

ANALYSIS OF HYDRODYNAMIC  
CONTROL, HRI, INC.  
CROWNPOINT AND CHURCHROCK  
NEW MEXICO URANIUM MINES

October 7, 1993

Prepared for

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direction of existing groundwater movement, to ensure that any excursion will be detected.

Because monitor wells will completely surround the mine workings in the production sand and, as described in Q1/88 and Q2/88, the mine workings will not materially increase the likelihood of excursions, especially since the location and extent of the mine workings will be considered when developing well patterns, HRI does not propose that licensing be dependent on future modeling.

Consistent with PBLC format, HRI will develop a Standard Operating Procedure (SOP) which addresses monitoring at the Churchrock site in the vicinity of the old mine workings.

Q4/98. COMMENT: Potential for Excursions at Church Rock Site.

ACTION NEEDED per NRC: Prior to the injection of lixiviant in the area containing mine tunnels at the Church Rock site, provide a modeling demonstration of the planned well fields to confirm that they can be properly operated in the presence of the preexisting tunnels without causing vertical or horizontal excursion or suggest another acceptable alternative. In addition, prior to the injection of lixiviant in the area of tunnels, provide a report explaining how upper aquifer monitor well locations will provide adequate coverage for the well field, as well as the area around the vertical shafts.

#### HRI RESPONSE

As described in HRI's response to Q1/88 and Q2/88, the ability to control the groundwater flow while mining will not be hampered by the presence of tunnels, and the potential for horizontal excursions will not be increased due to the mine tunnels. Because the mine workings are completely encased within formation sandstone, the most conservative or worst case would be to assume fluid movement through those workings would simply be displaced the width of the open section in the direction of flow. There would be very little or no other disruption to flow at very short distances from the mine tunnels because the velocities and direction of fluid movement would be completely controlled by the hydrogeological characteristics of the formation sand enclosing the mine workings.

In addition, the mine workings will be completely encircled by monitor wells as part of the wellfield area. The production zone mine workings will be treated like any other injection/extraction well as described in Section 6.3.1 of HRI's Consolidated Operating Plan (COP) for the Crownpoint Uranium Project: monitor wells will be placed no more than 400 feet from peripheral injection/extraction wells, or nearest extent of the mine workings, and at a spacing of not more than 400 feet between monitor wells. The angle formed by lines drawn from any production well, or nearest extent of the mine workings, to the nearest two monitor wells will not be greater than 75 degrees. The 400 foot spacing convention is widely used by the in situ industry throughout the United States.

HRI recognizes that lixiviant excursions are extremely costly, not only in real dollar costs because of lost production and clean up costs, but even more so in local perception and public relations. As a result, all wellfields will be designed, constructed and operated to minimize the possibility of an excursion. Well patterns will be developed on a well by well basis, incorporating the configuration of the uranium roll fronts, the locations of the mine workings and monitor wells, and the affects of multiple injection/extraction wells, one on another.

Monitor wells for vertical excursions will be placed within 40 feet of any likely openings of the mine workings into either the overlying Dakota sand or the Brushy Basin "B" Sand. These wells will be placed down gradient from the suspected open section in the

b) perimeter monitor wells will detect and allow control of any potential excursion, no matter how unlikely,

c) shallow monitor wells, twinned in the overlying sandstone with the production zone monitor wells and lie between the wellfields and the Town water wells, so that no vertical excursion will be undetected, and if detected, can and will be controlled and cannot affect drinking water supplies.

Q4/97. COMMENT: Potential for Excursions at Unit 1 Site.

ACTION NEEDED per NRC: As proposed in the evaluation of Comment 50, prior to the injection of lixiviant at the Unit 1 site bond to cover the cost of town well replacement, pipeline construction, and compatibility costs between the BIA and NTUA public water supply systems or propose another acceptable alternative.

#### HRI RESPONSE

HRI responded to the bonding issue in Q4.50 (please see that response). That response is, in part, restated below.

The NRC also recommended that *"prior to the injection of lixiviant at the Unit 1 site: that bonding be provided to cover the cost of town well replacement."* Since bonding is a common way to assure that monies will be available to perform and complete some important future task, HRI is not opposed to the concept of bonding itself. However, HRI is extremely concerned that such bonding might imply even the remotest, reasonable possibility that a lixiviant excursion from HRI's ISL operations at Unit 1 might reach the Town of Crownpoint water wells, a water travel-time distance away of 1000-2000 years.

Bonding will be in place as per regulatory requirement to assure that restoration actually takes place at Unit 1. During operations, production zone monitor wells, completely surrounding the ISL wellfields, will be sampled twice monthly and will detect any lixiviant excursions, which will be remediated if they occur. To finalize this "defense in depth" scenario, HRI proposes that three to five monitor wells in the overlying Dakota aquifer be placed between the wellfield and Town water wells. This will be in addition to the overlying monitor wells spaced at one well per four acres. These 3 - 5 additional wells would be "twinned" to the production zone monitor wells and would provide the same protection to the overlying zone.

In summary, while HRI is not opposed in principle to bonding for the relocation of the Town water wells, the concepts presented in the above question imply (we believe incorrectly) that the water supply of the Crownpoint residents will be deteriorated by ISL activities in the area. The company adamantly objects to this implication, and believes that defense in depth for Unit 1 includes:

a) the distance involved (over two miles), which means that an ISL project will have negligible likelihood of pressure changes that will cause a migration of solution that would ever approach the water supply for Town of Crownpoint.

Q4/95. COMMENT: Effect of Groundwater Drawdown on Town of Crownpoint Wells

ACTION NEEDED per NRC: Prior to restoration activities, bond for the projected increased pumping and well work over costs that might be incurred by the town of Crownpoint or propose another acceptable alternative.

HRI RESPONSE

In this comment, NRC proposed *"Therefore, when ground water restoration activities begin at a production scale at either the Unit 1 or the Crownpoint sites it is recommended that the applicant will be required to bond for the projected increased pumping and well work over costs that might be incurred by the town of Crownpoint."*

HRI agrees to this recommendation. Since the costs referenced by NRC are considered worst case, the bonding at the time of restoration will be determined by the actual equipment and materials in use: pump curves, amperage requirements of the pumps, etc.

Q4/75. Dakota Sandstone Vertical Excursion Control - Crownpoint Property

ACTION NEEDED per NRC: Respond to the recommendations in the NRC evaluation of Comment 50 or propose another acceptable alternative.

#### HRI RESPONSE

In HRI's response to Q4/50, HRI agreed to replace the Crownpoint Town water wells prior to beginning ISL operations at the Crownpoint site (please see that response) and we would like to re-iterate that commitment here. In addition, we proposed in Q4/50 that additional monitor wells in the overlying zone be "twinned" to production zone monitor wells between the HRI's wellfields and the Town water wells. Thus a barrier of monitor wells will be in place. These monitor wells would be in addition to the one well per four acres stipulated previously.

However, HRI takes strong exception to the implication that an excursion would be uncontrollable due to the affect(s) of the Town water wells: *"However, the NRC staff also observes that guard wells cannot be correctly located to assure an excursion will not migrate to the public water supply before the time consuming process of identifying the extent and location of the excursion is finished."* This characterization makes it appear that the Town water wells will affect groundwater velocities in the vicinity of the ISL wellfields and surrounding monitor wells on the order of hundreds of feet per year, and if an excursion were to occur, the contamination of the Town water wells would be imminent. This is just not so. The affect on groundwater velocities at the ISL wellfields and surrounding monitor wells is VERY SMALL. This was demonstrated again in our response to Q4/74. HRI believes that it has shown this through its hydrologic modeling and various submittals, and observes that there has been no credible engineering or hydrologic studies indicating otherwise, which would allow alternate operational plans to be made and safeguards developed.

This does NOT mean that HRI does not take excursions very seriously. We design and operate wellfields with this constantly in mind, as our operating history shows.



# REVISED SCHEDULE

Revised

8-14-93

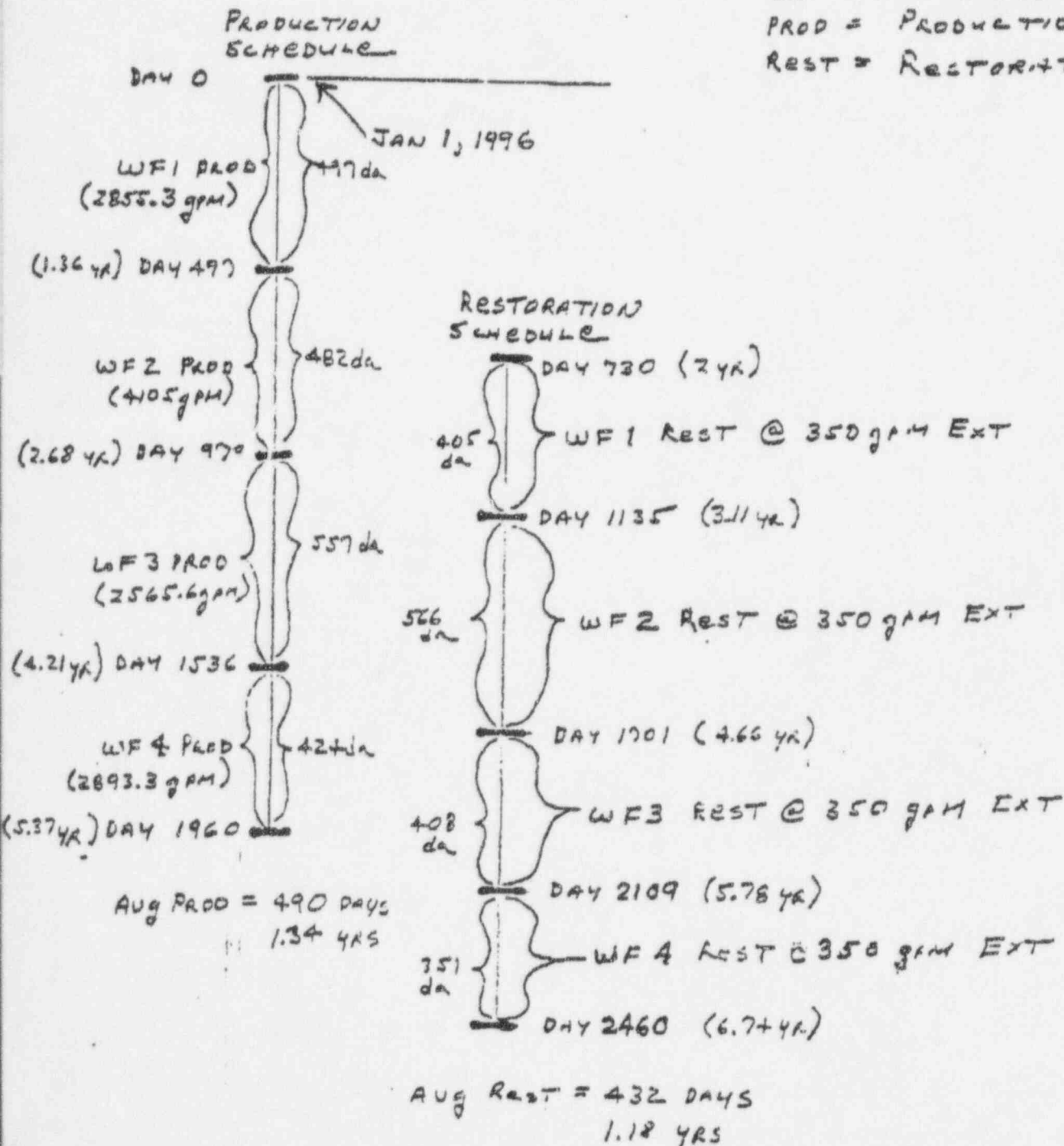
HLA/csb

## CROWNPOINT PRODUCTION + RESTORATION (REVISION #3)

WF = WELL FIELD

PROD = PRODUCTION

REST = RESTORATION



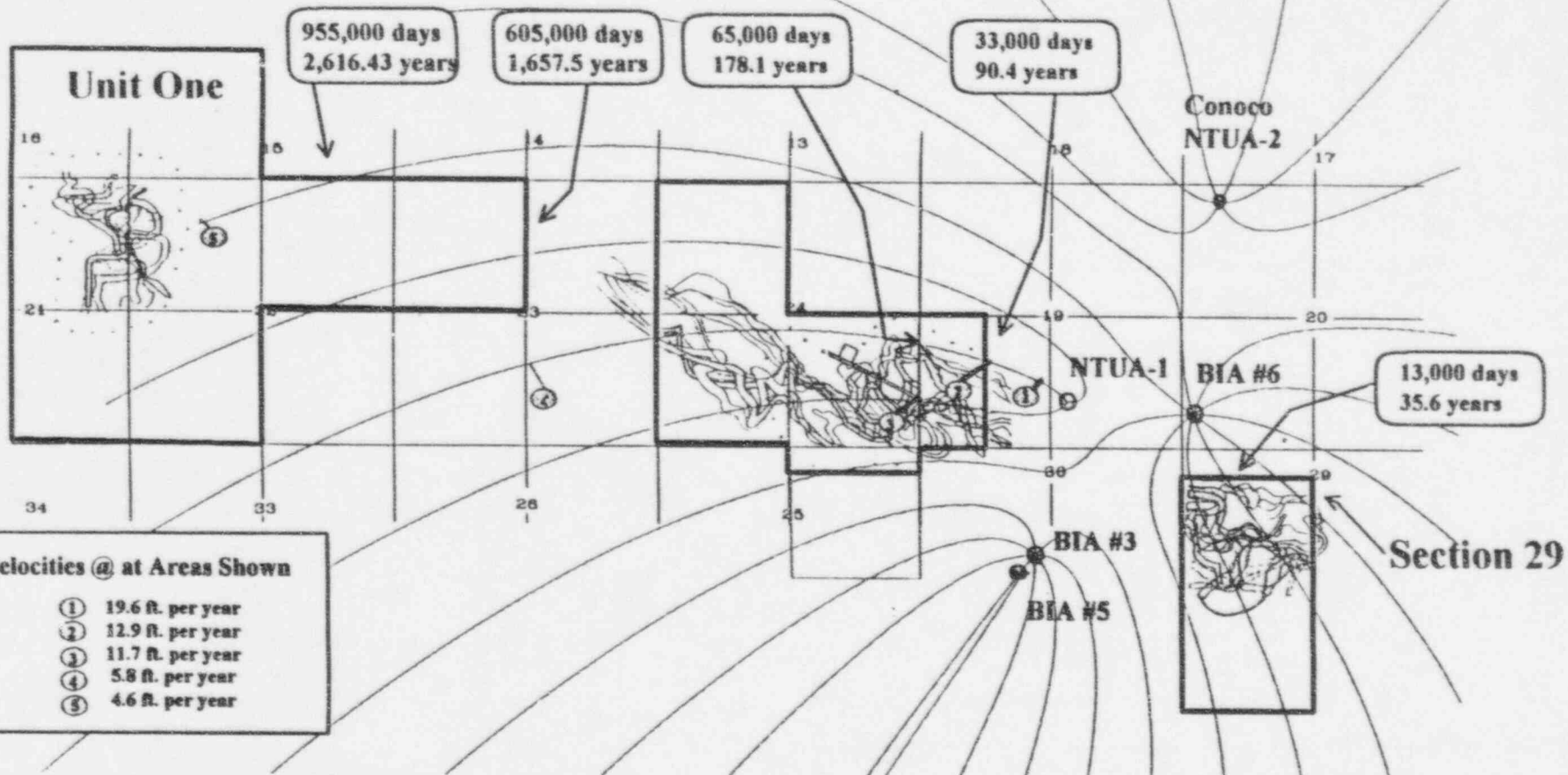
8-19-93 COPY TO Geraghty + Milled  
(JACK COLLINS)

8-16-93 COPY TO HARRY, PAUL, RON  
8-16-93 FAX TO MARK

8-18-93 COPY OF FIVE PAGES  
TO — HARRY, PAUL,  
RON, JIM, MARK,  
MIKE, FRANK, ADRIAN,  
D.



Attachment Q4/74 - 3



**Figure 50-2**

## Crownpoint New Mexico

Flow Pathways for Crownpoint Water Wells  
Pathways Indicate Withdrawal Area for Well Vs. Time  
Each Line Represents 10 GPM  
Color Changes every 5,000 days

File: Long\_1.sam

HRI, Inc.

Date 3-25-96

### Withdrawals by Crownpoint Water Wells:

1. NTUA-1	27.7 gpm
2. NTUA Conoco	58.7 gpm
3. BIA #3	79.4 gpm
4. BIA #5	6.2 gpm
5. BIA #6	100.0 gpm
6. Little Water	190.3 gpm

All Flowrates Average Summer Values 1993.

### Assumptions:

1. All Withdrawals from Westwater.
2. Formation Net Thickness 201 ft.
3. Porosity 0.251
4. Regional Groundwater Gradient 2.5 ft./Yr @ 70 degrees.

Scale (ft.)

0 1/2 Mile 1.0 Mile

Pathline Simulation Run for  
1,150,000 days ( 3,121 Years )

Attachment Q4/74 - 2