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STATE PLANNING BUREAU
State Capitol
Pierre, South Dakota 57501
605/773-3661

South Dakota Office of Executive Management





November 9, 1981

Mr. Harry J. Pettengill, Section Leader
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Uranium Recovery Licensing Branch

Dear Mr. Pettengill:

Enclosed please find a supplement to the comments which the State of South Dakota submitted on November 5, 1981 relating to the Draft Environmental Statement (DES) for the decommissioning of the Edgemont uranium mill.

Although this supplemental information parallels the previously submitted comments, more in-depth background information and reasonings for the comments are provided. I hope this information will assist you and your staff in any necessary redrafting of the DES.

Sincerely,

Craig McIntyre

Craig McIntyre
Executive Policy Analyst
STATE PLANNING BUREAU

CM:jrr

Enclosure





FEE EXEMPT



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comment 10

NRC EIS
Edgemont
Fall River
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MEMORANDUM

To : Bill Markley, Steve Pirner, James Nelson, Randy Britsch, Joel Smith, and Steve Stampfli

From : Michael Meyer, Hydrologist II

Subject : Review of US NRC Draft Environmental Statement Related to the Decommissioning of the Edgemont Uranium Mill (September 1981)

Date : November 5, 1981

This memo is in regard to the request by Randy Britsch and Steve Pirner that I review and prepare comments on the Draft Environmental Statement (DEIS) prepared by the U.S. Nuclear Regulatory Commission (NRC) for the decommissioning of the uranium mill and associated tailings located on the east side of Edgemont in Fall River County. The purpose of this memo is to provide a summary of my comments and suggestions on the DEIS. I did not evaluate the suitability of the alternative tailings disposal sites discussed in the DEIS but instead focused on the main tailings disposal site which has been selected as being most suitable.

This DEIS is entitled Draft Environmental Statement Related to the Decommissioning of Edgemont Uranium Mill, US NRC report NUREG - 0846, Docket No. 40-1341, September 1981. Apparently written comments on this DEIS are due at the NRC by November 9, 1981.

BACKGROUND

The uranium mill at Edgemont was constructed in 1956 by Mines Development, Inc., a subsidiary of Susquehanna-Western Inc. of Chicago, Illinois. Uranium ore was brought to the mill where the uranium was extracted with acid leaching and resin-in-pulp ion exchange. A solvent extraction circuit was added in 1958 (Ford, Bacon & Davis Utah, Inc., 1978, p. 1-6). In 1960 a vanadium circuit was added and additional vanadium was recovered from reclaimed resin-in-pulp slime tailings by acid leaching and solvent extraction. According to a report by Ford, Bacon & Davis Utah, Inc. (1978, p. 1-6) the ore had a U3O8 content of about 0.20% and a vanadium content of about 0.25%. Uranium recovery of the ore by the mill was originally about 95% but towards the end of the operation was about 90%. Vanadium recovery of the ore was about 75 to 80%. Uranium processing ended in 1972 and vanadium processing was shut down in 1974 when the mill was purchased by the Tennessee Valley Authority (TVA). During its operation the mill produced about 2.3 million tons of solid tailings. These tailings were placed into large holding ponds [Ford, Bacon & Davis Utah, Inc., 1978, Engineering Assessment of Inactive Uranium Mill

Tailings, Edgemont Site, Edgemont, South Dakota. [ hereafter referred to as FBDU].

TVA decided not to continue operation of the mill and did not request renewal of the NRC Source Material License SUA-816 to continue operation. NRC rules require decommissioning of the mill site. This DEIS was prepared by the NRC in accordance with NRC Commission Regulation Title 10, Code of Federal Regulations (CFR), Part 51 which implements requirements of the National Environmental Policy Act of 1969 (NEPA;PL 91-190) (DEIS p.1-1).

According to FBDU (p. 1-12)

> "About 85% of the total radioactivity originally in uranium ore remains in the processing wastes (tailings) after removal of the uranium because the radium and thorium, principal contributors to radioactive emissions, were not normally removed from the uranium ores during milling. The principal environmental radiological impact and associated health effects arise from the 230Th, 226Ra, 222Rn daughters contained in the waste materials. Other isotopes of uranium and thorium and their daughter products also may be present depending upon the type of ore present. Although these radionuclides occur in nature, their concentrations in tailings are several orders of magnitude greater than their average concentrations in the earth's crust."

According to Freeze and Cherry in discussing the impact of uranium tailings upon groundwater (1978, p.448)

> "radium 226 (226Ra) with a half life of 1620 years, poses the greatest environmental hazard. ... the maximum permissible concentration of 226Ra in drinking water is 3 pCi/l which is equivalent to $10^{-9}$ mg/l." (Freeze, R.A. and Cherry, J.A., Groundwater, Prentice-Hall inc., N.J.).

In review of the potential environmental impacts from uranium mill tailings, Edward Lorde states the following (1980, p.1 and 2.5)

> "By virtue of the physical and chemical processing of the ore and the redistribution of the contained radionuclides at the Earth's surface, these (uranium) tailings constitute a technologically enhanced source of natural radiation exposure. Sources of potential human radiation exposure from uranium mill tailings include the emanation of radon gas, the transport of particles by wind and water, and the transport of soluble radionuclides, seeping from disposal areas, by groundwater. Due to the 77,000 year half-life of thorium-230, the parent of radium-226, the environmental effects associated with radionuclides contained in these tailings must be conceived of within the framework of geologic process operating over geologic time." (p. 1)

> "....The long-lived components of the decay chain, and hence those of environmental concern, are uranium-238, uranium-234, thorium-230, radium-226, and lead-210. Because the drinking water standards for radium-226 are the most restrictive (3 pCi/l), most monitoring and research efforts on the radiological impact of uranium mill tailings on surface and ground-water quality have focused on this radionuclide. Assuming secular equilibrium, an ore containing 0.2 percent U3O8 will contain 0.00056 gram (g) of radium-226/metric ton of ore. As in both acid and alkaline leaching, greater than 98 percent of the radium-226 remains with the tailings; the tailings from such an ore will contain about 560 picocuries (pCi) of radium-226/g." (Landa, E., 1980), Isolation of Uranium Mill Tailings and Their Component Radionuclides From the Biosphere - Some Earth Science Perspectives, U.S. Geological Survey Circular 814).

In 1980 the EPA prepared a report involving a review of the potential health effects from 25 inactive uranium processing sites in Arizona, Colorado, Idaho, New Mexico, North Dakota, Oregon, Texas, Utah and Wyoming. In this report the EPA recommended a minimum release rate of radon gas to the air from tailings sites to be 2 picocuries per square meter per sec. The EPA estimates that implementing the proposed standard at all of the 25 sites would prevent about 200 premature deaths per century from radiation induced lung cancer. The EPA also estimated that about 140 of the 200 deaths would be expected in the populations within 50 miles of the tailings sites. Health effects from contaminated groundwater were not included in the above estimate. (US EPA, 1980, Draft Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites, 40 CFR 192, EPA 520/4-80-011, p. S-2).

Although South Dakota was not included in the above estimates the point is that in many ways the Edgemont mill site is no different from the above sites with respect to potential health risks and in some ways may even be worse. For example, I doubt that many of the above tailings sites have towns next to them as occurs at the present site in Edgemont. Moving the tailings to the proposed disposal site will of course considerably reduce the health risk for Edgemont.

The tailings at the Edgemont uranium mill were stored in unlined ponds overlying an alluvial aquifer on the east side of Whitewood Creek and the south side of the Cheyenne River (Figure 1). The DEIS states (p. 3-34):

> "Except for Pond 10, the storage areas were probably not designed to prohibit or to minimize the migration of leachates beneath the areas...Evaluation of the chemical data from the ponds shows the standing water to be acidic and to contain extremely high concentrations of dissolved solids, sulfate, cadmium, chromium, iron, nickel, titanium and vanadium. Sediment samples from the ponds were heavily concentrated with aluminum, barium, chromium,

> iron, nickel, titanium and vanadium. Lower concentrations of other metals were measured in both the water and sediment samples. Leachates migrating from the ponds and tailings piles are a potential source of contamination of the alluvial aquifer, Cottonwood Creek, and the Cheyenne River near the mill site. The water quality found in the alluvial aquifer has been determined by the sampling of 14 observation wells. Evaluation of groundwater quality data clearly shows that the groundwater beneath the site is contaminated with leachates from the tailings and slime storage areas."

TVA proposes to transport these uranium tailings to a new site located about two miles SE of Edgemont at T09S R03E, Sections 8 and 17 (Figure 1). The new site would lie in the Belle Fource Shale (Cretaceous). The closest aquifer beneath this site is the Inyan Kara aquifer which would be separated from the disposal site by approximately 500 feet of shale, including the Belle Fourche, Mowry and Skull Creek Shales (Figure 2). They plan to cover the tailings with approximately 10 feet or more of cover material including a 3-foot clay layer directly over the top of the tailings and then covered by other fill material (DEIS, p. 2-24).

REVIEW AND COMMENTS

I have been to the proposed site and have reviewed other reports on this proposed disposal site as well as the DEIS. In many respects, the DEIS appears to be adequate. However, I am concerned that the proposed disposal site is too close to Edgemont and that the proposed cover thickness may be inadequate over geologic time. I have the following comments and questions which the NRC may wish to address in the final EIS.

1. Who will have final ownership and responsibility for the original mill and tailings site and the new disposal site? Radium 226 is the principal radiologic contaminant in the tailings. It has a half-life of 1,620 years. It can contaminate water and decays into a radioactive gas - Radon 222. Thorium 230 has a half-life of 77,000 years. This means that these tailings will pose potential environmental hazards for, at the very least, several tens of thousands of years. This would be a monumental burden for the State of South Dakota to assume.

2. Will the tailings disposal site be fenced and well marked with signs? In the centuries to come, how long will people remember that there are radioactive wastes beneath this site?

3. The proposed disposal site is located only two miles from the town of Edgemont (Figure 1). This seems too close for comfort. Although this area is now sparsely inhabited and the town only has a population now of about 1200, this may not

Figure 1



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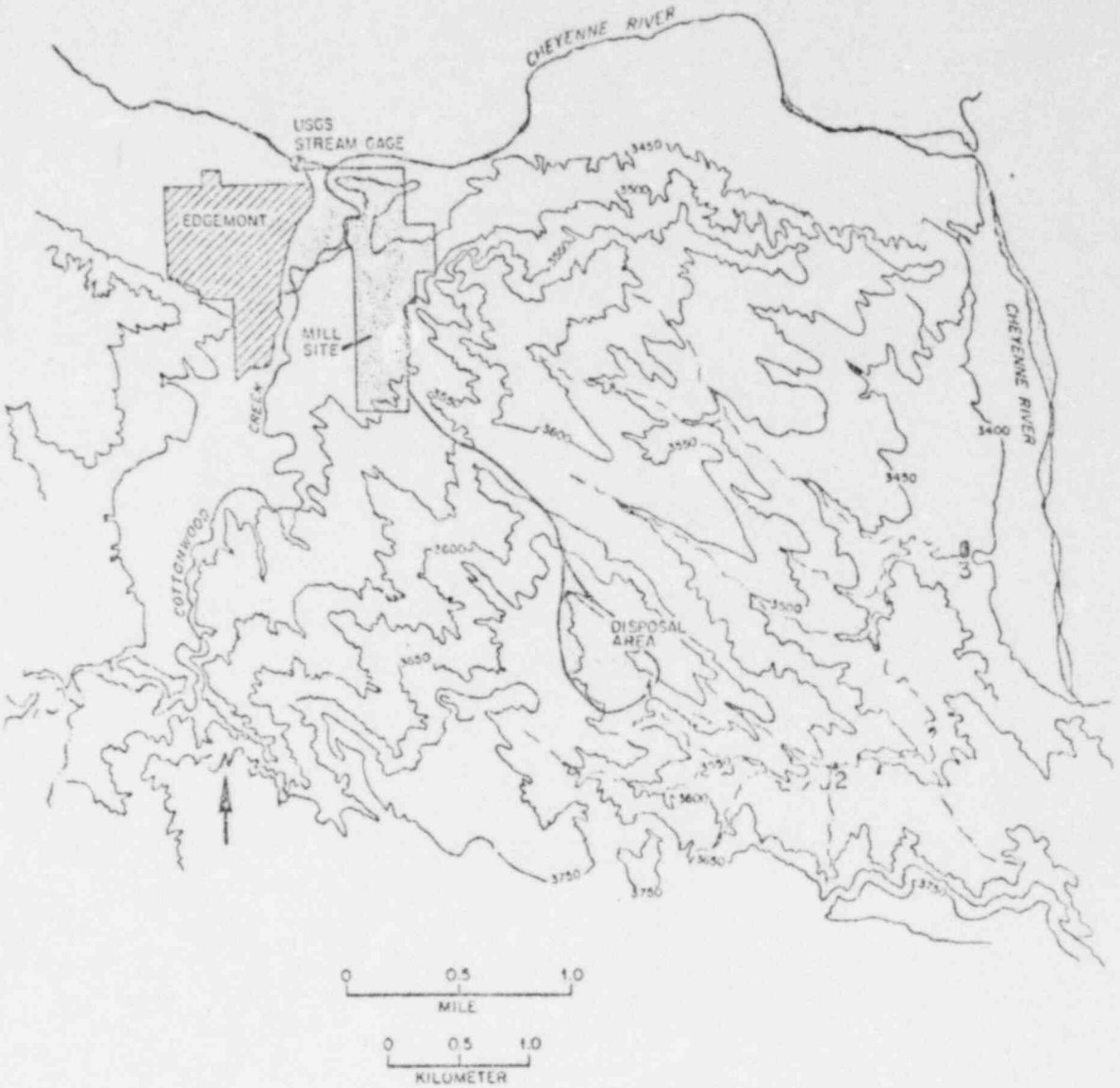


Fig. 3.4. Surface water features for the Edgemont decommissioning area. Single numbers correspond to ponds downstream of the disposal site that are discussed in the text. Source: Modified from ER, Fig. 4.2-1.

always be so. According to the DEIS (p. 3-1) the general direction of wind in this area is most frequently from the west-northwest, but there is also a secondary maximum from the east-southeast. Wind speeds are relatively high with a mean of about 11 miles/hour (p. 3-1). The proposed disposal site appears to be somewhat protected from the wind. However, in the many years to come, should erosion expose these tailings the town of Edgemont is located only two miles away in an east-southeast direction for the wind. Wind erosion has already affected the tailings at their present site beside the mill.

4. The DEIS indicates a slurry line will be used to transport the tailings which will involve dewatering of the original tailings ponds as well as dewatering of the tailings at the disposal site (p. iv and 2-18). Additional needed water will be withdrawn from the mill well in the Madison aquifer (p. 2-18). The DEIS indicates that the slurry water will be recycled and any excess water will be pumped into pond 10 for evaporation. In conducting the South Dakota Surface Impoundment Assessment (SIA) in 1979-1980, I received a letter from Mr. R.T. Moore of TVA that these ponds are not lined. The SIA study indicated that impoundments overlying alluvial aquifers are especially prone to seepage problems due to the often high permeabilities of such materials (SIA, p. 174). The DEIS states that groundwater contamination at the mill site tailings area can affect not only the alluvial aquifer but also Cottonwood Creek and the Cheyenne River (p. 3-33 and 4-6). Unless pond 10 is lined with an impermeable liner (plastic, etc.) it is not and will not be an "evaporation pond". Unless this pond is lined adequately to prevent seepage of the contaminated slurry water it should not be used as an evaporation pond.

5. The DEIS states that (p. 2-1):

"...the primary goal of mill site land decontamination is to return the mill site to productive use after removal of the tailings to a new disposal site. All of the uranium tailings will be removed from the site."

The DEIS also states (p. 2-1):

"Depending upon the cutoff limit ultimately established for removal of contaminated soils for disposal at the new impoundment area, it may be necessary to institute some land use controls at the reclaimed mill site; i.e. residential land use would not be permitted."

On page 2-23 of the DEIS the statement is made:

"The objectives of the applicant's reclamation plan for the mill site are to (1) provide livestock forage..."

However, on page 2-1 the DEIS states:

> "It is not known, however, to what extent the soils below the tailings piles have been contaminated by seepage of tailings liquor and what quantity of this contaminated soil may have to be removed. The staff (NRC) expects that a much lower quantity of contaminated soil will have to be relocated than that projected by the licensee. The staff feels that the exact land cleanup limits to be met should be based on site-specific considerations and on an evaluation of the environmental benefits of moving increasingly lower levels of contamination versus the economic costs of such action. These cleanup limits can only be determined once the exact depth and concentration of contaminated material are known. At the Edgemont site, such a final determination will not be feasible at some locations until tailings are removed from the site. In determining exact cleanup limits, the major consideration will be to ensure that resulting radiation exposures to individuals using the decontaminated land will be within current radiation exposure guidelines and as low as is reasonably achievable."

On page 2-21 of the DEIS reference is made to a construction of a diversion channel for ~~Hitt~~ewood Creek to allow cleanup of ~~Hitt~~ewood Creek. The DEIS states: "The base of the diversion will be excavated to uncontaminated material." What does the NRC define as "uncontaminated"?

On page 4-5 the DEIS states:

> "The full extent of contamination of streambed sediments in Cottonwood Creek is not know at this time. Lack of information on the quantity of streambed materials that will have to be removed from the creek to remove sediment contaminated with radionuclides or heavy metals. If only isolated pockets of contamination occur within the stream, these areas could be isolated and removed with minimal impacts to surface hydrology. In anticipation that contaminants are spread throughout the streambed sediments, it has been proposed, as discussed, to reroute the stream while removing these materials. The extent of material to be removed depends in part on the extent of transfor of contaminant materials from groundwater into stream alluvium and surface waters (Sect. 4.1.6.4). A data base defining types and quantities of contaminated

material must be determined by the Tennessee Valley Authority (TVA) in coordination with the US NRC, EPA, and the State of South Dakota, and the extent of contaminated material in both Cottonwood Creek and the Cheyenne River must be determined by the applicant before the effects of removal of the streambed material on hydrology and water quality can be fully determined. The extent of contaminated groundwater beneath the mill site and the time necessary for the groundwater to cleanse itself are not known (Sect. 4.6.1.4).'

On page 4-6 the DEIS states:

"Although the contaminated materials will be removed from the mill site, some water quality degradation of Cottonwood Creek is expected to continue as the result of groundwater inflow from beneath the mill site. The extent of present and projected groundwater contribution to surface water quality degradation cannot be determined because the extent of groundwater contamination beneath the site and the time necessary for the groundwater to be cleansed are not known."

On page 4-6 the DEIS states:

"The applicant has not determined the extent of heavy metal contamination of streambed sediments in Cottonwood Creek or the Cheyenne River as a result of tailings erosion not the method of isolation and removal of contaminated materials from the Cheyenne River. The applicant proposes to remove any contaminated material occurring in the Cheyenne River during low flow and should do so only after consultation with the EPA in coordination with the State of South Dakota to locate contaminated areas and to establish acceptable concentrations that may remain in the river. Determinations of impacts to water quality from migration of the trace element contaminants in the Cheyenne River depend upon the concentration, sediment particle size, and location of the contaminated material within the river relative to stream flow, all of which are unknown at this time. However, based on EPA findings (Report PB-256 453, 1973) that although Cottonwood Creek was contaminated by the Edgemont mill operation, contamination did not extend into the Cheyenne River, contamination of the river should be minimal. The extent of contamination in the river, however, may be greater than the 1973 EPA study indicates because it has been shown that leakage has occurred from ponds adjacent to the river."

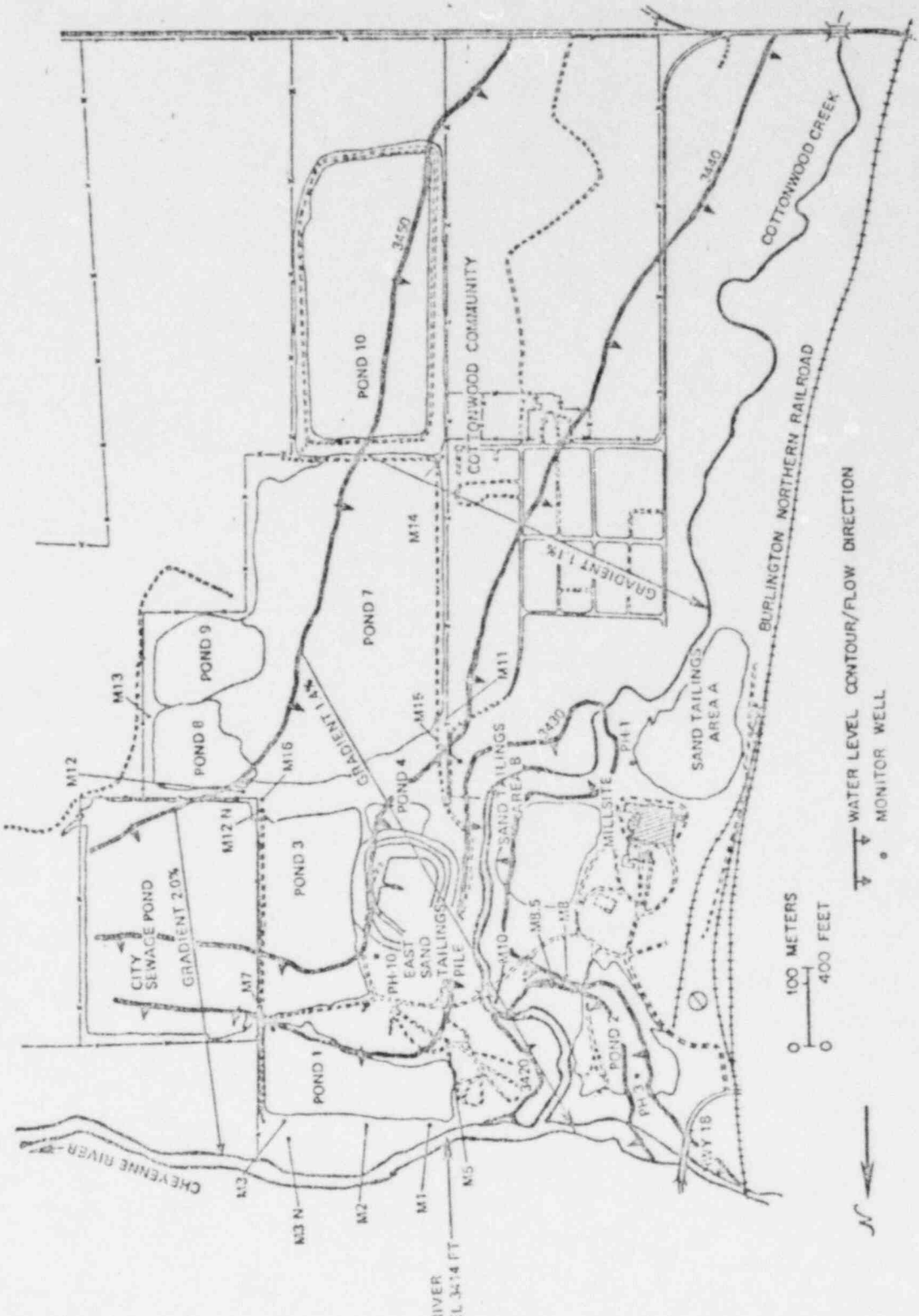


Fig. 3.6. Potentiometric surface and flow gradient of the unconfined groundwater at the existing tailings site.
Source: ER, Fig. 4.2-4.

Page 4-7 of the DEIS states:

> "Groundwater under the mill site is presently contaminated by past and present seepage from under and through the tailings piles and ponds on the site. Removal of the tailings and other contaminated materials from the mill site will allow natural processes, primarily subsurface flows, eventually to restore this groundwater to its previous condition by transporting excess soluble ionic species into Cottonwood Creek and the Cheyenne River."
>
> "Such transport is presently occurring and does not result in measurable degradation of either stream. The staff is of the opinion that continuation of this natural process is the only practical solution for restoration of groundwater quality under the mill site. The staff recommends that shallow wells not be permitted on the mill site after reclamation until chemical concentrations (mostly sulfate) decrease. No radiological contamination of groundwater in excess of standards is presently observed or expected after reclamation."

However, table 3-6 in the FBDU report does show at least 2 drillholes near the tailings ponds that exceed the EPA standard of 3 pCi/l.

It is rather curious that the DEIS states the purpose of the decommissioning of the mill site is to return it to productive use, including livestock forage, when they state that: (1) the groundwater is contaminated; (2) Cottonwood Creek will continue to be degraded from groundwater inflow; (3) residential land use is not recommended; (4) shallow wells should not be permitted.

The DEIS states cleanup of decontaminated land will be within current radiation exposures guidelines. Radiation exposure guidelines have been consistently lowered over the last 20 years as we have learned more about low level radiation. Will they be lowered again after the cleanup is completed? The above statements in the DEIS clearly indicate that no cleanup of the contaminated groundwater is proposed although no supporting reasons or possible alternatives are discussed. Another very important point brought to light by the above statements is that it will need to be determined what is considered "contaminated" during the cleanup. The State of South Dakota should play an integral role in these determinations, including appraisal of field sampling and laboratory analysis of the results. We should not rely solely upon the TVA to do all the field sampling and analysis. I am also somewhat skeptical as to the suitability of the

decommissioned mill site for livestock foraging. Livestock should probably not drink from the creek, nor from shallow wells at the site.

Page 2-21 of the DEIs also mentions that tailings removal from the mill site might affect the integrity of the adjacent City of Edgemont sewage lagoon and suggests that sheetpiles or other forms of containment may be necessary to prevent collapse of the sewage lagoon imbankment. DWNR should be involved with any such proposed steps.

6. The proposed disposal site is underlain by the Greenhorn Shale. With respect to this the DEIS states (p. 2-3):

> "Soils and shale from that form the base of the impoundment area are reported to have permeabilities on the order of 1 X $10^{-4}$ to 1 X $10^{-7}$ cm/sec. (100 to 0.1 ft/yr). Should <u>further permeability tests</u> determine that the native soils and shale exposed in the impoundment excavation do not provide <u>adequate seepage</u> control, additional excavation and/or the placement of a clay liner over the base and sides of the impoundment will be necessary. Potential borrow areas have been identified as a source of the clay liner material, although the applicant does not presently control such sites. Onsite materials could however, be employed for the construction of the liner provided they can be shown to be suitable for constructing a liner with a permeability of about 1 X $10^{-7}$ cm/sec."

Page 2-36 of the DEIS states:

> "If natural hydrogeological conditions of the impoundment based are such that permeabilities greater than 1 X $10^{-7}$ cm/sec are encountered, it would be necessary to emplace clay over portions of the entire bottom of the impoundment excavation to inhibit seepage of fluids from the tailings. In that event, the applicant should provide a liner design and material and compaction specifications to ensure that permeabilities of about 1 X $10^{-7}$ cm/sec can be obtained for the clay liner. Properties of the clay should be compatible with impoundment fluids to ensure against cracking of the liner or chemical breakdown of the clay minerals.
>
> "The installation of clay liners is the seepage control measure <u>preferred</u> by the staff (NRC)..."

In referring to the alternative of not using a clay liner and simply placing the tailings onto bare shale, the DEIS states (p. 2-36):

"The major advantage of this alternative is a relatively low cost especially where excavated materials are needed for other uses such as dike, cap, or cover construction. A disadvantage is that soil and bedrock conditions can vary significantly over short distances and permeabilities measured at one point in the impoundment excavation may not be representative of permeabilities of other points in the excavation. In addition, vertical joints or fractures in soil and rock may go undetected in boring investigations, yet may provide significant pathways for migration of contaminated fluids away from the impoundment.

"Therefore, the staff has concluded that this alternative should only be used where it can be demonstrated with a sufficient number of permeability tests and detailed field mapping of the excavation bottom that permeabilities across the entire bottom and sidewalls of the impoundment excavation are uniformly about 1 X $10^{-7}$ cm/sec. Otherwise, a clay liner will have to be installed."

On page 2-41 the DEIS states:

"If a liner is required, a license condition would be included that would require the applicant to provide test results that ensure that the materials used for the liner would not undergo an increase in permeability characteristics or deterioration of consolidation or stability properties when exposed to tailings impoundment solutions over the long term. In addition, the applicant would develop and submit for review (1) criteria to define foundation conditions that are acceptable for the placement of a clay liner; (2) conditions which will require the use of subdrains and filters; and (3) liner material specifications, compaction criteria, and field compaction procedures."

On page 3-34 the DEIS states:

"Unconfirmed groundwater conditions occur in the unconsolidated surficial materials (alluvium) at the proposed disposal site. This perched water generally lies within a few feet of the soil-bedrock contact. Groundwater levels in the vicinity of the stock-watering pond located on the southern side of the site are affected by seepage from the pond. In the absence of the stock pond, the water table in this area would be expected to be lower, probably within a few feet of the bedrock surface."

On page 3-38 the DEIS discussed the geology of the proposed disposal site and states:

> "The silty clays (Greenhorn Shale) are characterized by numerous horizontal partings (very fissile) that are often filled with calcium deposits or stained with iron and sulfur (limonitic staining). Vertical fractures are also very common in this zone and impart a blocky structure to the formation. ... Packer tests performed in the silty clay materials indicate that they are relatively impermeable and also have a tendency to self-seal with time.
>
> The materials that comprise the third unit occur below the weathered silty clays and are very dense, slightly fissile, relatively unaltered clays of the Lower Greenhorn Shale Unit. These materials are very hard and can be considered highly impermeable ($10^{-8}$ cm/sec or less) to the depth explored."

With regard to the above statements I have the following questions and comments:

A. What are the "packer tests" which were performed (p. 3-38)? How were these conducted? Where were they conducted? Why is none of this data included in the DEIS? What is the evidence that the silty clay tends to "self-seal" with time? On page 2-3 the DEIS mentions that "should further permeability tests...". What permeability tests have been conducted at the site? Where and how were they conducted? Why is no mention made of this information in the DEIS?

B. The NRC in the DEIS indicate that adequate seepage control (p. 2-3) will be required and apparently define as "adequate" a minimal seepage rate of $10^{-7}$ cm/sec. This is an extremely low permeability and is very likely to be exceeded at least locally in some areas. Recent work by the USGS on the bedrock aquifers indicate that fractures may play a major role in the permeability of shale units.

C. Due to the difficulty with disturbing the sample, laboratory permeability tests often give unrealistically low permeabilities that do not reflect actual field conditions. Any laboratory field permeability tests should be used only in support of in-situ permeability tests (such as the double ring infiltrometer).

D. The possibility of contamination of the Inyan Kara aquifer appears unlikely not only because of the probably low permeabilities of the shale between the disposal site and

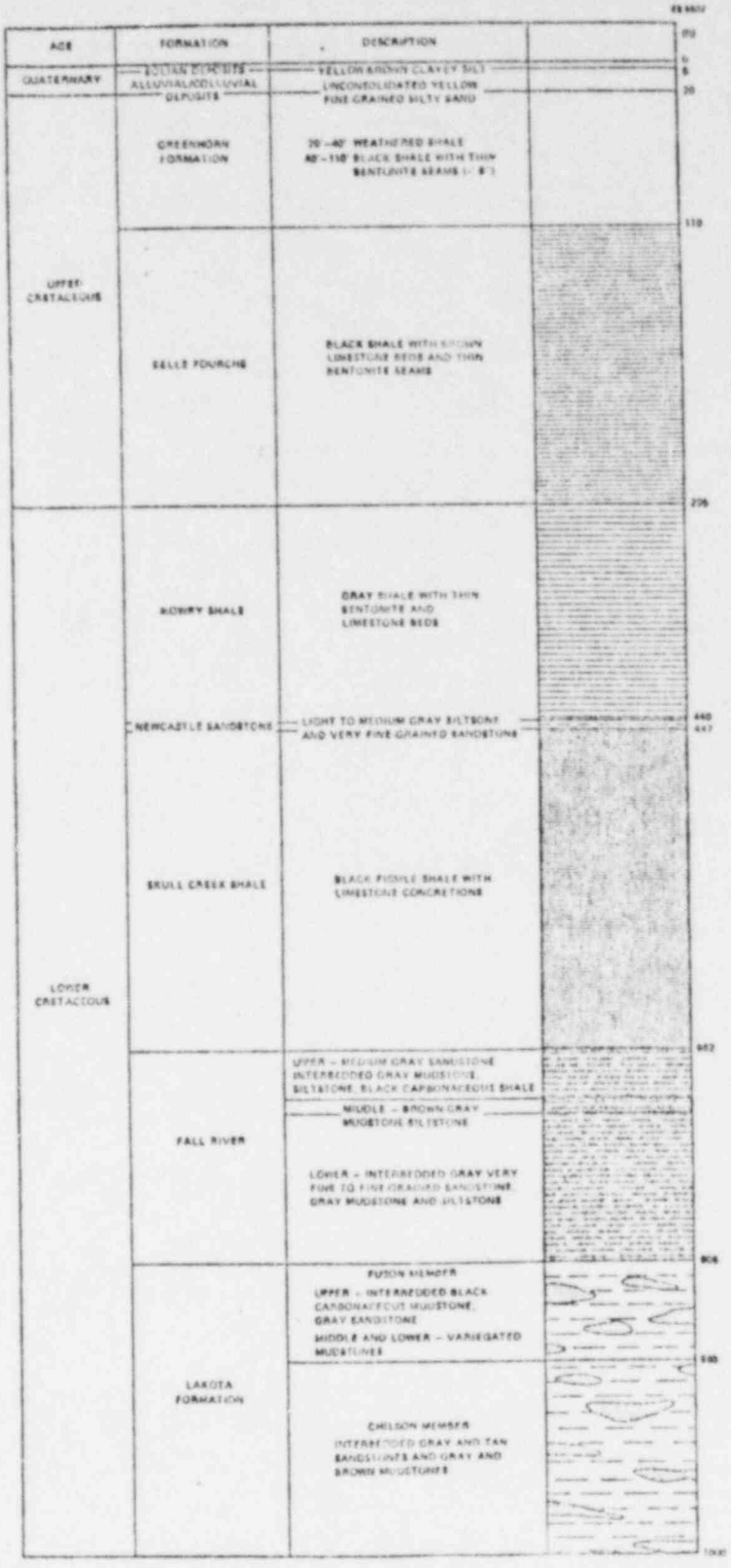


Fig. 3.12. Stratigraphic column based on data from Komes Test I test hole [elevation 1124 m (3687 ft)] (see Fig. 3.11). Source: Francis-Meador-Gellhaus, Inc., *Subsurface Soil Exploration for Proposed Edgemont Uranium Waste Disposal Site*, prepared for Silver King Mines, Inc., Edgemont, S.D., June 1980.

the aquifer but also because the artesian surface (potentiometric surface) of the Inyan Kara is above the top of the aquifer which would make it difficult for seepage to migrate downward from the site into the aquifer. However, over time, should the potentiometric surface of the Inyan Kara be lowered due to pumping demands etc. below the top of the aquifer then contamination of the aquifer by seepage from the disposal site might occur. There is also the possibility of seepage from the disposal site following fractures in the perched water table whichlies between the bedrock and soil surface and then discharging into the intermittent stream or stock ponds below the site or causing contamination of the perched alluvial aquifer downgradient from the site.

E. TVA is apparently planning to drill some exploratory testholes into the Inyan Kara aquifer at the disposal site to make sure no commercial uranium deposits may underlie the site. DWNR should insist such testholes be carefully plugged to minimize the possibility of seepage from the disposal site reaching the Inyan Kara aquifer. It would be preferable to have a DWNR person present during such drilling and plugging activities.

F. I am somewhat skeptical as to the long-term suitability of an unlined impoundment for containing any seepage which may result from the tailings. It is recommended DWNR require a clay liner and require in-situ field permeability tests monitored by DWNR personnel.

7. In considering reconstruction of Cottonwood Creek after decontamination, the DEIS states (p. v and 2-43) that erosion should be allowed to shape the banks in a natural manner as opposed to the use of 10 degree bank slopes and plowing and discing along the streambank for shrub planting as is apparently proposed by TVA (p. v.). DWNR should request more clarification as to what extent "erosion" should be allowed to shape the reconstructed creek. Apparently what the DEIS means by this is to avoid the excessive use of riprap (p. 2-43).

8. Although the DEIS state that the groundwater beneath the mill site is contaminated and may affect Cottonwood Creek and the Cheyenne River and although the DEIS states that any overflow from the ponds below the proposed tailings disposal site could reach the Cheyenne River (p. 3-24) the NRC in this DEIS does not seem to be too concerned with potential long-term impacts. On page 2-41 in discussing the proposed disposal site the DEIS states:

> "Elimination of need for ongoing monitoring and maintenance. After reclamation and a short-term observation and maintenance period for surface cover, the

> staff expects no further active maintenance will be required for the foreseeable future."

Presumably the NRC believes the clay and soil cap on the disposal site will be thick enough to minimize any radon emanations.

On page 2-43 the DEIS states:

> "The staff notes that during previous mill operation, although fresh tailings and contaminated groundwater degraded the water quality of Cottonwood Creek, no detectable effects on the Cheyenne River of the Angostura Reservoir were observed. With this past history, the staff is of the opinion that any potential effects of remaining contaminated creek sediment (after decommissioning) entering the river will be transient and will result in no measurable change in water quality or environmental consequences."

9. On page 2 - 16 the DEIS states:

> Sequence of disposal operations. The basic sequence of proposed disposal operations includes (1) decontamination and/or demolition of mill structures; (2) slurry transport and disposal of tailings sands; and (3) truck transport and disposal of tailings sands, slimes and contaminated soils."

Figure 2.21 from the DEIS shows the proposed sequence. In this sequence, the slimes are mixed with the sand tailings and placed last on top of the demolished mill structure and on top of most of the sand tailings. In my opinion, it would be much more preferable to reverse this sequence and place the slimes in first. According to the DEIS (p. 2-18):

> "The milling process separates the solid tailings into two size fractions: sands, which comprise about 80% by weight of the tailings, and slimes, which make up the remainder. The principal content of ponds 3 and 7 are slimes (see also DEIS table 2-2)."

With respect to the radioactive content of tailings sands and slimes, Edward Landa (1980, p. 6) states:

> "The tailings are often classified into a coarse and a fine-size fraction referred to as "sand" and "slime" respectively. The uranium-bearing minerals are generally softer than the bulk components of the host rock. Thus crushing of the ore tends to concentrate the uranium and uranium-daughter products in the slime fraction. Borrowman and Brooks (1975) examined acid and alkali-processed tailings and found that while the slime fraction makes up only 25-27 percent by weight of the tailings,

it contained 77-94 percent of the radium inventory. Slimes from the processing of ores from the Western United States may contain up to 3,00 pCI/l of radium-226/g (Haywood and others, 1977)."

The proposod decommissioning plan provided in the DEIS would place the most radioactive portion of the material (the slimes) on the top of the material in the disposal area. This means the radioactive slimes would be among the first materials exposed if excessive erosion etc. occurs. In my opinion, we should perhaps deepen part of the proposed disposal area, emplace the slimes first at the bottom, cover the slimes with a clay cover and them emplace the rest of the tailings and mill debris on top of the slimes. The DEIS indicates at least some of the slimes have already been separated from the sand tailings in ponds 3 and 7 (DEIS, p. 2-18). Another option would be to separate the slimes and deeply bury them thus significantly reducing the radioactive content of the remainder of the tailings.

MONITORING

With respect to monitoring, the NRC does emphasize the need for monitoring and the DEIS states on page 4-26:

"... The water quality parameters included in these tables...indicate that elevated chemical and trace metal levels at the mill site should continue to be sampled during predecommissioning, decommissioning, stabilization and reclamation to ensure that contaminants released during decommissioning are determined and that data for all sampling periods are comparable. For example, pH, specific conductance, sulfate, chloride, iron, manganese, magnesium, arsenic, nickel, molybdenum, selenium, titanium, and vanadium should be monitored because levels of these constituents exceed EPA standards in groundwaters beneath the mill site. ... The applicant will conduct a surface-water monitoring program at the mill site during decommissioning, with details of the program to be finalized with EPA and NRC in coordination with the South Dakota Division of Water Quality.

"... Cleanup of Cottonwood Creek will occur as discussed... A water quality monitoring program, including parameters measured in the baseline monitoring program, including parameters measured in the baseline monitoring program, will be continued at the mill site during decommissioning and and afterwards, if inspections indicate a need to do so. ... The results of the predecommissioning and decommissioning monitoring programs will be compared to determine the effectiveness of erosion control and contaminant removal from

Cottonwood Creek and the Cheyenne River and to determine if groundwater contamination from beneath the site is significantly affecting surface water quality."

CONCLUSIONS

1. The proposed disposal site is only 2 miles from Edgemont. In view of the long-term radioactivity of these tailings (thousands of years), I am concerned that the proposed disposal site may be too close to town. However, removal of the tailings from near Edgemont to the porposed site will greatly reduce potential health risks to the town's population. This, of course, should be done as quickly as possible in the safest way feasible.

2. Although 10 feet of fill (including 3 ft. of clay) may be adequate at this time to cover the tailings, I am concerned if this will still be adequate in several hundred years or more. In safely disposing of radioactive wastes one must think in terms of thousands of years. Landa (1980, p. 20) notes that if one uses the average erosion rates reported by Schumm of 9-20 cm/1000 years for arid to semi-arid terranes then 10 feet of cover would be removed in 33,000 years. At the end of this time, only 26 percent of the thorium present in the tailings would have decayed.

3. Although the DEIS states that groundwater contamination occurs at the mill site, no discussion of alternatives is offered as to how it might be cleaned up or why it cannot be cleaned up. Instead, the DEIS states that "natural processes" should be allowed to "cleanse" the aquifer. This could take possibly thousands of years.

4. The proposed sequence of placement of material from the mill site into the disposal area appears inadequate. It is probably preferable to place the "slimes" in first rather than last as is presently proposed. In fact, it might be wise to deeply bury the "slimes" separately from the rest of the tailings, mill site material, etc.

RECOMMENDATIONS

1. Pond #10 should be lined with an impermeable liner if it is to be used as "evaporation pond" for excess water from the slurry operation.

2. It is recommended the "slimes" portion of the tailings either be (1) deeply buried in a separate place or; (2) be buried at the bottom of the proposed disposal area, preferably with a clay liner between the top of the slimes and the bottom of the rest of the tailings.

3. It is recommended a clay liner approved by DWNR should be installed at the bottom and sides of the proposed disposal site.

4. It is recommended that appropriate State, NRC and TVA representatives hold a meeting with the people in the City of Edgemont to inform them of the proposed plans and potential environmental consequences and to secure public acceptance before starting the proposed decommissioning.

5. In view of the long-term potential impacts from these tailings, it is recommended a large permanent concrete marker be placed at the disposal site with appropriate markings to serve as a permanent warning to anyone who may live near the disposal site in the many thousands of years to come.

6. DWNR should participate and plan an integral role in the following:

   A. Determination of "acceptable" levels of contamination in Cottonwood Creek, the Cheyenne River, the mill site and the groundwater beneath the mill site. This should include field sampling involving DWNR personnel. At least some of the sampling should be done in labs other than those of TVA.

   B. In-situ permeability tests of the disposal site should be required. DWNR personnel should be present.

   C. The proposed testholes at the site to evaluate the Inyan Kara should be properly plugged. DWNR personnel should be present during drilling and plugging.

   D. DWNR should be closely involved in the development and implementation of any monitoring activities. This should include some involvement in the actual sampling and sending some of the samples to an independent lab. It is recommended background radon be determined at the proposed disposal site before construction and after the site has been covered with fill, etc.

7. It is recommended information be provided in the final EIS as to why no attempt will be made to clean up the contaminated groundwater at the mill site.

8. If feasible, it is recommended the standards proposed by the EPA in Draft Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites EPA 520/4-80-011 be utilized in the decommissioning of the mill site.