode: These types of masks fit 95% of the population - 5% cannot obtain a good fit with full-face respirators. A fit test with irritant smoke is good for a one year period. All negative pressure mode respirators have the disadvange that air, like water, will follow the path of least resistance. Thus, if a breach in the seal occurs, air will pass through that breach before going through the filter media.

(c) Full-Face Mask: Positive pressure mode (powered air): Face piece same as negative pressure mode face piece. This respirator has the advantage of forcing air out of breaches, rather than allowing it tc be pulled in.

4. General restrictions that apply to all respirator types:

(a) Medical limitations: Chronic restrictive lung diseases, high blood pressure, etc.. Explain medical check up.

(b) Facial hair: Surprisingly, a good fit can often be obtained on individuals with full beards while in the class room. When the individual starts to sweat under actual work conditions, however, the perspiration will cause a "channeling" effect that will result in a breach of the seal. This will always reduce the P.F. to "0".

NOTE: It should be emphatically stated that there can be no "partial" seal. Either the user obtains a proper seal, or he does not!

(c) Any facial hair (side burns, whisker stubble, etc.) may destroy the seal.

(d) Temple bars: Temple bars on glasses will interrupt the seal on full face masks.

(e) Contact Lens: Contact lenses may not be worn with full-face piece, negative pressure mode, respirators. The negative pressure under arduous work conditions, will cause the lenses to slip, or become dislodged.

(f) Facial abnormalities: Changes in facial structures (absence of dentures, scars, etc.) may often destroy the seal.

(g) Head gear: A cap worn under the respirator head bands will destroy the seal.

5. Review proper and improper usage.

(a) Do not remove respirator while in the area, e.g. to talk to someone.

This rule is rather obvious, but the practice is quite common with half mask respirators.

(b) Do not wear respirator around the neck while not in use. Contamination present on clothing may contaminate the inside surfaces of the respirator.

(c) When not in use, put the respirator in approved temporary storage location. Do not lay respirator down on any handy surface. Return to R.O. any respirator found outside of approved storage locations.

(d) Do not loosen head bands, or make any other fit adjustment while in the area.

(e) Immediately report respirator defects and malfunctions to R.O.

6. Detail proper methods for inspection and donning of various respirator types:

Selection criteria:

(a) R.O. or supervisor will specify respirator type to be used for a specific job, including cartridge types.

(b) Respirator must be in a plastic or paper bag.

(c) The bag must be closed (sealed).

(d) The bag must bear an "Inspected" sticker with the inspection date clearly marked on it.

(e) The above rules apply to cartridges as well, if they are stored separate from the face pieces.

7. Inspection Criteria: Even though each respirator has been cleaned, sanitized, and inspected by radiation safety, the employee should be told to inspect his own, using the following criteria:

(a) All flexible components must be supple, showing no signs of stiffness or brittleness.

(b) All flexible components must be free of any indication of significant wear or aging (cracks, thinning of the rubber, etc.).

(c) All sealing surfaces (gaskets, filter and/or hose connections, surfaces which mate with the face, etc.) must fit properly, and be in excellent repair.

(d) All valves, and other moving parts must be in excellent conditions. Such moving parts should be function tested (connections made and tightened, etc.) to assure proper operability.

(e) Lens should be well seated with tight seals, and should be relatively free of scratches, marring, etc.

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(f) Head bands should show uniform elasticity, lack of wear, and aging.

(g) Head band fasteners should be tight when fastened, and be free of physical defects (dents, cracks, etc.).

(h) Filter cartridges should be free of cracks, chipping, and visable damage to the filter media.

NOTE: It is helpful to use a full-face piece while reviewing inspection criteria. Emphasize to the employee(s) that any criteria in this sections that cannot be met is cause for rejection of the device. Rejected face pieces and/or cartridges must be turned in to the R.O.

8. Donning procedures: Use an aid or select (en) employee for demonstration of the following general rules using a full face piece:

(a) Pull head band straps out to the full extended position.

(b) Reverse the head bands so that the entire harness lies in front of the face piece.

(c) Enter the face piece chin first, place chin <u>in</u> chin cup. Warn against placing chin forward of chin cup.

(d) Reaching from behind the head to the front of the face piece, grasp the head band harness by the body of the "spider".

(e) Sharply, pull the harness up and back.

(f) Starting with the bottom straps of the harness, pull both straps at the same time until the face piece is just barely snug. Continue until all straps have been snugged-up in this manner.

(g) Settle the face piece until it fits squarely and comfortably on the face. The spider should now be located squarely on the top back of the head.

(h) Again, starting at the bottom, snug-up tow straps at a time so that a uniform pressure can be felt at all points on the face.

(i) Negative pressure fit test the respirator by closing off the inlets (cover the filters, or the filter connectors), taking a deep breath and holding it for 8 to 10 seconds. The face piece should collapse slightly toward the face, and stay collapsed until exhalation. If the face piece does not stay collapsed, then a seal has not been obtained.

NOTE: The employee should be warned not to inhale too sharply, as eardrum damage may occur.

(j) Warn the employee about too much tension on head band straps. Localized pain point, restricting blood circulation, etc.

(k) Emphasize that the negative pressure fit test must be performed each time the respirator is donned.

9. Removal procedure:

(a) Lean slightly forward.

(b) Grasp the respirator by a rigid part of the face piece.

(c) Pull the face piece forward and slightly up, at the same time, moving the head downward.

NOTE: Point out how contamination may occur if the head band straps are loosened first, or the respirator is pulled off back over the head.

10. Relief from respirator usage: Emphasize that anyone can leave the area for relief from respirator use, for any one of the following reasons:

(a) Equipment malfunction - give a few examples:

- Head band breaks.

- Batteries fail. Reassure the employee that it is possible to breathe without the air pump on. Remind them that if the batteries on air pump fail, the protection factor reduces from 1,000 to 50. Also, that having a seal with the pump "on," does not mean the seal remains when it is "off."

- Sticky inhalation/exhalation valves.

(b) Physical discomfort:

1. Perspiration in eyes.

2. Localized pain from over tightened head band straps.

3. Increased difficulty in breathing due to filter plugging, etc.

(c) Vision impairments due to lens fogging:

(d) Loss of communications, such as with a back-up (standby) man when cleaning inside of tanks.

(e) Deterioration of operating conditions, such as loss of the ventilation system in the barrelling enclosure.

(f) Psychological distress, or any other condition that would require relief

NOTE: Make a special point of telling the employee that any time he has reason to believe that his respirator seal has been breached, he should leave the area immediately, and report to the Radiation Safety Office. At this point, you may wish to explain special bioassay procedures.

G. Medical Evaluations

Each employee will be medically evaluated for fitness to use respirators These evaluations will consist of the following minimum items.

(1) Anthropometric measurements (weight, height, blood pressure, pulse, e

(2) Eye test.

(3) Hearing tests.

(4) Pulmonary function tests.

(5) Blood sample.

(6) Urine sample.

(7) Further studies, or examination, if physician orders.

8. Discuss reasons or needs for medical evaluation

(a) Respirators put additional strain on the cardiopulmonary system, and individuals with chronic heart or lung disorders may have their health endangered.

(b) A risk is associated with radiation work, consequently medical base line data is required to determine if additional risk (due to poor health, etc.) might be involved. If there is a chance for additional risk, restrictions on use of respirators and radiation work may be imposed.

H. Contamination Protection

Individuals assigned to work in areas, or on equipment, wherein there exists a heavy contamination potential, are afforded protective clothing. Emphasize the need for these individuals to survey themselves prior to leaving the restricted area, i.e. The maximum permissible contamination level is 1,000 dpm/ $100cm^2$. or about 0.0000015 ounces/ $inch^2$, an invisible quantity!

(1) Outline procedure for decontamination:

(a) Wash with cold water and soap.

NOTE: Cold water keeps pores closed.

(b) Resurvey affected area.

(c) If still 1,000 dpm/$100cm^2$, contact Radiation Safety Immediately.

(2) Demonstrate proper use of RM-19/AC-3 for alpha contamination survey.

I. Radiation Work Permits

Show typical form as you explain its purpose and use.

(1) *RWP is used for special or nonroutine maintenance jobs and in the IX, Precip and Dryer Circuits.

(2) *RWP specifies requirements for protective clothing and equipment.

(3) *RWP specifies special monitoring requirements.

(4) *Conditions on RWP MUST BE FOLLOWED.

8. 10 CFR 19 Requirements:

Under the provisions of Title 10, Code of Federal Regulations, Part 19 all radiation workers must be advised of their rights and responsibilities with respect to radiation work. Outline these rights and responsibilities.

(a) Responsibilities:

(1) Each worker must observe work area for violations, or potential violations of federal regulations, and promptly report the condition to their supervisor.

(2) The worker must endeavor to maintain his own exposure to levels as low as is reasonably achievable (Section 9.0 of this manual).

(3) Each worker must be aware of the health protection problems associated with exposure to the various forms of uranium in the mill.

(4) Each worker must be aware of the function of each protective device (badges, masks, lapel air samplers, etc.) afforded him.

(b) Rights:

(1) Each worker has the right to request all radiation exposure data (including bioassay measurements, etc.) recorded for him. Upon written request, the worker will receive an annual report of his exposure history for that year.

(2) Each worker has the right to request all radiation exposure data recorded for him during his entire employment, upon his termination of employment. Such information shall be forwarded to the worker within 30 days of receipt of the request, or within 30 days after the exposure has been recorded, whichever is later.

9. Conduct of Radiation Workers:

This is the practical approach for the employee and should be emphasized strongly.

A. Protection against external radiation.

Emphasize that the individual must be cognizant of his own exposure control at all times. Warn that almost any vessel within the mill may contain uranium in one form or another, and that the employee must be continually aware that he is receiving exposure from them. The basic control measures that the employee can use, are:

(1) Time: The shorter the time period spent next to or in close proximit of a vessel, the lower the received dose, i.e. use dose rate example - mr/hr x hours of exposure.

(2) Distance: The further away from the source (tanks, barrels, etc.) that the employee gets, the lower the dose rate. Use example with small beta-gamma source and G.M. instrument.

(3) Posting: CAUTION RADIATION AREA OR AIRBORNE RADIOACTIVITY AREA. If a sign proclaims an area to have an unusually high dose rate or concentration: do not enter that area unless absol tely necessary; spend as little time in the area as possible, know the source of the radiation, and spend as little time near it as possible.

(B) Protection Against Internal Radiation

Explain that internal deposition is the major hazard in a mill. The employee must know the sources of most exposures (i.e. yellowcake dryer, raw ore, etc.). Strong emphasis should be placed on the minute quantities of uranium and its daughters required to result in various maximum permissible values (see "Useful facts and Data in Appendix-A).

(1) Do not enter areas known to have high concentrations of airborne radioactive materials without proper respiratory protection.

(2) When entering areas known to have high concentrations of airborne radioactive materials use the proper respirator if respirators are required.

(3) Attempt at all times to keep uranium contamination off the skin and clothing. Again emphasize the minute quantities that will result in the maximum permissible contamination levels.

(4) Avoid handling uranium in any form with bare hands whenever possibl

(5) Always throughly wash hands after working in or on potentially contaminated equipment.

(6) Always wash hands throughly before smoking, eating or chewing.

(C) In Case of injury: (Leave contaminated area if possible).

(1) Apply pressure. Save the first blood on a paper towel.

(2) Isolate.

(3) Report to Safety to have wound treated. Always report injuries no matter how small they might be.

(4) Safety should be advised of possible contamination so that Radiation office can monitor.

NOTE: Employee should be appraised that his or her safety takes precedence over decontamination.

10. Examinations:

The instructor may wish to allow another short break prior to the test. A true-false/multiple choice test from 10 to 20 questions should take no more than 15 to 25 minutes. Conduct the test in the following manner:

(A) Tell the employee(s) to put away all notes and instructional material.

(B) Pass out test, instructing employee(s) to Print their name and the date at the top.

(C) Do not talk while the test is being given. Remain in the room.

(D) Collect the test papers as each individual completes the test.

11. Fit Testing

Fit testing of 15 individuals in two respirator types will require 45 to 60 minutes. Before beginning the test explain exactly what the test(s) consist of, then proceed in the following manner:

(a) Hand out blank individual training record forms. (Attachment

(b) Instruct the employees to fill in all required information above the dotted line (PRINT), then sign the form.

(c) Have two employees bring their completed Individual Training records to the testing area.

(d) Instruct the employees to disinfect the respirators with the provided supplies one with a half-mask and one with a full face unit.

(e) While the employees are disinfecting the respirators, note which type each has chosen, then print the make and model information under the "Type of Respirator Fitted" heading.

(f) Observe the employee as he dons the respirator. Assure that it is done correctly, and that the straps are not pulled-up too tight. Around all areas of the face piece that mate with the face.

(g) Ask each employee to demonstrate the negative pressure fit t If a leak occurs, the first place to check is the hands - assure that the inhalation valves have been completely close off. Otherwise check the overall fit of the respirator on the trainee's face.

(h) Watch the employees eyes. Severe pupil dialation would be indicative of fear (claustrophobia).

(i) Have the individual stand still with the head in the normal position. Use the irritant smoke generator to check all points where a leak might occur:

(a) Filter cartridges.

(b) Lens.

(c) Exhalation valves, during inhalation.

(d) Around all areas of the face piece that mate with the face.

WARNING: Warn employees in half-masks to close their eyes during the test, and not to open them until told to do so, to preclude irritation. The first test (above) ascertains whether or not there are now any gross breaches of the seal.

(j) Have each individual in-turn perform a number of facial stress exercises:

(1) Frown (full face pieces only).

(2) Smile.

(3) Head movement - both up and down, and side to side.

(4) Talk and/or laugh.

(5) Wrinkle the nose and/or knit the eyebrows (half masks only).

Check for seal breaches with the irritant smoke during each of the required stress tests.

(k) Have two medically qualified employees run (trot) in place until they are breathing hard, then repeat the irritant smoke test.

(l) While the first two employees are running in place, start two more.

(m) Once the individual successfully passes the irritant smoke fit test, fill in the appropriate protection factor on the training record.

NOTE: An employee failing any portion of the fit test, as observed by a negative reaction to the irritant smoke (attempting involuntary coughing, etc.) should be reexamined. If, upon re-examination, there is no obvious defect, have the employee re-don the respirator. Then repeat all steps of the fit test. If the employee fails the fit test a second time, enter a "0" under "protection factor assigned" heading on the training record. Concurrently, in the "Limitations" blank, print - "Failed qualitative fit test - cannot wear X (Brand name) Y (Model) respirator."

(n) Continue as outlined above until all employees have been fit tested.

12. Grading and Documentation

Grading examinations:

(a) Determine the number of correct answers (some questions have more than one correct answer).

(b) Divide this number into 100, and round to the nearest integer to arrive at the points per correct answer.

Attachment 2

Example Examination Questionnaire

EXAMPLE QUESTIONS FOR RADIATION SAFETY WRITTEN EXAMINATIONS

1. Uranium is hazardous only if you are exposed to large concentrations over a long period of time (i.e. chronic exposure).

   Circle one only:

   A. True

   B. False

2. If you see an air sampler that has been unplugged, you should:

   Circle one only:

   A. Plug it back in.

   B. Notify the Radiation Officer, immediately.

   C. Ignore it, somebody else will take care of it.

3. What effect will a beard have on the protection provided by a full-face mask?

   A. Reduce protection by 75%

   B. Reduce protection by 25%

   C. Cancel out all protection

   D. No effect at all

4. It is permissible to pull your mask away from your face in order to talk to someone.

   Circle one only:

   A. True

   B. False

5. To obtain a good fit you should:

   A. Pull up all head straps as tight as they will go.

   B. Leave the head straps loose.

   C. Tighten just the bottom two straps.

   D. Tighten all head straps so that the face piece is snugly seated against your face.

6. The purpose of the bioassay program (urine sampling and whole body counting) is to:

   Circle all correct answers:

   A. Determine how healthy you are.

   B. Measure the effectiveness of your respirator use.

   C. Determine how much uranium is deposited in your body.

   D. To see if you are drinking enough water each day.

7. For which of the following reasons should you leave your work area and remove your mask?

   Circle all correct answers:

   A. In the event of equipment failure.

   B. In the event of extreme physical discomfort.

   C. A communication failure.

   D. You suspect that the respirator may not be providing you with adequate protection.

8. If, after obtaining a respirator from the storage rack, you cannot get a good fit due to a defective exhaust valve, you should:

   A. Replace the respirator in the storage rack; the person responsible will find and repair it.

   B. Use it anyway, because it makes breathing easier.

   C. Turn the defective respirator into the Radiation Officer.

9. If your respirator starts to leak while you are working in the yellowcake area, you should:

   Circle one only:

   A. Continue to work because the job is almost finished anyway.

   B. Leave the area immediately, and notify your foreman or the Radiation Officer.

   C. Leave the area immediately, obtain another respirator, and return to your job.

10. If, because of ammonia fumes, you have to wear a full-face mask equipped with green filter cartridges, you can transfer directly to the yellowcake dryer and still have the right amount of protection for yellowcake dust.

    A. True

    B. False

11. Respirator head straps:

    Circle all correct answers.

    A. Can be worn over a hat or cap with no effect.

    B. Must be worn under any head gear.

    C. Can be worn over a small cap if they are pulled up very tight.

12. You must perform a negative pressure fit test:

    Circle one:

    A. Once a day, at the beginning of each shift.

    B. Once a year during a respirator training class.

    C. Each time that you put the respirator on.

13. Which of the following mill circuits has the lowest concentration of airborne uranium and radon daughters?

    A. Ore Crusher

    B. Yellow cake Dryer

    C. Precipitation

14. Respirators are checked for defects each time they are cleaned. This means that you do not have to check the respirator before you put it on.

    A. True

    B. False

15. If you find yellowcake inside of a half-mask you have been wearing, you should:

    Circle one only:

    A. Clean the mask out and continue to use it.

    B. Report immediately to the Radiation Safety Officer.

    C. Discard the mask and get a clean one to use.

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D. Continue to use the mask without cleaning it.

16. You are assigned to a special maintenance job in the barrelling enclosure. Which of the following respirators would you choose to wear while performing this job?

Circle all correct answers:

A. A Half-mask, because the operation is shut down and the contamination levels should be lower than normal.

B. A full face mask, because the airborne uranium concentration levels should not exceed 50 times the maximum permissible concentration - MPC.

C. Full-face mask with powered air, because you don't really know what the concentrations might be, and the powered air unit will provide the maximum protection.

D. Ask the Radiation Safety Officer, because you don't really know what the concentrations might be.

17. You may use a full-face mask powered air unit in an oxygen deficient atmosphere, because it is a closed system supplying you with the proper amount of oxygen.

A. True

B. False

18. It is permissible to wear contact lenses with a negative pressure mode, full face mask.

A. True

B. False

19. Air sampling is a management tool, used only to evaluate the effectiveness of engineered confinement.

A. True

B. False

20. In the event of an over-exposure to yellowcake, which of the following organs would we be most concerned about?

Circle one only:

A. Bone

B. Kidney

C. Lung

D. Lymph System

21. Why is a respirator user required to undergo a medical evaluation prior to use of a respirator?

Circle one only:

A. Because it is required in order to obtain NRC approval for the respiratory protection program.

B. Because everyone who works in the mill must have a physical.

C. Because wearing a respirator puts an additional strain on the heart and lungs, and the company wishes to protect the health of its employees.

22. A paper dust mask provides adequate protection against ore dust.

A. True

B. False

23. The powered air full-face mask has a protection factor of 1,000, while the full-face mask with the filter cartridges on the face piece has a protection factor of only 50. Both devices have identical face pieces. Why then is there such a large difference in protection factors?

Circle one only:

A. The powered air unit supplies cool air to the seal surfaces. This in turn provides a positive temperature differential between the inside and outside of the mask, thus providing a much better seal.

B. Because of the large filters on the powered air unit.

C. Because the powered air unit works in the positive pressure mode, and the mask with the cartridges attached to the face piece works in the negative pressure mode.

24. Why are negative pressure mode respirators less efficient than positive pressure mode respirators?

Circle one only:

A. Because it is harder to breath through negative pressure mode respirators.

B. Because negative pressure mode respirators have filters with smaller surface areas.

C. Because it is much more likely that a breach in the seal of a negative pressure mode respirator will result in an in-leakage of contaminated air, than it will in a positive pressure mode respirator.

25. Why are you required to be off work for at least 48 hours prior to submitting a urine sample?

A. To stabilize your uranium elimation rate.

B. To minimize the potential for contaminating of the sample.

C. To be sure that any uranium detected in the urine is not the result of a minor uptake immediately prior to the "days-off" period.

26. Which of the following items would <u>definitely prohibit</u> the use of a full-face piece respirator?

Circle all correct answers:

A. Temple bars on eye glasses

B. Bushy eyebrows

C. Full beard

D. Absence of dentures

E. A severe claustrophobic reaction

27. When not in use, it is permissible to wear a half-mask (suspended from the head straps) around the neck.

A. True

B. False

28. It is permissible to wear a respirator even though you haven't been told to do so.

A. True

B. False

29. You have a legal right to request (and receive) a copy of your exposure history for the past year's period.

A. True

B. False

30. Which of the following radiation types is the most penetrating?

A. Beta

B. Gamma

C. Alpha

31. You are responsible for maintaining your own exposures as low as you can.

A. True

B. False

32. Contamination can be defined as:

Circle all correct answers:

A. Uranium in a process vessel.

B. Uranium on the floor.

C. Uranium dust in the air.

D. Uranium on your shoes.

33. It doesn't matter if you leave the site to go home with visible yellowcake on your shoes.

A. True

B. False

34. If you find excessive contamination (The meter alarms) on your hands you should wash with:

A. Warm water and soap.

B. Cold water and soap.

C. Hot water and soap.

35. If you happen to see that the ventilation system for the barrelling enclosure is not working, you should:

A. Do nothing, because your supervisor, not you, is responsible for the ventilation system.

B. Do nothing, because no one is in the enclosure.

C. Notify your supervisor immediately.

36. Which of the following actions should not be taken if you cut your finger while working on the yellowcake dryer?

A. Report immediately to Radiation Safety.

B. Put a band-aid on it, and continue working.

C. Wash the cut thoroughly and return to work.

D. Catch any blood on a paper towel, and report immediately to your supervisor.

Number: 02.119.00	PATHFINDER MINES CORPORATION Lucky Mc Mill MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Date: 4-24-86	
Page: 1 of 1	

Title: Management of Contractor Personnel

1. Policy:

It is the policy of Pathfinder Mines Corporation, Lucky Mc Mill, to maintain exposures As Low As Reasonably Achievable. This SOP will assist in maintaining contractor exposures within the ALARA concept.

2. Scope:

This SOP will apply to all contractor personnel.

3. Responsibility:

The RSO is responsible for maintaining this SOP and implementation of the procedures.

4. Requirements:

A. Training: All contractors shall receive adequate training in order to make them aware of any radiation hazard that they may encounter, the potentially hazardous areas within the restricted area, and the restrictions under which they must work. Use Attachment 1 as a checklist/record of training.

B. Complete/fill out an NRC Form 4 for each individual.

C. Consider issuing a TLD badge to at least one member of the contractor's crew (normally a working foreman). Generally speaking, issuance of a badge should be considered if the contractor will be on site for at least six weeks out of any given quarter.

D. Obtain a baseline urine sample and a termination urine sample.

E. If the individual will be required to wear a respirator, obtain a physical.

5. References:

SOP 02.004, "Methodology for Completing NRC Form 4."

SOP 02.014, "Physical Qualification for Respirator Use."

Contractor Training Record

Hazards

- ☐ Natural Uranium
- ☐ Soluble Uranium
- ☐ Penetrating Radiation
- ☐ Radon Daughters

Locations of Hazardous Materials

- ☐ Mill Locations
- ☐ Locations Outside Mill
- ☐ Signs/Meanings
- ☐ Fire Alarms

Respiratory Protection (if required)

- ☐ Types of Respirators
- ☐ Types of Cartridges
- ☐ Physical
- ☐ Fit Test
- ☐ Limitations
- ☐ Restrictions

Other

- ☐ Eating Areas
- ☐ Smoking/Drinking
- ☐ Self-monitoring
- ☐ Protective Clothing
- ☐ Release of Equipment

Date:_____ Amount of Time:_____

Signature (Contractor):_____

Signature (Trainer):_____

Attachment 1

Number: 02.131.04	PATHFINDER MINES CORPORATION Lucky Mc Mill
Date: 3-2-92	MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Page: 1 of 3	

Title: Radiation Work Permit

1. Purpose:

This SOP establishes criteria and procedures for Radiation Work Permits (RWP).

2. Scope:

This SOP applies to all mill department personnel.

3. Policy:

It is the policy of Lucky Mc mill to maintain exposures as low as reasonably achievable. This SOP will help achieve that goal.

A. An RWP is required anytime work is performed in the following circuits.

(1) Ion Exchange
(2) Solvent Extraction
(3) Precipitation Circuit

B. Additionally, an RWP is required anytime any of the following conditions exist:

(1) Gross Alpha:

(a) Direct measurement - greater than 15,000 DPM/100cm^2.

(b) Wipe sample - greater than 1,000 DPM/100 cm^2.

(2) External radiation greater than 2.5 mR.

(3) Airborne contamination - any area greater than $2.5x10^{-11}$ uCi/ml.

Note: Paragraph A establishes circuit criteria for an RWP. The intent is to ensure that worker protection is being utilized as the tanks, pipes, pumps, etc., are being worked on, or when external surface contamination is such that protection is required. Normally, maintenance on structural steel, water lines, electrical circuitry will not necessitate an RWP unless surface contamination dictates use of protective equipment.

Any area which exceeds 25% MPC as designated by the RSO shall require an RWP regardless of the type of maintenance activity (i.e., structural steel repair, electrical, etc.).

4. Procedures:

A. Morning Work Planning Meeting: A meeting shall be conducted each morning to outline the day's activities and to determine if a Radiation Work Permit is required. The RSO and the chief electrician will attend the meeting.

B. Preplanned work activities for those periods when the RSO will not be present will be coordinated with the RSO to determine if an RWP is required.

C. Unscheduled/Emergency Work Activities: In the event unscheduled work activities or emergency work must be accomplished and the RSO is not present, then a mill supervisor who has received special training will conduct adequate surveys to determine if an RWP is required. Procedures for determining if an RWP is required and use of equipment/detectors are listed in attachment 1.

D. Protective Equipment and Administrative Procedures:

(1) Normally the following minimum protective equipment will be worn and may be modified only by the RSO. (See attachment 2 for instructions.)

(a) One-half face or full face powered air purifying respirators.

(b) Rubber gloves.

(c) Lapel air sampler.

(d) Work coveralls. If visible surface contamination exists, then use disposable coveralls over the work coveralls.

(2) Either the RSO or the supervisor will complete the RWP form (attachment 3).

(3) At the completion of the task, self-monitoring for personal contamination will be accomplished.

E. Records: A record of the RWP shall be maintained (attachment 3). The corrected exposure shall be transferred to the permanent exposure record.

References:

1) SUA-672 Source Material License, License Condition 38, September, 1984.

2) Orientation, supervisory and reinforcement training, 02.116.

Procedures for using the PAC-7:

1. Turn on the instrument.

   Knob on right side should be turned clockwise. Move the knob out of the "off" position, but do not turn full clockwise.

2. Check battery.

   Place the left knob to "B" and see that the needle is in the "BATT OK" range.

3. Set scale at X1.

4. Place instrument on surface of area to be surveyed.

   Be cautious not to puncture the mylar. Irregular/rough surfaces may ground the instrument (i.e., full scale needle). Press the reset button and the needle should zero.

5. Record the results and correct the CPM to DPM.

   The correction factor is listed on the side of the instrument. Multiply the needle reading (CPM) by the C.F. to obtain DPM.

6. Remember.

   a. Take adequate surveys.

   b. Survey inside surfaces as well as outside surfaces.

   c. If the needle reads full scale, press reset. If the needle returns to full scale, set the left knob at X10, you may have exceeded the X-1 value.

   d. Correct CPM to DPM.

7. Fill out the section 5A of attached survey sheet.

Procedures for using Ludlum Model 2:

1. Place AUD switch to ON.

2. Place F/S switch to S.

3. Check battery.

   Place large knob in BAT position and check needle in BAT test range.

4. Place large knob to X1.

5. Check that the probe is open (white dots not visible).

6. Take adequate surveys.

   Survey inside and outside of equipment. The probe should be near the surface being surveyed.

7. Read the needle at each survey point.

   Note: If needle is full scale at X1, turn knob to X10 and correct needle reading.

8. Log results in section 5B of the attached survey form.

Wipe Samples:

1. Procedure for taking wipe samples.

   a. Use round filter paper.

   b. Wipe an area approximately 4" x 4".

   c. Use moderate finger pressure.

   d. Fold paper in two and write on surface of the paper the location of the wipe (i.e., pipe - inside; tank; inside/outside).

   e. Take adequate samples.

   f. Return to RSO office to count the paper.

2. Procedures for counting wipes.

   a. Use the MS-2/RD-14. They are located on the left side of the counting table.

   b. Set "count time in minutes" at 1x1. Ensure that the timed-stop-man switch is in timed position.

   c. Center the filter paper, dirty side up, under the RD-14.

   d. Press reset-start switch.

      The red counting light will illuminate. At the end of one (1) minute, the red light will go out. You can check the time on the second hand of your watch.

   e. Record the value shown in the window on the attached sheet, section 5C.

   f. Multiply the value by the CF found on the calibration label on the top of the MS-2.

1. Date _____ Time _____ Initials _____

2. Equipment Surveyed _____

3. Equipment Location _____

4. Purpose of Survey _____

_____

5. Survey Results

a. PAC-7 (Direct Alpha):

#	CPM	x	CF	=	DPM
1					
2					
3					
4					
5					
etc					

b. Ludlum 2 (Beta Gamma):

#	Results (MR)
1	
2	
3	
4	
5	
etc	

READ THIS

1. Review the procedures for using the equipment.
2. Take adequate surveys, inside and outside.
3. Obtain wipe.
4. RWP required if:
   a. Wipe > 1,000 DPM.
   b. Direct > 15,000 DPM
   c. B/G > 5 MR.

c. Wipes (Removable Alpha):

#	CPM Location	x	CF	=	DPM
1					
2					
3					
4					
5					

Instructions to Supervisors

Procedure for Radiation Work Permit During Swing and Graveyard Shifts

1. Assemble the supplied air respirators. You will require the following:

   a. Rechargeable battery pack.

   b. Blower assembly.

   c. 30" hose.

   d. 2 high efficiency filters.

   e. Leather belt.

2. Select the appropriate mask and attach hose.

3. Assemble the monitaire sampler.

   a. Attach a flexible tubing to the sampler and to the male end of the filter paper holder.

   b. Place a single sheet of filter paper in the holder. Note the grid pattern on the filter paper must face outward.

   c. Attach the sampler to the belt and place the filter paper holder on the collar, near the individual's face.

4. White disposable coveralls should be worn.

5. Complete the radiation work permit form.

6. Note the time that the sampler was turned on and turned off. The name, date, sample no., start and stop times shall be noted on the adhesive label as shown below. The label shall be adhered to a plastic vial which holds the used filter paper.

   Name_____
   Date_____
   Sample No._____
   Start_____
   Stop_____

7. At the completion of the task, remove the filter paper and place it in a vial. Remove the paper with tweezers and do not disturb the surface of the paper.

8. Leave the RWP and vials on the counter in the Radiation Lab.

PATHFINDER MINES CORPORATION
Lucky Mc Mine

1. Radiation Work Permit Number_____ Date_____

2. Area where work is performed and task:_____

_____

3. Hazard:_____

4. Name of individual covered by RWP:_____

5. Protective Equipment:

   a. Type Respirator_____

   b. Protective Clothing_____

   c. Lapel Sampler_____ _____ _____
   ID Start Stop

   d. Personal contamination survey:_____

6. Signature of person covered by RWP, acknowledging receipt of equipment:

   _____
   Signature

7. RSO/Supervisor Signature:_____

8. RWP Termination:_____ _____ _____
   Date Time Initials

_____

CALCULATIONS:_____
Date

Instrument_____ Gross Count_____

Vol/liters_____ Concentration_____

Time-hours_____ Exposure_____

Background_____ Protection Factor_____

Corrected Exposure_____

Attachment 3

Number: 02.132.01	PATHFINDER MINES CORPORATION Lucky Mc Mill
Date: 8-2-85	MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Page: 1 of 3	

Title: Change Room Procedures and Related Activities

1. Purpose:

   The purpose of this procedure is to outline the operation and management of the mill change room facility.

2. Scope:

   The scope of this procedure shall include all mill personnel; i.e., all personnel employed within the restricted area, excluding the warehouse employees.

3. Equipment:

   A. Coveralls, or equivalent.

   B. Laboratory smocks, or equivalent.

   C. Eberline Instrument Corp., Count Rate Meter (RM-19/20) with Model AC-3 Alpha Scintillator Probe, or equivalent.

   D. Personal Self-Monitoring log sheet.

   E. Boots.

4. Policy:

   The policy of the Lucky Mc Uranium Mill management is to maintain personnel exposure to radiation and radioactive materials as low as reasonably achievable (ALARA). The Nuclear Regulatory Commission endorses this policy.

   This SOP outlines a comprehensive program through which management has chosen to implement a portion of the ALARA concept. Compliance with this procedure is a requirement of employment. Changes to this program shall be made by management as necessary to insure compliance with all State and Federal Regulations and the safe productive operation of the Lucky Mc mill facilities.

5. Procedure:

   A. Instructions to Workers:

      All workers shall be informed of the change room procedures. Attachment 1 is a handout which will be given to workers.

B. Change Room Operations:

(1) All employees, prior to the start of their shift, shall place their "street" clothes in the lockers and put on their work clothing.

(2) Coveralls shall be provided by Pathfinder. Coveralls will be provided to each employee.

Workers are encouraged to wear rubber boots (provided by Pathfinder). However, the use of personally supplied safety shoes is acceptable. Boots worn within the mill shall not leave the mill site.

Laboratory personnel will be issued smocks in lieu of coveralls, but they shall be required to monitor and sign out before departing the mill area.

(3) Employees shall report to their assigned work areas in time to start their shift.

(4) At the completion of the shift, employees will remove their work clothing, including shoes or boots, and place them in assigned lockers on the "work" side of the change room. Coveralls that require washing shall be placed in the dirty clothes hamper.

(5) Shower facilities are provided for those desiring to use them. Towels, washcloths and soap shall be provided by Pathfinder. Towels and washcloths shall be placed in the appropriate hamper after use. Showering is encouraged, but not mandatory unless personal contamination cannot be removed by other means.

(6) All employees shall monitor themselves and sign the appropriate log prior to leaving the change room and restricted area. Supervisors shall monitor themselves prior to leaving the mill area in either the mill office or in the change room, and shall sign the log. This self-monitoring and sign-out procedure is mandatory.

(7) Traffic through the change room shall be kept to a minimum.

C. Clothing:

(1) Coveralls or lab coats shall be worn as an outergarment. Coats may be worn over the coveralls during inclement weather.

(2) Approved minor alterations to company provided clothing shall be permitted. Alterations shall be at the employees expense.

D. Visitors:

Any person who visits any mill circuit shall be required to monitor prior to departing the restricted area.

E. Release of Equipment to the Unrestricted Area:

Personal equipment such as boots, tools, etc., which has been used within the mill may be removed from the restricted area after the equipment has been monitored and released by a supervisor. A record of the release shall be made, with one copy for the individual's use and one copy maintained by the Radiation Safety Officer.

References

1. Standard Operating Procedure Number 02.034, "Personal Contamination Surveys."

2. Source Material License SUA-672, January 19, 1978.

3. Title 10, Code of Federal Regulations, Parts 19 and 20.

4. Change Room Instructions to Mill Department Employees (Attachment 1).

Attachment 1

CHANGE ROOM

INSTRUCTIONS TO MILL DEPARTMENT EMPLOYEES

Purpose

The change room has been designed to provide mill employees with a clean facility to change from street clothing to work clothing. The goal is to ensure that all radioactive material remains at the work site.

Equipment and Clothing

A. Coveralls:

1. Each Mill Department employee, except laboratory personnel, shall be issued three sets of coveralls. Employee's name shall be written on the breast pocket.
2. Employees shall sign a receipt for the coveralls, accepting responsibility for them. Coveralls shall remain the property of Pathfinder Mines Corporation and shall be returned upon conclusion of employment in the Mill Department.
3. Coveralls shall be replaced no more frequently than one pair each six months. Coveralls may be replaced on a more frequent basis at employee expense. To receive a new set of coveralls, contact your supervisor who will determine your eligibility. He will give you an issue slip (company charge if eligible, otherwise personal charge) for you to present to the warehouse.
4. WEARING OF COMPANY PROVIDED OR EQUIVALENT COVERALLS IS MANDATORY AND IS A CONDITION OF EMPLOYMENT. Coveralls shall be normally worn as an outer garment except for those personnel performing duties outside of the mill who may wear a coat over the coveralls. Any coat worn as an outer garment will be considered work clothing and must be left on the "work side" of the change room. For duties within the mill, the coveralls will be the outer garment. Personnel on radiation work permits will be issued disposable coveralls to be worn over the standard coveralls. Yellowcake operators will not be required to wear disposable coveralls except when a task on or around the dryer and precipitation circuit could result in direct contact with dried or slurried yellowcake.

August 13, 1984

5. Coveralls shall not be taken off the property. Dirty or contaminated coveralls shall be placed in a hamper located in the entry foyer on the work side of the change room to be laundered on site.

B. Footwear:

1. Each Mill Department employee, except laboratory personnel, shall be issued one pair of rubber boots. Boots can be replaced at the rate of one pair each nine months. They may be replaced (at employee expense) on a more frequent basis. To receive a new pair of boots, contact your supervisor who will determine your eligibility. He will give you an issue slip to present to the warehouse.

2. The use of company provided rubber boots is not mandatory. As an alternative, employees may wear a pair of personal safety boots in the workplace. IT IS A CONDITION OF EMPLOYMENT THAT BOOTS WORN IN THE MILL SHALL NOT LEAVE THE PROPERTY. Employees must have another set of personal footwear to wear to and from work. If you desire to take your personal boots home, you must obtain a release authorization form from your supervisor or a member of the radiation staff. Your work boots are not to be worn home as you shall be required to wear your street shoes to and from work.

C. Personnel on radiation work permits shall be provided disposable coveralls which are to be worn over the issued coveralls. Do not modify the coveralls (i.e., don't cut holes for access to pockets). Yellowcake operators shall use coveralls as outlined in A.4 above. Personnel wearing disposable coveralls shall discard them properly prior to entering the change room. Do not wear disposable coveralls in the change room or lunch room.

D. Laboratory personnel will be issued three lab coats to wear while working in the lab. They shall receive one replacement every six months, as outlined in paragraph A.3. Laboratory personnel who perform duties in the mill shall be issued two pairs of coveralls to be replaced at 12 month intervals with your supervisor's approval and a warehouse issue slip. Footwear for laboratory personnel will be handled as in B.2 and B.3.

Procedures

(1) General Concept:

a. All mill personnel shall change clothes in the change room.

b. To minimize traffic in the change room, mill personnel must take all work articles and lunches out of the change room at the start of the shift. (Note: Traffic through the change room is to be limited to a single trip in and out of the change room at the beginning and end of each shift.)

(2) Start of Shift:

a. Leave all clothing and street shoes that you will not wear while at work in your assigned clean side locker.

b. Proceed to "work side" and dress for work.

c. Take lunch with you, pick up TLD badge, report to work station.

(3) End of Shift:

a. Mill operators running circuits may proceed to the change room after they have been relieved. All other mill employees may proceed to the change room 10 minutes prior to the end of their scheduled shift.

b. Wash off boots if dirty or contaminated with visible yellowcake at the boot wash station located outside the work side entry to the change room.

c. Upon entering the change room, place the TLD badge on the badge board.

d. Take off work clothes and boots and place in your assigned work side locker; or, if your coveralls are dirty, place them in the dirty clothes hamper on the work side. Operators who have been on the yellowcake and precipitation circuits must place their coveralls in the dirty clothes hamper at the end of each shift. Coveralls placed in the hamper will be laundered and placed on the tables near the washers for you to pick up. Yellowcake operators and personnel on RWP's shall discard the disposable coveralls in the waste receptacle located outside the work side entrance prior to going into the change room. All work clothing and boots shall be kept on the work side of the change room.

e. Shower facilities are available for those employees who want to use them. An employee may be required to shower before leaving the restricted area. Early release from work to shower must be approved by your supervisor. Towels, wash cloths and soap will be available on request. Place used towels and wash cloths in the proper receptacle before leaving the site.

f. Prior to proceeding to the clean side, all employees must self-monitor. This is a condition of employment and must be done in accordance with the instructions posted next to the monitoring station. AFTER MONITORING HAS BEEN SUCCESSFULLY COMPLETED, SIGN THE LOG CERTIFYING THAT YOU HAVE SATISFACTORILY COMPLETED THE SELF-MONITORING.

g. Proceed to the clean side, put on your street clothes and wait for the bus.

FACILITY CLEANLINESS

WE ARE PROUD OF OUR NEW CHANGE ROOM. WE BELIEVE THAT THE FACILITY AND THESE PROCEDURES WILL ENHANCE YOUR EMPLOYMENT AT LUCKY Mc AND WE SOLICIT YOUR ASSISTANCE IN KEEPING THE AREA CLEAN.

August 13, 1984

Number: 02.137.01	PATHFINDER MINES CORPORATION Lucky Mc Mill MILL RADIATION SAFETY AND ENVIRONMENTAL STANDARD OPERATING PROCEDURE
Date: 3-30-92	
Page: 1 of 4	

Title: Confined Space Entry

1. Purpose:

The purpose of this procedure is to provide criteria for entry into, and work within, confined spaces.

2. Definitions:

(a.) Confined Space: A tank, vessel, silo, vault, pit, open topped space more than 4 feet deep (except open-topped spaces whose width is greater than the depth), or any other enclosed space that is not designed for routine employee occupancy.

(b.) Entry: Any action resulting in any part of the employee's face breaking the plane of any opening of the confined space and includes any subsequent work activities inside the confined space.

3. Scope:

This procedure applies to all mill department employees.

4. Policy:

It is the policy of Lucky Mc mill to maintain a safe work environment. Compliance with this SOP will contribute to the achievement of that goal.

5. Procedure:

A. Preplanned work activity meetings shall be held the day preceding the desired activity. The RSO and mill supervisor (s) shall be in attendance.

B. No employee shall be allowed to enter a confined space without issuance of an entry permit.

C. No employee shall be allowed to enter an atmosphere which has been determined to be "Immediately Dangerous to Life or Health (IDLH)", where such atmosphere cannot be made safe by remedial measures.

D. All atmospheres shall be evaluated for radiological hazards and require the issuance of a radiation work permit (RWP) as provided for in SOP 02.131.04.

E. Atmosphere evaluations shall include the following:

(1.) Airborne Particulate -	SOP 02.041 shall establish sampling criteria and exposure limitation.
(2.) Surface Contamination	SOP 02.032 shall establish sampling criteria and remedial action levels.
(3.) Radon Daughters	SOP 02.036 shall establish sampling criteria and exposure limitations.
(4.) Beta/gamma	SOP 02.038 shall establish sampling criteria and exposure limations.
(5.) Oxygen Content	Minimum of 19.5% and maximum of 23.5 % as determined by a calibrated MSA model 245 oxygen detector with remote sampling capabilities.

(6.) Toxic Air Contaminants — Sampling shall be performed using the Draeger color-metric tube methodology. The American Conference of Governmental Industrial Hygienists (ACGIH), "Threshold Limit Values for Chemical Substances in the Work Environment" shall be the referenced standard.

6. Protective Equipment:

A. Normally the following minimum protective equipment will be utilized and may be modified only by the RSO.

(1.) One-half face or full faced powered air purifying respirators.

(2.) Lapel air sampler.

(3.) Work coveralls. If visible radiological surface contamination exists, then disposable coveralls over the work coveralls will be used.

(4.) Ladders or other safe means of access/egress shall be used in confined spaces exceeding four (4) feet in depth from the bottom of the entry point.

(5.) Life line attendant shall only be required when personnel in the confined space are wearing respiratory protection.

(6.) Life line procedures shall mandate personnel in the confined space will wear a "D" ring parachute harness with minimal 7/16" diameter rope line attached. Attendant shall be provided appropriate respiratory protective device and shall also be provided self-contained breathing apparatus (SCBA).

B. Mechanical ventilation may be used to purge confined spaces prior to entry. Personnel will not be permitted into confined spaces that are so hazardous they require continuous cast or exhaust ventilation. Mechanical ventilation will be utilized for worker comfort only.

7. Administration:

At the site of confined space entry, readily available portable, mobile or land line communications shall be provided. Such methods of communications shall be attended at designated reporting facility.

Personnel involved in confined space entry shall receive initial and yearly refresher training in procedures.

PATHFINDER

Pathfinder Mines Corporation
Lucky Mc Mine
P.O. Box 831
Riverton, Wyoming 82501
(307) 457-6626

(Formerly Lucky Mc Uranium Corporation)

02.137 Confined Space Entry Permit (CSEP)

1. Confined Space Entry Permit Number: _____ Date: _____

2. Area where work is performed and task: _____

_____

_____

3. Hazard Evaluation Procedures: _____

_____

_____

4. Name of individual covered by CSEP: _____

5. Protective Equipment:

   a. Type of Respirator: _____

   b. Protective Clothing: _____

   c. Ladders: _____

   d. Ventilation: _____

   e. Life Line Attendant: _____

   f. Lapel Air Sampler: _____ (ID) _____ (Start) _____ (Stop)

6. Signature of person covered by CSEP, acknowledging receipt of equipment:

_____
SIGNATURE

7. RSO/Supervisor Signature: _____

8. CSEP Termination: _____ (DATE) _____ (TIME) _____ (INITIALS)

RSO:CFVB:rc/3-92
02.137

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

"EXHIBIT 2-1 MILL AREA BUILDINGS AND ALTERNATE BURIAL SITE"

WITHIN THIS PACKAGE.

D-01

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

"EXHIBIT 2-2 MILL DEMOLITION RUBBLE BURIAL SITE LOCATION MAP"

WITHIN THIS PACKAGE.

D-02X