INTERIM OPERATION REPORT

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December 11, 1979

Commonwealth of Pennsylvania
Department of Environmental Resources
Bureau of Design
P.O. Box 1467
Harrisburg, PA 17120

Re: Ernest Mine Complex
SL 107-1-1

Gentlemen:

In accordance with item, II- INTERIM OPERATIONS, of our amended Professional Design Services Agreement dated August 23, 1979 we are forwarding herewith the INTERIM OPERATIONS REPORT dated December 1979 for the Carl A. White Water Reclamation Plant located at Creekside, Indiana County Pennsylvania.

Representatives of our firm will be pleased to meet with you at a convenient time to discuss this report.

Sincerely,

L. Robert Kimball

LRK/ts

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CARL A. WHITE
WATER RECLAMATION PLANT
CREEKSIDE, INDIANA COUNTY, PENNSYLVANIA

COMMONLY KNOWN AS THE

ERNEST MINE COMPLEX
ACID MINE DRAINAGE TREATMENT PLANT

INTERIM OPERATIONS REPORT

PURPOSE

The Commonwealth of Pennsylvania, Department of Environmental Resources, Office of Resources Management has engaged the services of L. Robert Kimball & Associates Consulting Engineers and Architects to recommend interim operational procedures for the Carl A. White Water Reclamation Plant so that the existing plant may be kept in operation while studies are performed on the raw water quantity and quality and on sludge dewatering and disposing techniques. Also operations shall commence and continue, if possible, until such time as additional facilities are constructed and made operational to effectively treat the mine water and dispose of the waste products generated.

This report is intended to provide guidelines and operational procedures for the time period required to place on-line such additional equipment and facilities as are necessary and cost effective to treat the raw water and dewater and dispose of the sludge. This "interim" program of operations is expected to last about two years.

INTRODUCTION

The Carl A. White Water Reclamation Plant, located at Creekside, Indiana County, Pennsylvania was placed in operation in June 1978. Shortly after beginning operations of the plant, it was discovered that certain design parameters were different from those anticipated vis. raw water quality and quantity, sludge wasting and recirculation. Therefore, it became necessary to reduce plant operations until such time as adequate facility modifications were available to enable the plant to resume full operations.

The plant was designed to pump 4.5 MGD of raw mine water from the Ernest Mine Complex, treat the water via a lime neutralization, mixing, oxidation and precipitation process and discharge the treated water to McKee Run, a tributary of Crooked Creek. The waste product generated at the plant was designed to be pumped back

into the abandoned mine for ultimate disposal. Certain features were built into the treatment plant to enable its operation under various modes; including but not limited to (a) continuous or intermittent operation, (b) reduced or slowdown operations, (c) diversion of flow patterns, (d) sludge recirculation, etc.

In order to implement the recommendations contained in this report, operations personnel will be required to refer to the plant Operation and Maintenance Manual, manufacturers' catalog information regarding equipment servicing, history and records of past operations and supervisory directives for proper plant operations. Special consideration shall be given to seasonal operations, variations in raw water quality and quantity, if any, breakdowns and equipment malfunction, manpower, supplies and any other such feature that might affect the interim operation of the plant.

OPERATIONS

A. General

Operations of the treatment plant are to be reduced to such an extent that maximum utilization of plant facilties is conducted yet minimum sludge wasting to the abandoned mine is effected. This mode of operation immediately is identified as being somewhere between full-scale operation and complete shut-down. Selected herein is a plan which the professional deems most suitable under current conditions. The plan may require modification as conditions governing plant operations change.

B. Flow Quantity

Raw water pumping is recommended at a pumping rate of having one raw water pump in operation. Throttling of the raw water force mains (adjusting valves under raw water flumes in the Control Building) should not be performed. Throttling will reduce liquid flow, but it will also require extra electrical power for pumping and cause unnecessary wear on valves and pump bowls.

Under plant design operations one raw water pump will produce a minimum of 780 GPM (1.125 MGD). However, total plant design criteria is non-existent; therefore, some variation in raw water quantity will be expected. For example; if the mine pool elevation is above the design pool elevation one can expect more water than design and if the mine pool elevation is below the design pool elevation one can expect less water than design.

If flow quantity varies from day to day because of variations in mine pool elevation or from time to time because of variations in pump design, efficiency, production, etc. the plant operator is advised to compensate for this quantity change by making appropriate adjustments in plant operations rather than attempt to equalize raw water pumping quantity.

C. Flow Distribution

It is advisable to maintain complete operation of all facilities. Should equipment, channels, tanks, etc. be operable, they ought to be kept in operation. Where variations in equipment operating rates are available, a slower-than-design rate is to be employed. Where operating conditions are flow dependent, caution must be exercised to guard against plugging, over conditioning, effects of increased detention, freezing, etc.

Total plant facility operation does not necessarily mean continuous operation of each and every item of equipment or plant facility. It means maximum utilization of all the facilities; some would be operating intermittently. Flow distribution then would be established by operating sequentially all the raw water pumps and performed by splitting the flow into both sides of the plant and operating all four clarifiers. Support equipment such as lime handling and lime slurry application shall all be kept functional and on line either at reduced rates or in an intermittent mode.

Environmental conditions may require flow distribution revisions from time to time. Therefore, it is not intended to provide an iron-clad distribution procedure. Varying climate and process developments are expected to become a factor in the selection of the distribution of flow through the plant. Whenever revisions to flow distribution are made, notations are to be logged on the operations report as to what mode is being performed as well as the operators' reason for making the flow distribution revision.

D. Operation Time

The plant should continue operation on a two shift per day, seven days per week basis. The principal basis of this procedure is to maintain current manpower, operating costs, supply quantities and maintenance needs. Actual plant operation would be approximately fourteen to fifteen hours per day; allowing time for daily mobilization and demobilization of plant facilities.

Inclement weather conditions, mine pool levels, emergencies and unexpected situations may require periods of

continuous operation (around-the-clock). This time of operation would be employed on an as-needed or required situation. Manpower availability must be such that, if needed, the plant can be operated 24 hrs/day. It is expected that continuous operation will be needed during extreme cold weather to preclude freezing and damage resulting from icing of liquid in the tanks.

It is presumed in this report that the plant will not be shut-down for an extended period of time. However, if complete shut-down becomes necessary, the following action should be taken by the plant operator to preclude any detrimental effect a shut-down might have on the mechanical equipment:

i. Consult with both district and state offices of the owner.
ii. Consult with the professional.
iii. Perform a thorough inspection of all equipment.
iv. Monitor plant security features regularly.
v. Guard against rusting, flooding and freezing.

Operation time of the various plant components is expressed under each component section of this report. Due to the nature of equipment and its operation at the plant a single statement of operation time would not be applicable for each and every plant component.

E. Operation Data

A written log of operations is necessary. The existing format for reporting plant operations is excellent. However, it is desired to secure additional data on a regular basis; Therefore; a new OPERATORS REPORT form has been prepared. It is recommended that this form be placed into effect as soon as possible. A copy of the "Operators Report" is included in this report.

Operation data is valuable in many ways. It is used for evaluating plant performance, for making plant process adjustments, for determining plant operation and maintenance needs, for determining plant alterations and/or improvements, etc.

The OPERATORS REPORT form should be professionally printed on reproducible contact paper to eliminate the need for carbon paper. Four copies of each report is advisable with each copy a different color of paper. Distribution should be: (1) Plant, (2) District, (3) Harrisburg, (4) Professional. Mailings could be weekly or monthly, as desired, to keep mailing costs to a minimum.

RAW WATER PUMPS

There were designed a total of six raw water pumps to lift the mine water from the mine to the treatment facilities. Due to problems with these pumps, there are presently only four pumps in operating condition. The number of operable pumps is likely to change during the period of interim operations.

Each of the raw water pumps should be operated the same length of time each day. Depending upon the number of shifts and the length of shift, the operating time may vary. Example: Total operating hours of 14 hours per day

Pump #1 to operate	3 1/2 hours	(say 8:00 - 11:30)
Pump #2 to operate	3 1/2 hours	(say 11:30 - 3:00)
Pump #4 to operate	3 1/2 hours	(say 3:00 - 6:30)
Pump #5 to operate	3 1/2 hours	(say 6:30 - 10:00)
Total	14 hours	

We recommended that the raw water pumps be permitted to operate per their pumping rate without throttling the force main piping to attain a constant flow rate. Should an excessive quantity of raw water be pumped in the 14 hours of our example mentioned in the preceeding paragraph (say 1.5 million gallons) the pumping time should be shortened for each pump; however, the time from pumping start to pumping stop should be as long as possible. To effect this, a pause between each pump operation would be necessary.

Due to problems encountered during the winter months, it is advisable to consider some type of cold weather protection for the raw water pumps. Some ideas include a single housing over all the pumps, each pump in an individual housing, and/or thermal protection of oiling mechanisms. Whichever idea is developed, consideration must be given to appearance and its effect on the overall plant aesthetic principle.

As an oil conservation matter, shuttling off the oil when the pump is not operating would be required. Certainly, if a pump is not operated for an extended period of time, its oiler should be shut off.

The raw water pumps should not be left standing in the mine water without being operated occasionally. Should a pump become inoperable and repairs not contemplated within a month to six weeks, the pump should be removed from contact with the water. The chemical characteristics of the mine water has a detrimental effect on the pump bearings and will cause a deposit build-up

on the pump bowls, column and piping. Should it become necessary to shut down the treatment plant, the raw water pumps should be removed and stored in the control building. Either the top of the well casing should be sealed with a packer or the pump mounting plate covered, gasketed and bolted in place to eliminate the possibility of mine water discharge. We recommend a sealing device for all six openings be purchased now.

A high mine pool elevation will not be cause for alarm at the treatment plant. All structures are protected against flotation and deleterious effects of mine water.

Cold weather icing causes pressure against equipment submerged in the liquid. In this instance, ice chopping should resolve or prevent any malfunction.

Bubbler system purging is required and must be conducted on a regular basis. The air system, which controls pump operations, is subject to water entry which requires purging.

Lubrication of the raw water pumps must be continued as mentioned in the operation and maintenance instructions.

Maintenance of the raw water pumps must be continued as mentioned in the operation and maintenance instructions.

The pumping of returned sludge by the raw water pumps must be kept at a minimum. If there are any abrasive materials in this liquid (it is assumed that there are) it will have a detrimental effect on the pump bearings and shafts. Hardened shafts and bearings may become required if large quantities of abrasive materials are pumped.

FLASH MIXERS

Both flash mixers are to remain in operation with equal flow distribution from the raw water pumps. The reduced quantity flow through the flash mixers should not be detrimental to the flash mixer operation. The increased detention time in the mixer tanks will assure complete, mixing and assist in equalizing the hydrogen ion concentration (pH).

If it is discovered that the mixing operation is adding oxygen to the liquid contents (O_2 will precipitate sludge in the unit) one of the following courses of action must be taken:

i. Shut-down flash mixer and operate 1/2 of plant
ii. Increase flow through flash mixer to reduce detention time
iii. Revise mechanical mixing device

   a. Reduce speed of unit (requires major change).
   b. Replace with smaller unit (requires major change).
   c. Install temporary portable mixers.

The flash mixers discharge pH should be reduced to a point where the plant effluent iron concentration does not exceed 3.0 mg/l. Original plant design was for an effluent pH of about 8.5 which was needed to reduce iron levels to practically 0.0 mg/l. Under interim operations we feel that the effluent iron levels should be between 2.5 mg/l and 3.0 mg/l. McKee Run (plant effluent receiving stream) classification by both federal and state regulatory agencies has been established at a total iron discharge maximum of 3.0 mg/l. We estimate that a pH of 7.8 would be satisfactory. This will also reduce lime consumption.

The pH probes at the flash mixer effluent troughs require frequent cleaning. The current schedule of preventive maintenance in this respect should continue. It is expected that reduced flow and sludge recirculation in the mine will contribute to the coating of the pH probes. The pH monitoring system of flash mixer effluent and pacing of lime slurry seeding should continue.

Sludge recirculation from the clarifiers to the flash mixers should not be performed. It has been discovered that this feature of operation has not been complementary to the overall treatment plant process.

Lubrication and maintenance of the flash mixers, mixing tanks and instrumentation must be continued as presently scheduled or as mentioned in the operation and maintenance instructions.

AERATION TANKS

Both aeration tanks are to remain in operation with equal flow distribution from the flash mixers. The reduced flow through the aeration tanks is expected to cause some problems with the aeration process. The increased detention time provides time for floc formation after aeration but prior to discharge from the tank. The agitation in the tank will cause the floc to break up which is detrimental to the sludge blanket and settling in the clarifiers.

If it is discovered that the aeration operation is causing problems with clarifier operations one of the following courses of action must be taken:

i. Shut-down aeration tank and operate 1/2 plant
ii. Increase flow through aeration tank to reduce detention time
iii. Install a temporary bottom in the aeration tank - to effluent pipe elevation - to reduce detention time
iv. Revise aeration facilities to reduce agitation and air quantity

a. Shut down aerator (Exercise weekly for 1/2 hrs)
b. Shut down center mounted diffuser with existing valves
c. Throttle perimeter diffusers with existing valves
d. Raise perimeter diffusers

The dissolved oxygen content of the liquid discharged from the aeration tanks should be maintained between 5.0 mg/l and 8.0 mg/l. Adjustments, as noted above, should be employed to effect this D.O. concentration. Less than 5.0 mg/l D.O. is insufficient to convert ferrous iron to ferric iron; however, this is no problem. The present problem seems to be keeping the D.O. level down; it usually is higher than 8.0 mg/l.

In order to maintain the essential monitoring of dissolved oxygen levels a dissolved oxygen meter purchase is recommended. The present method of visual observation of liquid characteristics is inconclusive and advisable only as a preliminary objective. Laboratory analyses on a weekly or monthly basis is not frequent enough to maintain effective control of the aeration process.

Investigations of the blower discharge and regulation of air to the diffusers plus increased orifice size in the diffusers has revealed that a restrictive pipe size in the air piping take-off at aeration tank) is the probable cause of lack of air production by the blowers. It is recommended that this situation of air piping be corrected next summer. This will not only reduce electrical power consumption by the blowers but also reduce wear on the blower components.

The outlet weir levels of the aerating tanks should be adjusted to provide for equal distribution of flows to each of the two clarifiers from the aeration tank. This should be started with establishing an exact level which will produce equal flows (flow should be measured, not estimated) by installing temporary or adjustable weirs.

Lubrication and maintenance of the aeration tanks and related equipment and appurtenances must be continued as presently scheduled or as mentioned in the operation and maintenance instructions.

Sludge recirculation from the clarifiers to the aeration tanks should <u>not</u> be performed. It has been discovered that this feature of operation has not been complementary to the overall treatment plant process.

SETTLING TANKS

All four settling tanks (clarifiers) are to remain in operation with equal distribution from the aeration tanks. The reduced quantity of flow through the clarifiers is not detrimental to the clarifier operation. In fact, the increased detention time in the clarifiers will complement the settling and sludge production process. The major problem with decreased flows through the clarifiers is the probability of increased icing during cold weather.

The effluent launders in the clarifiers need to be leveled and the v-notch weir plates adjusted to provide for equal effluent flow over each and every foot of weir plate. Buoyancy of the effluent launder troughs have created the problem of uneven or misalignment of level. One of the several methods of trough support listed below should be provided:

i. Install spreader plates at the midpoint of the hanger rods.
ii. Install pipe sections over the hanger rods.
iii. Baffle the final effluent trough to create a liquid level back-up into each trough.
iv. Install additional support beams closer to the troughs or lower the existing support beams.
v. Plug holes in bottom of troughs in addition to the above.

Until the effluent launders are level, the clarifiers cannot be expected to operate efficiently.

Each of the clarifier scrapers are recommended to be operated daily during times of sludge withdrawal. The "raise" mechanism on the clarifiers should be actuated, manually once per week allowing the scrapers to rise to their maximum height and immediately return to their normal operating level. Clarifier scrapers do not need to be in continuous operation.

Sludge withdrawal should be accomplished daily at a slow rate from the clarifiers; preferably, toward the end of the last shift. Approximately 20,000 gallons per day of sludge will be required to be wasted from each clarifier (total of 80,000 GPD). Withdrawal at a rate of 0.120 MGD for a period of four hours is recommended. The electrically operated sludge wasting valves must be exercised once per week through their full operating span. NOTE: Wasting quantity and sequence may require changing from time to time. To assure proper operation, it is recommended that a sludge blanket depth indicating instrument be purchased and used with the blanket level recorded daily.

Anytime it appears that the sludge in any clarifier will overflow the effluent troughs, it will become necessary to waste sludge; whether it is on the operations schedule or not. The treatment plant will be operated such that the plant effluent will not pollute the stream. Sludge drawn from the clarifiers shall be as slow as possible. If an emergency arises such that sludge begins to overflow toward the stream (McKees Run); that individual clarifier must be shut off immediately until the sludge blanket is drawn down to an acceptable operating level (about 3 feet below the liquid level). Should sludge overflow occur from all clarifiers, temporary plant shut-down must be accomplished immediately. Upon attainment of acceptable clarifier sludge levels, resumption of plant operation is to be performed.

Each of the sludge recirculation pumps is to be operated daily for a period of approximately 1/2 hour with recirculation directly to the clarifier from which the sludge is withdrawn. During this time of exercising the sludge recirculation pumps do not recirculate either to the influent end of the treatment plant or to the aeration tank influent. In cold weather make sure the sludge recirculation pipelines are drained. The sludge recirculation pumps operation should be performed early in the day. This will assure that the clarifiers have an opportunity to re-settle the sludge prior to sludge wasting later the same day.

During cold weather it will be necessary to monitor for freezing over or icing of the tank liquid surfaces. If ice forms, it must be broken up daily at the close of the last shift and at the beginning of the first shift. Make sure that it is broken in each clarifier between each radial effluent launder and in the center well. Also keep the ice broken on the surface of the clarifier sludge withdrawal boxes.

Lubrication and maintenance of the settling tank mechanical equipment and appurtenances must be continued as presently scheduled or as mentioned in the operation and maintenance instructions.

LIME HANDLING

Lime handling consists of operation of the lime storage bins, lime feeder, lime slaker, lime slurry vats, lime slurry pumps, lime slurry tanks, lime slurry feeders and related pipelines and accessories. The various items under this heading are considered individually, yet collectively they all work together as a process which is titled here as "Lime Handling".

By not maintaining full or nearly full lime storage bins, the bins will be subject to condensation which will affect the flow of lime from the bin. By maintaining full or nearly full lime storage bins, the lime has a tendency to pack over a period of time (now this will become evident since lime usage is low) which will affect the flow of lime from the bin. Therefore, it is recommended that the lime bin levels be maintained between 1/4 and 3/4 full. Surveillance of problems due to lime bin levels may dictate adjustment to a higher or lower level.

Both lime storage bins should be maintained in operation to provide for flexibility of operation in case of malfunction of any of the lime handling equipment. If a lime storage bin is expected to be out-of-service for a considerable length of time (say a month or longer) it should be emptied and only one unit utilized. The plant continues to have as a back-up system the lime conveyors and third feeder slaker, etc. This back-up system needs exercised weekly for at least 1/2 hour. Exercise back-up lime feeder unit "dry".

All the lime feeders are to be available for operation with alternate operation of two lime feeders and the third unit as a standby unit. Adjustment of lime feed shall be required to maintain slaker operation for a maximum period of time each day. A "trial and error" adjustment sequence is necessary to attain proper adjustment. This adjustment may vary within each day, each day, etc; as plant liquid pH varies, as lime purity changes, etc.

Two lime slakers are to be in operation (one at a time) with the third unit utilized as a back-up or standby unit. One slaker should be operated for one full week with the other slaker operated during the alternate week. Alternation of slaker operations should occur during the same day each week. The standby unit is to be operated using utility water only (no lime) for 1/2 hour periods each week. At the end of each week's operation of a slaker, the slaker should be flushed with utility water, thoroughly cleaned by hand, flushed again with utility water, drained and allowed to remain ready for its next operation sequence. Waterline valves and electrical current should be shutoff of both the standby and reserve slakers.

Unused lime slurry vats should be drained, thoroughly cleaned, flushed and remain empty during non-use. Mixers in the lime slurry vats should be exercised weekly for 1/2 hour periods. The mixer may be operated with or without water in its lime slurry vat. Each used lime slurry vat should be cleaned weekly and remain in an empty state during periods of non-operation.

Lime slurry pumps shall be used in conjunction with their related lime feeders, slakers and lime slurry vats. The standby unit shall be exercised weekly for 1/2 hour periods. During

operation utility water must be allowed to be pumped-provisions shall be made to discharge to waste. Do not operate pump dry; always have some liquid passing through the pump when it is in operation. The standby lime slurry pump should be drained and remain empty of liquid between exercising periods. The reserve lime slurry pump must be flushed with utility water and drained when placing it into the week reserve period. The active lime slurry pump and its connected lime slurry pipelines should be flushed daily at the end of the last working shift.

Both lime slurry tanks (tanks located on the second floor of the control building) should be kept in operation. These units are to be operated in parallel as if the treatment plant was in full scale operation. The lime slurry tanks act as a buffer or equalization of lime slurry such that lime slurry remains available for raw mine water neutralization even though a lime feeder, slaker, vat or pumps is being serviced, cleaned and flushed, or being converted to reserve operation. Each of the lime slurry tanks should be drained and cleaned bi-weekly; every week one would be on the cleaning schedule. Mixers must be in operation continuously.

During the period of interim operations the middle lime slurry feeder (Roto-Dip) is to be operated with the other two units shut-down. This middle unit is plumbed to provide lime slurry to both flash mixing tanks. Manual adjustment of valves on the slurry feed pipelines will be required. The feeder should be thoroughly flushed with utility water each week. The two standby units are to be operated for 1/2 hour each week utilizing utility water. A malfunction of the operating roto-dip may require its replacement with one of the standby units by moving the standby unit into the position of the malfunctioning unit.

The treatment plant interim operations requires a substantial reduction in the quantity of product generated and processed in the lime handling system. Lime handling, at best, requires a considerable amount of preventive and corrective maintenance. The interim operations situation is expected to place an additional burden on plant personnel monitoring and service of the lime handling equipment. An estimation of work requirements would be merely speculative; therefore, it is considered adequate here to just alert plant personnel of a more intensive and frequent watch and consideration of the lime handling process.

Lubrication and maintenance of the lime handling equipment must be continued as presently scheduled or as mentioned in the operation and maintenance instructions for the various items of equipment.

SLUDGE WASTING

Sludge wasting is to the abandoned mine workings. The current method of sludge wasting shall continue unitl some other method is employed or until a malfunction in operation prohibits its continuance. As sludge is withdrawn from the clarifiers (see section titled SETTLING TANKS) it is measured and deposited in a sludge well from which it is pumped to the mine. Pumping rates to the mine are automatically regulated; being paced by the liquid (sludge) level in the sludge wells.

Experience in sludge wasting has revealed that soon (times vary from one to three hours) after wasting begins a higher concentration of sludge return appears in the raw mine water. The objective is to reduce sludge recirculation in the mine as much as possible. The less sludge wasted, the less returned and vice versa. In order to attain the objective (reduction of sludge re-circulation) frequent adjustment of sludge withdrawal and wasting may be required.

Continuous recirculation of wasted sludge in the mine will ultimately ruin the raw water pump bearings. Concentrations of settleable solids in the raw water above 350 ml/l are to be avoided. Should 350 ml/l (plus or minus 30 mg/l) settleable solids be observed continuously over a full operating day, plant adjustments are to be made to reduce the quantity of settleable solids. eg. Waste less sludge, pump less raw water, etc. The 350 ml/l criteria is considered a threshhold limit for plant shut-down(1 hour test).

Although it is not felt to be in the best interest of plant operation and sludge wasting to introduce a chemical additive (flocculant) to aid in sludge settling, it may become necessary for continued plant operation. Concentrated sludge will increase the possibility of mine void filling and ultimate termination of the present point of sludge introduction. Pressure injection at the existing point of sludge wasting was considered as a means of prolonging plant operations; however, the professional does not recommend this be done.

Frequent analysis of raw mine water in relation to sludge recirculation is important. The logging of characteristics relative to sludge wasting and its effect and impact on the mine and treatment plant operations is essential. Unusual or radical changes throughout the monitoring operations should be reported as soon as possible to higher authority so that directives may be issued as to any change in operational procedures needed.

The waste sludge pumps must be operated at least weekly. Under the conditions noted hereinbefore operation can be assured to adequately keep the equipment in acceptable operating condition.

The pumps are variable speed with automatic adjustment of rate of speed. At least once per week, each pump should be exercised through its entire speed range. This will require manual operation to assure that this occurs.

Lubrication and maintenance of the sludge wasting equipment must be continued as presently scheduled or as mentioned in the operation and maintenance instructions.

UTILITY WATER

Two utility water pumps, located in the treatment plant final tank, automatically supply water to the hydropneumatic tank which furnishes water for use throughout the plant. Both utility water pumps are to be maintained in operation (one operates at a time with automatic alternation between operation cycles) as if the treatment plant were in full scale operation.

The pumps are actuated by a loss of pressure in the hydropneumatic tank. The pumps will operate less often due to the decrease in demand for utility water; however, all the precautions, maintenance, etc. presently employed must continue. Cold weather problems with lubrication may be corrected by adding electric heat tapes and insulation.

Utility water is to be used for slaker operation, flushing certain lime handling equipment and piping, clean-up of control building, hosing service areas and tanks, purging instrument stilling wells, etc. All operations of the utility water considered in the design of the treatment plant are to be continued.

Lubrication and maintenance of the utility water pumps and related accessories and appurtenances must be continued as presently scheduled or as mentioned in the operation and maintenance instructions.

BLOWERS

Two blowers (or air compressors) were originally supplied to assist in aerating the liquid in the aeration tanks, sufficiently to cause a chemical change in the iron from ferrous to ferric. The blowers are located on the second floor of the control building in an isolated and insulated (for sound) room. Both blowers are to be maintained in operation (one blower operating at a time). Blower speed and air output are variable.

Blowers are to be manually alternated once each day. This sequence shall provide nearly equal operation time and considerable operation time each time a blower is started. One blower has capacity to adequately supply all the compressed air required in the aeration process.

Blower speed shall be reduced to a point that the dissolved oxygen in the aeration tank is less than 8 mg/l. Care must be

exercised such that the blower is not slowed to the point that the quantity of air flowing through the blower is too small to keep the equipment cool. Besides checking the operations curve of the blower to evaluate the lower limit of operation, monitoring of the temperature of the blower must be performed for a short period (about an hour) immediately upon reduction of blower speed. Remember that, due to manufacturing tolerances built into the machinery, both blowers may not operate exactly the same. Excess air may be vented to atmosphere if desired. NOTE: A throttling valve should be installed on the air pipe to the wastewater treatment plant as this unit is being overaerated.

Once per week each blower should be slowed down to its lowest safe operating limit and speeded up to its highest safe operating limit. This feature of exercising will assure continued flexibility in blower operation and variable air supply, if needed. Daily observation of the suction pipe manometer is required to verify operation of the air intake filters. A difference in liquid level of 4 inches or more is an indication that the inlet filter either needs to be cleaned or replaced.

If a ventilation system were installed in the blower room with a selection of discharge points (either to the control building exterior for summer operation or to the second floor of the control building for winter operation) more comfortable operating conditions could be maintained in the blower room, plus there is an added advantage of heat utilization in other parts of the control building. It is recommended that a ventilation system be installed in the blower room. The system must be a forced air manually actuated system.

Lubrication and maintenance of the blowers and related equipment must be continued as presently scheduled or as mentioned in the operation and maintenance instructions.

EMERGENCY GENERATOR

The emergency generator is designed to supply full electrical power to the treatment plant in case of an outside electric power utility failure. The generator will also furnish power for each and every electrically operated item within the treatment plant on an individual basis. In other words, it doesn't matter how much electrical power is needed (full plant or partial plant), the emergency generator will not be under or over powered during its operation. Failsafe features built into the unit will automatically compensate for the power used without harm to the unit.

The emergency generator must be maintained to be operable at all times. Once per week an exercising program is to be instituted (approximately 1/2 hour running time) to assure complete lubrication and functioning of all components. Twice per year (at 6 month intervals) the emergency generator needs to be operated under full plant load. To effect this, have all major plant electrical components in operation, throw open the main outside power disconnect, wait about 2 to 5 minutes for full load transfer, then re-engage the main outside power disconnect. NOTE: Generator will remain in operation until it automatically times out (approximately 10 minutes) and return shall be effected automatically to outside electrical power.

Lubrication and maintenance of the emergency generator and accessories must be continued as presently scheduled or as mentioned in the operation and maintenance instructions.

UTILITIES

In this era of energy conservation plant operating personnel need to be reminded that the use of the various utilities furnished at the treatment plant are to be utilized conservatively. One must not sacrifice energy use to the extent that pollution abatement is not controlled; but a sincere effort needs to be made in the area of limited utility use.

For cold weather operation temperature in the control building should be maintained at 68°F in the office and electrical room adjacent to the office and 40°F in other areas of the control building. For warm weather operation the air conditioning unit should be set at 76°F. This temperature range will provide for ultimate humidity control in relation to electrical apparatus utilizing existing equipment. It also will provide fair working conditions and minimize electrical power consumption. Starting of electrical motors uses more power than running of the motor; therefore, reducing the number of times a motor starts is an effective method of conserving electricity (particularly large motors).

Although the energy consumed for electric lighting is small in comparison with the total plant electrical requirement, one must be amenable to practice conservation in all areas to have a total effective impact. Consequently, we recommend only security lights be on except when servicing equipment or monitoring process operations. On bright days, lights in the laboratory and office may not be needed.

The use of city water must be limited to potable water and laboratory uses. Leaking gaskets and equipment malfunctions that waste city water should be corrected in a timely fashion. Water uses in and around the treatment plant should be with utility water inasmuch as possible.

HOUSEKEEPING

There should be no change in housekeeping chores from full treatment plant operation to interim operations. Although some of the duties may be performed less frequently, they must remain on the housekeeping schedule. Good housekeeping not only is essential for health and safety reasons but it also presents an image to the plant visitor of concern and principle of employees.

Exterior housekeeping activities include snow removal and ice melting in the winter and during cold weather. Grass cutting, weed control, debris removal, equipment storage, etc. are exterior summertime duties. All these items must be cared for as needed.

Plant cleanliness is to be maintained by hosing, scrubbing, mopping, wiping, dusting, sweeping, etc. regularly. Spills of lubricants must be cleaned up as soon as possible. Lime dust, grit, water spills, etc. need periodic attention. Area tidiness not only provides a good appearance but also complements safety practices. Orderliness of supplies, periodicals, records, etc. assists in finding items; particularly by different persons on other shifts.

Past history of housekeeping at the treatment plant has been very good. It is expected that this same concerted effort will continue during the period of interim operations.

MAINTENANCE

Special maintenance considerations for the period of interim operations is listed under the various items contained in this report. Regular maintenance of mechanical equipment shall continue as listed in the plant Operation and Maintenance Manual and the manufacturers' maintenance and instruction procedures. Both preventive and corrective maintenance practices must continue as directed and/or needed.

Lubricants should be used conservatively; yet no skimping of lubricants beyond the equipment requirements shall be performed. An actual written lubrication schedule should be compiled from the brochures and data furnished by the equipment suppliers. This schedule should be followed religiously as part of an intensive preventive maintenance program.

As items of painting develop, they should be noted and cared for as time and weather permits. Protective coatings, on masonry, concrete, metal, bituminous, etc. surfaces will prolong the expected life of these items. Periodic spot painting will extend the period required for a comprehensive repaint order.

Any item of maintenance observed should be immediately noted in a log book. Then, as an opportunity for corrective action becomes available, reference to this written list will readily provide the maintenance needs of the plant. Such a list will also assist in ordering and purchasing items needed for the maintenance concern.

INSTRUMENTATION

All the instrumentation, except the telephone dialer, should be maintained in continuous operation unless the instrument is on an inoperable process. In such instances, where instrumentation is not being utilized, the equipment should be exercised weekly by manually causing the instrument to operate through its entire operating range.

pH probe operation and maintenance is previously discussed in this report under the FLASH MIXERS section.

Flow meters, whether on raw mine water, recirculated sludge or wasted sludge, should be maintained in operation and serviced promptly and regularly. Since the recirculated sludge instrument will not be in use, it should be shut-off with weekly, exercising via manual raising and lowering of the float; slowly pacing the instrument through its entire operating range. It is important to maintain accurate instrument calibration so that records of operation will not be in error.

Air meters on the compressed air lines to the aerators should be maintained in operation so that air flow records can be documented. These instruments should be serviced and calibrated regularly. Due to the number of instruments at the treatment plant, it is recommended that an annual service contract be secured from the instrument supplier.

The air-water ratio control on the hydropneumatic tank must be maintained in operation in order to have utility water automatically supplied to the various places of need. If this unit should become inoperable, immediate service should be ordered. In the meantime the air-water volumes must be monitored and air pumped into the tank via manual operation, if necessary.

Due to the treatment plant not being in operation when it is unattended, there is no need for operation of the telephone dialer. This instrument was furnished so that unattended plant operation might be performed. History of plant operations and the evident need for personal monitoring, now concludes that the plant should not be operated unattended.

The air bubbler system utilized for pump start-stop and liquid level indication and recording must be maintained in operation for effective automatic pump sequences, pacing and protection. This system requires water purging daily and periodic servicing of the equipment and accessory components. The cleaning of immersed pipes is to be done when clogging becomes evident.

The operating console remains the "heart" of the treatment plant operations. It is here where considerable monitoring of flows, levels etc. occurs. Also this unit is utilized to effect changes in plant operations as well as starting and stopping operation of pumps and equipment. Therefore, it is extremely essential that the operating console be maintained in operating condition. The magnitude of the console features allows some latitude in assessing its operational capabilities and servicing requirements. In other words, every item of malfunction may not require immediate correction. In lieu of this, a ledger of malfunctions, until such time as service is warranted, should be maintained such that one service call may address several problems.

LABORATORY

Laboratory analyses during the period of interim operations is an extremely valuable part of the overall treatment plant operations. It is from data generated in the laboratory that ultimate operational revisions may be based. Therefore, it is recommended that full laboratory operations be continued.

The treatment plant laboratory is equipped to perform the regular routine daily analyses needed. However, the plant laboratory is limited in its scope and ability to perform certain tests. The tests outlined in the "Operations Report" (daily log of operations) can be conducted at the plant very readily provided a dissolved oxygen meter, a hydrometer for specific gravity testing, a sludge blanket monitor and a sampling bomb for taking samples at various liquid levels are purchased. It is recommended that these items be secured to enable plant personnel to document additional data than presently done.

Other laboratories operated by the Commonwealth of Pennsylvania or the laboratory of the Professional should be utilized from time to time to complement the plant laboratory analyses and to provide the completion of tests beyond the capability of the

treatment plant laboratory. Tests such as acidity, alkalinity, iron, manganese, sulfates, conductivity, solids, aluminum, etc. may be done more accurately in a laboratory outside the plant premises.

All laboratory analyses should be logged and either placed upon the daily report or attached thereto for distribution to interested persons and agencies. Copies of these reports, filed at the treatment plant may become a valuable asset to plant operations, problems, conditions, etc. in the future. Results of certain parameters graphed usually provide a ready reference to trends and long term system conditions.

EXHIBITS

The exhibits that follow are provided for the use of the treatment plant operators.

Exhibit I is a sample operators report. It contains places for inserting information that the professional feels ought to be recorded daily. See the last paragraph on page 4 of this report for further discussion.

Exhibit II is an operations schedule which should be posted so that all operations personnel are aware of scheduled operations tasks.

Exhibit III is a Raw Water Analysis Reporting form. At monthly intervals this full compliment of tests should be run on the raw water; either by the Department or the Professional. We have completed our latest analysis. This form should be printed in several copies and distribution made as outlined for the Operators Report.