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DRAFT COMMENTS ON BWIP ENVIRONMENTAL ASSESSMENT
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2-1 Chapter 2 Summary, Page 2-Vi, Paragraph 3, Accuracy and Reasonableness

In this section it is suggested that the Yakima Fold belt is similar in view to low profile ripples in a smooth rug or carpet. This is an oversimplification. For example, the Umtanum Ridge - Gable Mtn structure has locally box like geometry and numerous thrust faults have been recognized or inferred along one or both flanks of the Yakima folds and are often south dipping (WNP-2 FSAR Vol. 25).

It has been recognized that the basalt of the Yakima Fold Belt as well as the interflow sediments deformed in an essentially brittle manner. The following excerpt is from (WNP-2 FSAR Vol. 3): "Folding is often considered a ductile process but this is not so under the conditions present when the Columbia Plateau Folds were formed. Beds are usually fractured to some degree and in the more steeply dipping parts of anticlinal limbs they are thoroughly brecciated. The folds have usually sharp although rounded hinges and as a rule are monoclines rather than anticlines, features which set them apart from the sinusoidal concentric folds of folding theory and schematical textbook illustrations."

The oversimplification (detailed above) in the summary can be misleading in giving the reader an impression that is unwarranted and could distort evaluations of the mechanical properties of these rock and the tectonic behavior under stress.

The complexity of the Yakima Fold Belt should be part of the information in the summary and references to rugs or carpets being rippled should be dropped.

2-2 Chapter 2, Summary, Page 2vi, Paragraph 4, Accuracy and Reasonableness

In this section it is indicated that the folding process has given rise to small tear faults caused by differential folding and shallow dipping thrust

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faults. It is further stated, that all available evidence to date suggests that all faults found to date result from these processes.

Several folds in the Yakima fold belt have thrust faults associated with them. The Washington Public Power Supply System investigations (for WNP-2, FSAR, 1981) regard some of the thrust faults to be primary, i.e. not the results of folding. The following is from Vol. 25 of the WNP-2 FSAR, 1981 "West of the Columbia River, the Umtanum Ridge and Hanson Creek faults farther north have the spacing and geometry of an imbricate south dipping thrust zone of primary origin."

WNP-2, FSAR, Vol. 3, 1981 indicates the depth of detachment as about 1-3 Km by localized decollement at the base of the Yakima sequence.

Primary thrust faulting can impact assessments of the geologic stability of the repository. Deformation is still ongoing as is indicated in many documents for the WNP 2 power plant and Rockwell Hanford tectonic portions of documents. Reactivation of primary (i.e. larger scale and greater movement) thrust faults could adversely affect the repository especially during pre-closure. Additional consideration of primary origin for thrust faults and the impacts seems warranted.

2-3 Chapter 2, Summary, Page 2viii, Paragraph 1, Accuracy and Reasonableness

This section indicates that the Cohassett flow has been identified as preferred on the basis of expert judgement. However, neither professional judgement or data clearly identifies the cohassett as preferred.

Other flows should continue to be treated as candidates without over emphasizing the Cohassett.

2-4 Section 2.1.1 Regional Geology, Page 2-4, Paragraph 3, Inadequate consideration of available data

In this section it is indicated that fractures range from 10-30 fractures per meter (.03 to 9 fractures per foot). Based on Rock Quality Designation

Method (RQD), this is very poor quality rock. Also, it is not clear if discing was included in the fracture frequency given.

Rock quality can affect stable openings and is important especially during pre-closure. Clarifications are needed regarding the matter of whether or not discing was included in the fracture frequency.

2-5 Chapter 2 Summary Page 2-VI, Paragraph 4, and Page 2vii Paragraph 1, Inadequate consideration of available data

The section is about Gable Mtn. The only Gable Mtn. fault acknowledged is the central fault. Gable Mtn. has five major faults (Nureg 0309, supplement 3). The five major faults are:

1) Central fault
2) North dipping reverse fault
3) The south fault
4) The west fault
5) DB10 fault

All of these faults can be considered or assumed to be capable because of their structural association (Nureg 0309, supplement 3). Although Gable Mtn. faulting is given two more paragraphs in Chapter 3, page 3-33. It remains an oversimplification not to even mention the other well known and documented faults in the introductory discussions of the central fault at Gable Mtn.

2-6 Section 2.1.1 Regional Geology page 2-4, Paragraph 3, Inadequate consideration of uncertainties

The fracture abudances and widths of fractures may be inaccurate due to a lack of adequate data from angle core holes.

Also, even through fractures have deposition of multiple generations of mineral deposition they may:

1) not be filled completely 2) may be subject to cycles of opening and closing, or 3) may be water conduits.

2-7 Section 2.1.1.3 Seismicity, Page 2-13 Inadequate consideration of data

This section indicates that deep seismicity occurs in a seemingly random pattern and isn't associated with swarm activity. A case for some correlation of seismicity with mapped structures can be made in some cases and this matter warrants further discussion. For example, one exception of association between shallow and deep earthquakes occurs at the eastern end of Saddle Mtns. (RHO-BWI-ST 19P, 1983). The nature of the deep seismicity could be occuring on unmapped structures and faults. The seemingly random pattern needed further explanation.

2-8 Section 2.1.2 Tectonics Page 2-17, Paragraph 6 Inadequate data

This section indicates that deformation rates are less than 0.1mm (near the limit of detection). Because of the problems with the accuracy of the supporting data and the short time period during which data has been collected, the NRC staff is unable to accept the given rates of deformation. It is believed based on seismic activity and measured deformation rates, that the Yakima Fold Belt is continuing to deform with North-South compression. This is a potentially adverse condition because it is recognized that geologic processes and events may not continue at uniform rates. Ranges of potential deformation rates which clearly include consideration of unanticipated processes and events affecting the geologic setting should be presented. Fault movement event could be used, without averaging the movement, to give part of the ranges of movement.

2-9 Section 2.1.2 Tectonics Page 2-19, Paragraph 1 Inadequate Consideration of available data

This section indicates that micro earthquakes are not stress relief along geologically mapped or unmapped faults. Micro earthquake swarms occur in the RRL and movement along faults is potentially adverse or even potentially disqualifying. Some correlation of microseismicity and faults has been

established (Malone et al, 1975) and (Nureg 0309, supplement no. 3). The correlations made between micro earthquakes and faulting must be examined further.

2-10 Section 2.3.4.2 Summary of the Natural Resources disqualifying analysis Inadequate Consideration of Uncertainties

This section states that natural resources analysis with respect to previous activities involves little or no uncertainty. While this may be true, future activities are uncertain. There is much uncertainty about the commercial gas exploration occurring in the vicinity of the repository. Presently there is a lack of information on deep (below basalt) sediments as a source of hydrocarbons.

Future activities, depending upon the targets below basalt, might be expected to result in an inadvertant loss of waste isolation.

Deep below basalt sediments must be examined as a source of hydrocarbons.

3-1 Section 3.2.3.2 Umtanum Ridge - Gable Mtn. Structure Page 332, Paragraph 2, Accuracy and Reasonableness

This section indicates that Umtanum fault, which is part of an imbricate system of about 3 faults, dies out about 11 kilometers (7 miles) east of Priest Rapids Dam. This is based on a judgement that a decrease in structural relief results in less fault displacement. Because the Umtanum fault is associated with imbricate thrust fault processes, the NRC staff judgement (see Boyer and Elliott 1982) it that its possible that the faults, while buried, continue east to the vicinity of the Reference Repositiory Location (RRL).

The existance of thrust faults under or near the RRL in the Yakima Fold Belt which is continuing to actively undergo N-S compression (RHO-BWI-ST-19P) is a potentially adverse condition. Further consideration should be given to a tectonic model of folding due to thrusting and seismicity relating to thrust planes.

3-2 Section 3.2.3.2 Umtanum Ridge - Gable Mtn. Structure Page 3-33, Paragraph 2 Inadequate Consideration of Available Data

This section indicates that a fourth buried fault was discovered in the central Gable Mtn. area. Five faults are associated with Gable Mtn. (NRC NUREG 0309, Supplement No. 3). The faults at Gable Mtn. are considered to be interrelated such that movement on one may move another fault at the same time. (NRC NUREG 0309, Supplement No. 3). However, the Environmental Assessment does not name this fault or address interrelationships to other faults.

The central fault at Gable Mtn. is considered capable based on (NRC NUREG 0309). The central fault at Gable Mtn. is considered to be Quaternary in age. In addition, the central fault at Gable Mtn. is likely to be interrelated with the other faults, the faulting is a potentially adverse condition. The fourth fault referred to in this section should be designated based on the teminology used by other investigators. If the fault has not been investigated by others, this should be clear and a new designation should be given to the fault.

3-3 Section 3.2.3.2 Umtanum Ridge - Gable Mtn. Structure Page 3-33, Paragraph 3 Inadequate Consideration of Available Data

This section states: "New trenches in the central Gable Mountain area exposed offsets of up to 6.5 centimeters (2.5 inches) along narrow fractures in glaciofluvial sediments that are continuous with a reverse fault in the basalt." Borehole data is stated as showing that the fault has a much greater displacement at depth 50 meters (160 ft.). Further, it is indicated that displacement is either the latest movement on an older fault of greater displacement at depth or caused by rapid loading and unloading during catastropic flooding.

No explanation is given regarding the dates of the new trenches and the fault is undesignated. Five faults have been identified and named for Gable Mtn. (NRC NUREG 0309, Supplement No. 3). Also, the dip of the undesignated fault is not given.

The origin of fault displacement at Gable Mtn. has been found to be most likely tectonic in origin (NRC NUREG 0309, Supplement No. 3).

It appears possible that the older fault with 50 meters (160 ft.) of displacement at depth moved about 13,000 years before the present. If Quaternary, the faulting is an adverse condition.

3-4 Section 3.2.3.2 Umtanum Ridge - Gable Mtn. Structure Page 3-33 Paragraph 3 Inadequate Documentation

This section indicates long term average displacement rate on an undesignated fault of about 5.08×10^{-4} centimeters (2×10^{-4} inches). The time frame of the displacement rates is not specified but appears to be per year.

Five faults associated with Gable Mtn. area have been identified and named (NRC NUREG 0309, Supplement No. 3). Some type of common terminology can and should be included in the Environmental Assessment.

The rate of displacement of the fault which is discussed above, is not believed to be continuous over time. The displacement could have been a single event and cannot be averaged. Due to the fact that the undesignated fault apparently continues its trace at depth, a significant earthquake could be associated with this fault. Episodic events associated with the fault and the magnitude of earthquakes which could be generated needs to be addressed.

3-5 Section 3.2.3.3 Cold Creek Syncline Page 3-34, Paragraph 1 Inadequate Documentation

This section indicates that the basalts near the reference repository location are nearly flat with: "very gentle dips toward the trough of the Cold Creek Syncline."

The dip of the basalts in degrees from horizontal is not given. Also, no references to data on dips are presented. Data on the variation and averages of the dips measured is important to determining rock characteristics.

3-6 Section 3.2.3.7 Rattlesnake-Wallula Alignment, Page 3-36, Paragraph 2, Inadequate Documentation

This section is about the Rattlesnake Wallua Alignment. The seismic hazard potential of this feature is not discussed other than to mention that is has been interpreted as capable. The faulting on the Rattlesnake-Wallula alignment is Quaternary in age at the eastern end of this 120 kilometer (75 mile) long fault. The Rattlesnake-Wallula alignment seismicity is a potentially adverse condition.

3-7 Section 3.2.3.8 Structural Analysis Page 3-36, Paragraph 3 Inadequate Consideration of Available Data

This section indicates that little deformation, other than tectonic jointing has taken place in the anticlinal crests of the Yakima Fold Belt. This concept of little deformation does not agree with what has been documented for Toppenish Ridge crest which has undergone faulting that is late Quaternary and Holocene (Price 1982). The Toppenish Ridge faults are interpreted to be of tectonic origin and related to anticlinal growth (Price 1982).

This concept of little deformation may not agree with what has been documented for the Saddle Mtns. Anticlines (Reidel 1983). The crest and fold hinge are often the same but not necessarily. The Saddle Mtns. fold hinge, most of which has been eroded, is complex in some areas. Specifically, the intersection of McDonald Springs and Boylston Mtns. segements.

The structural analysis of the Yakima Fold Belt is of interest in aiding the determination of the tectonic character of these folds. Additional consideration should be given to the structural complexity of the anticlinal crests.

3-8 Section 3.2.3.3 Cold Creek Syncline Page 3-34, Paragraph 1, Accuracy and Reasonableness

This section states that the reference repository is located in a part Cold Creek Syncline which is described as "nearly flat lying with very gentle

dips towards the trough of the syncline." Further, it is indicated that the RRL appears to be free of potentially adverse bedrock structures. However, Chapter 6, page 155 of the draft Environmental Assessment indicates that geophysical anomalies have been found in and near the RRL. These geophysical anomalies are indicated as being in the process of interpretation.

The tectonic interpretations for the Cold Creek Syncline are important because it is this syncline in which the Reference Repository is to be located. The dips described as very gentle are not given. Information on geophysical anomalies isn't mentioned. The presence of tectonic breccia zones from core holes in and near the RRL (RHO-BWI-ST-14) are not mentioned.

The dips, including estimates on the ranges of variations possible, should be given. The fact that geophyiscal anomalies in and near the RRL remain in the process of interpretation should be mentioned. The presence of tectonic breccia zones from core holes in and near the RRL should be discussed.