Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

Paul Lohaus
Acting Branch Chief
Low-Level Waste and Uranium
Recovery Project Branch
MS 623SS
Washington, DC 20555

Dear Mr. Lohaus:

Enclosed for your review are three (3) copies of the U. S. NRC comments and U.S. DOE responses on the Draft Comparative Analysis of Disposal Site Alternatives Report (CADSAR) for the Maybell, Colorado, UMTRA site.

Should you have any questions, please contact Jolene Garcia of my staff at (505) 846-1238.

Sincerely,

James R. Anderson

James R. Anderson
Project Manager
Uranium Mill Tailings Project Office

Enclosures (3)

cc w/o enclosures:
Maxine Dunkelman, NRC/HQ

THE U.S. NUCLEAR REGULATORY COMMISSION COMMENTS
AND
THE U.S. DEPARTMENT OF ENERGY RESPONSES
ON THE
DRAFT COMPARATIVE ANALYSIS OF DISPOSAL SITE ALTERNATIVES REPORT
FOR MAYBELL, COLORADO

OCTOBER, 1987

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment:

We did not see any fatal flaws in the draft CADSAR at this time which would preclude use of the two proposed alternatives. However, NRC concurrence that either alternative will meet Environmental Protection Agency standards cannot be provided until the detailed information discussed above has been reviewed.

SECTION 2

Response: Page _____ By: TAC - Nelson Date: 9/1/87

Agreed.

Plans for Implementation:

The detailed information needed to fully evaluate the proposed remedial action will be included in the RAP.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 5, Section 3.0, Characterization of Sites

Characterization of each alternate site has not considered the neighboring mines and heap-leach facilities. Stabilization of the tailings may be jeopardized by future mining at the site.

SECTION 2

Response: Page 5, Section 3.0 By: TAC - Nelson Date: 9/1/87

It is unlikely that the operator would have placed the mill on an ore body. In addition, the collapse of U_3O_8 prices makes it very unlikely that the future mining will occur here.

Plans for Implementation:

No change anticipated.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/87
Document: Draft CADSAR
Commentor: NRC

Comment: Page 9, Section 3.1.3, Table 3.2

The draft CADSAR does not appear to contain sufficient groundwater quality or geochemical data to conclude that groundwater contamination is not a concern. Some groundwater concerns that may need to be addressed during characterization are:

a) The present and future water use in the area may need to be addressed. This is important, because the Browns Park Formation appears to be a significant aquifer, which is composed largely of sandstone, is up to 900 feet in thickness, and may have 750 feet of saturation (Ford, Bacon & Davis Utah Inc., 1981, pages two to four and two to 13). Furthermore, future water use in the area may increase as a result of energy development (uranium, oil and gas, coal, and oil shale). This may be especially true at this site, since a uranium mine and milling area is immediately adjacent to the site.

b) The sandstones of the Browns Park Formation may not offer much attenuative capacity either in the unsaturated or saturated zones.

c) Radiological contaminants may be much more mobile in the groundwater after having been processed.

d) Local groundwater flow directions may not reflect regional groundwater flow due to the existence of open pits around the tailings site.

e) It may be difficult to determine background water quality due to past milling and mining activities in the area.

f) It may be difficult to determine if any groundwater pollution associated with the pile is from the pile or from adjacent mining, milling, and heap-leaching operations, or both.

g) In order to identify groundwater pollution from the pile, post remedial-action monitoring may need more detail than planned, because of adjacent mining, milling, and heap-leaching operations.

SECTION 2

Response: Page 9, Section 3.1.3 By: TAC - Longmire Date: 9/1/87

GROUNDWATER

A groundwater monitoring program has been established to determine the extent of potential groundwater contamination resulting from tailings seepage at the Maybell site. Monitor wells are completed beneath and hydraulically downgradient (west-southwest) from the tailings impoundment. Two monitoring wells east of the tailings impoundment will help define background water-quality conditions at the site. Several private wells completed within the Yampa River alluvium at Maybell are also included as part of the groundwater monitoring program.

Geochemical data will be evaluated on the subjacent soils within the neutralization zone to address mobility/attenuation capacities of the contaminants.

Detailed hydrogeological and geochemical analyses will be included in the draft EA within the Hydrology Appendix. This appendix will include hydrological characterization, water use, geochemical controls on contaminant migration, effects of remedial action, and risk of human exposure.

Plans for Implementation:

Groundwater contamination will be addressed in detail in the EA. Geochemical processes influencing contaminant migration will also be addressed.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/87
Document: Draft CADSAR
Commentor: NRC

Comment: Page 9, Section 3.1.3, Table 3.2

Table 3.2 of the Maybell draft CADSAR states that the DOE does not consider groundwater conditions to be a "concern" for the stabilization in place alternative. The table states that there is a "neutralization zone" three to four feet below the tailings pile which prevents "significant movement" of radionuclides or other contaminants. DOE does not define "neutralization zone," nor does it include any details concerning this zone in the draft CADSAR. DOE apparently feels that the "neutralization zone" will protect the groundwater of the Browns Park Formation, an aquifer approximately 900-feet-thick consisting primarily of sandstones interspersed with "some shale and mudstone layers" (Ford, Bacon & Davis Utah, Inc., 1981), which underlies the tailings. However, without additional information concerning the "neutralization zone," the NRC staff cannot assess whether the potential exists for contaminants to move from the reclaimed tailings pile and into the groundwater. In the final CADSAR, DOE should define "neutralization zone," describe the zone in more detail (e.g., thickness, areal extent, mineralogy, grain size, permeability, etc.), and identify the properties responsible for isolating radionuclides and other contaminants. Since incorporating engineered groundwater protection (i.e., an impermeable liner) into the remedial action could seriously impact the final cost, DOE should demonstrate early in the evaluation process that the "neutralization zone" will adequately protect the groundwater.

SECTION 2

Response: Page 9, Section 3.1.3 By: TAC - Longmire Date: 9/1/87

GROUNDWATER

A groundwater monitoring program has been established to determine the extent of potential groundwater contamination resulting from tailings seepage at the Maybell site. Monitor wells are completed beneath and hydrologically downgradient (west-southwest) from the tailings impoundment. Two monitor wells east of the tailings impoundment will help define background water quality conditions at the site. Several private wells completed within the Yampa River alluvium at Maybell are also included as part of the groundwater monitoring program.

SECTION 2 (Continued)

Geochemical data shall be evaluated on the subjacent soils within the neutralization zone to address mobility/attenuation capacities of the contaminants.

Detailed hydrogeological and geochemical analyses shall be included in the draft EA within the Hydrology Appendix. This appendix shall include hydrological characterization, water use, geochemical controls on contaminant migration, effects of remedial action, and risk of human exposure.

Plans for Implementation:

Table 3.2 of the draft CADSAR has been revised to include groundwater contamination in Browns Park Formation.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 11, Section 3.0, Table 3.3

This table is inconsistent in stating that geomorphology (erosion in Johnson Wash) is a concern while surface waters in the area are not. These two issues are one in the same and cannot be treated separately.

SECTION 2

Response: Page 11, Section 3.0 By: TAC - Nelson Date: 9/1/87

Geomorphology and surface water are related but separate issues. Geomorphology is the study of land forms and, on the UMTRA Project, is usually associated with arroyo headcutting and channel migration. Surface water relates to flooding and the force applied by swiftly moving water.

Plans for Implementation:

No change anticipated.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 11, Section 3.0, Table 3.3

Table 3.3 states that surface water is not a concern for the Johnson Pit disposal alternative. However, we consider this conclusion to be premature because in Section 4.2, page 15, it is stated that the pit would be "filled with the tailings and other contaminated materials to above the elevation of the surrounding terrain to provide external drainage away from the stabilized tailings." A conceptual design which calls for overfilling of the Johnson Pit to provide drainage away from the tailings may also subject them to the erosional forces of surface water flow. Therefore, surface water is a concern for the Johnson Pit alternative unless further information indicates otherwise.

SECTION 2

Response: Page 11, Section 3.0 By: TAC - Nelson Date: 9/1/87

Agreed. All of the issues mentioned are a concern for all UMTRA Project sites. A no response in Table 3.2 means that the issue can be easily mitigated during remedial action design.

Plans for Implementation:

Clarification has been added to Table 3.3.

SECTION 3

Confirmation of Implementation:

Checked by: _____, Date: _____

Approved by: _____, Date: _____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/87
Document: Draft CADSAR
Commentor: NRC

Comment: Page 11, Section 3.0, Table 3.3

Table 3.3 states that "prior to backfilling" the groundwater table in the Browns Park Formation intersected the bottom of Johnson Pit. This is a potential problem, as groundwater may infiltrate the tailings pile from below, providing a mechanism for leaching and transporting contaminants. To mitigate this problem, DOE will leave "at least 10 feet" of fill in the bottom of the pit to separate the tailings from the groundwater. The concern remains, however, and Table 7.2 (page 23) identifies that the proximity of groundwater to the tailings, particularly during wet periods, is a risk associated with selecting the Johnson Pit alternative. The cost impact of mitigating this problem is not examined in the draft CADSAR. The final CADSAR should recognize the potential impacts of mitigating the groundwater infiltration problem for the Johnson Pit alternative and explore whether using methods such as allowing more than 10 feet of backfill to remain in the pit (which will reduce the volume of tailings the pit can hold) or constructing a liner are feasible methods of eliminating water infiltration from below.

SECTION 2

Response: Page 11, Section 3.0 By: TAC - Longmire Date: 9/1/87

The language has been changed in Table 3.3.

Stabilization in the Johnson Pit

The tailings will be isolated from the biosphere; however, the tailings would be stabilized close to the water table in the Browns Park Formation. Hydrogeochemical processes will be evaluated for this disposal alternative. Degradation of groundwater quality due to natural processes, such as oxidation of uranium ore deposits within the Browns Park Formation, adjacent to Johnson Pit will be evaluated. Natural contamination versus tailings seepage may be difficult to assess for stabilization at Johnson Pit.

SECTION 2 (Concluded)

Plans for Implementation:

Infiltration of tailings leachate within Johnson Pit to groundwater will be addressed in detail if the Johnson Pit option becomes the preferred option.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/87
Document: Draft CADSAR
Commentor: NRC

Comment: Page 14, Section 4.1, Stabilization in Place (SIP)

Regrading of the tailings pile and the erosion protection required for the SIP alternative will need to be discussed in the final CADSAR. Review of the draft CADSAR and the FBDU (1981) report indicate that extensive regrading of the tailings pile and considerable erosion protection may be required for several reasons:

a) The topographic map and cross section of the tailings pile in the FBDU report (Figures 2-2, 2-5A) reveal slopes on the E and SE sides of the tailings that are rather steep. Rough calculations indicate slopes as steep as 5h:1v at the SE corner. Erosion on the eastern side of the pile (FBDU, page 2-4) is probably directly attributable to the steepness of the slope. It therefore appears that significant regrading of the pile will be necessary to make these slopes less steep.

b) Figure 3.1 of the draft CADSAR and Figures 2-2, 2-4, 2-5A, and 2-5B of the FBDU report depict a channel (or gully) on the tailings pile. Construction of a drainage channel directly on the stabilized pile is generally undesirable, because erosion could occur in the middle of the pile rather than along the edges. Therefore, extensive regrading of the tailings pile appears to be necessary to alter the present system of surface drainage.

c) Examination of aerial photographs and topographic maps indicates the presence of nearby gullies and erosion features which could potentially impact the site design. Provisions for protection of the stabilized pile against lateral erosion and headcutting need to be examined to estimate the erosion protection requirements associated with the phenomena.

The extent of tailings regrading and erosion protection considered in the draft CADSAR for the SIP alternative needs to be clarified and expanded in the final CADSAR.

SECTION 2

Response: Page 14, Section 4.1 By: TAC - McBee Date: 9/14/87

The CADSAR acknowledges that regrading of the pile and placement of a rock erosion-protection cover and riprap will be required for SIP. Details on how this will be accomplished (i.e., thickness of the riprap) will be presented in the RAP and is beyond the scope of the CADSAR.

Plans for Implementation:

None.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 16, Section 5.0, Significant Issues

The draft CADSAR is a preliminary document with no technical information on seismology and geophysics. Therefore, before making any preliminary technical evaluation, the following points should be addressed:

a) The report cites the existence of faults within 0.25 mile of the tailings. These faults should be characterized fully and the risk associated with the faults impact on the site should be discussed.

b) Seismic activities within the vicinity of the site should be addressed and a map showing the locations of the earthquakes should be provided.

c) The report should identify the design acceleration.

d) Table 7.2 should include faults as a risk item.

SECTION 2

Response: Page 16, Section 5.0 By: TAC - Nelson Date: 9/1/87

A complete seismic analysis has been performed and will be available in the draft RAP.

Plans for Implementation:

Faulting has been included in Table 7.2.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 16, Section 5.1, Flood studies

This section leaves the impression that flood studies are required only if the SIP option is chosen, and then only to define the rock size required to armor Johnson Wash. We conclude that flood studies (PMP and PMF) are required for both the SIP and Johnson Pit alternatives for two reasons:

a) Tables 3.2 and 3.3 list erosion of Johnson Wash into the tailings as a concern for both options. Therefore, the size of rock required to armor the piles and/or Johnson Wash should be determined from flood studies for both options.

b) The size of rock required to armor the diversion system which protects the tailings from surface runoff should be determined from flood studies. This is obviously important for the SIP option since the present diversion system has been breached on the western side (FBDU, page 2-4). The need for such a diversion system for the Johnson Pit option is not addressed in the draft CADSAR, but aerial photographs indicate one may be required.

SECTION 2

Response: Page 16, Section 5.1 By: TAC - Nelson Date: 9/1/87

A full and detailed flood analysis will be completed for whichever option is selected for remedial action.

Plans for Implementation:

No change required.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 19, Section 6.0, Table 6.2

The table shows erosion-protection costs for the Johnson Pit alternative are 50 percent higher than for the SIP alternative (page 18). This appears to contradict Sections 4.1 and 4.2, Site Conceptual Designs, which specify similar volumes of erosion-protection materials for each alternative. The final CADSAR should justify erosion-protection costs in more detail.

SECTION 2

Response: Page Table 6.2 By: TAC - McBee Date: 9/14/87

Erosion protection costs for both alternatives have been revised. The required volumes and estimated costs are similar.

Plans for Implementation:

Revised volumes and costs are included in the final CADSAR.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 21, Section 7.1, Table 7.1

a) This table states, that for the Johnson Pit alternative, "headcutting of Johnson Wash would not affect the site." This appears to be in direct conflict with Table 3.3 on page 11, which lists erosion of Johnson Wash into the pit as a concern. Based on our review, headcutting and lateral erosion appear to be potential problems at the Johnson Pit; therefore, Table 7.1 should be amended for consistency.

b) In the comparison of disposal alternatives, isolation from the bedrock aquifer by Mancos Shale is cited as a positive technical factor for the stabilization in place alternative. However, the draft CADSAR does not seem to recognize the Brown's Park Formation which directly underlies the site and may be a significant bedrock aquifer. Credit for this aspect of the site should not be taken until additional groundwater information is obtained.

SECTION 2

Response: Page 21, Section 7.1 By: TAC - Nelson Date: 9/1/87

Headcutting toward Johnson Wash could be easily mitigated by the placement of large rocks if a geomorphologic analysis showed it to be necessary. A discussion of the Browns Park Formation has been added to the final CADSAR.

Plans for Implementation:

Additional language has been added to Table 3.3.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment:

a) The table assigns 25-percent risk to the SIP option based on a potential of erosion-protection needs above those anticipated, and no such risk for the Johnson Pit alternate site. The comparison directly contradicts Tables 3.2 and 3.3, which identify Johnson Wash as a threat to geomorphic stability at both sites. This inconsistency should be resolved.

b) This table contains risk values associated with each alternative. However, the table contains no reference to methods for the risk assessments. This information should be supplied.

SECTION 2

Response: Page _____ By: TAC - Nelson Date: 9/1/87

a) Agreed. We do not believe it is an issue; however, until a full analysis is completed, there is some risk.

b) The risks were determined from the combined input of the technical specialists assigned to the site and are not intended to be definitive and statistically defensible.

Plans for Implementation:

The table has been modified.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 24, Section 8.0, Recommendations

We conclude that a surface-water quality investigation should be included as part of the field characterization program. Such an investigation should be made to determine the quality of water upstream from the site, downstream, and draining directly off the tailings pile. These data are necessary to establish background surface-water quality and any current contamination of surface water caused by the tailings. It will later be used to assess the effects of the chosen stabilization option on surface-water quality as part of the monitoring program. Of particular importance is the effect of runoff from Johnson Wash on the water quality of Lay Creek and especially the Yampa River, from which at least one farmhouse is known to obtain drinking water (FBDU, page 2-5). The potential for future surface-water use in the downstream areas affected by the tailings should also be addressed.

SECTION 2

Response: Page 24, Section 8.0 By: TAC - Nelson Date: 9/1/87

DOE agrees. Samples have been collected in Johnson Wash and Lay Creek. No surface-water runoff from the pile could be collected.

Plans for Implementation:

No change necessary.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 5, Section 3.0, Characterization of sites

a) Section 3.0 provides very little factual information on actual site conditions. Basic information needs to be presented (site stratigraphy, exploration data, description of static and dynamic engineering properties of foundation, embankment and borrow materials, soild and rock characteristics that would prevent migration of contaminants) on the processing site, Johnson Pit, and proposed borrow areas.

b) The two references cited in Tables 3.2 and 3.3 should be provided to understand the basis for DOE's conclusions on concerns for site characteristics that are identified in these tables.

c) The areal extent and thickness of pockets of slimes at the south end of the tailings pile and the condition of the partially backfilled Johnson Pit (material types, construction method for placement and any compaction effort, etc.) need to be described and understood in order to make a reasonable estimate of their impact and costs on remedial action work.

d) It would appear from Table 8.1 that the results of site investigations that would cover geotechnical drilling, borrow areas and groundwater would be available for incorporation into the final CADSAR. After having established preliminary site conditions, an engineering assessment would need to be made on potential slope stability and settlement or subsidence problems, on stability under earthquake loading and any specific feature that might adversely impact safe construction and operation. The impact of these specific site features on remedial action costs would then need to be estimated.

SECTION 2

Response: Page 5, Sec. 3.0 By: TAC - McBee Date: 9/14/87

a) The requested detailed information is beyond the scope of the CADSAR but will be included in the RAP.

b) Comment acknowledged.

c); d) See response to comment a).

Plans for Implementation:

See references cited in Tables 3.2 and 3.3.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 14, Section 4.0, Site conceptual design

The staff agrees with DOE that the designs of possible alternative disposal options in this section are preconceptual only, and will change as site characterization is completed. As an example, the proposed alternative for stabilization of Johnson Pit needs to establish the engineering properties and condition of the existing pit materials and slopes and backfilled portion (material types, densities) in order to identify required remedial action work (cutting back or sealing of pit walls and bottom, etc.). The staff would anticipate major revisions and updating of Section 4.0 in the final CADSAR along with sectional views that illustrate the conceptual scope and extent of proposed remedial-action work.

SECTION 2

Response: Page 14, Section 4.0 By: TAC - Nelson Date: 9/1/87

Agreed.

Plans for Implementation:

If Johnson Pit were selected as the preferred alternative, an intensive data collection and analysis program would be conducted.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Maybell, Colorado Date: 9/8/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page 17, Section 6.0, Cost estimates

Section 6.0 and the work items in the cost estimate summaries of Tables 6.1 and 6.2 are not sufficiently described which raises questions as to whether the cost estimates appropriately reflect the remedial work to be performed. As an example, it is unclear for the proposed stabilization in place alternative, what work effort and costs have been considered for either removing or stabilizing the soft slime materials at the south end of the existing tailings pile. In the final CADSAR, Section 6.0 should be expanded to describe the major design features and construction operations with sufficient information on remedial-action quantities and cost presented to demonstrate that the significant design and construction features have been adequately addressed.

SECTION 2

Response: Page 17, Section 6.0 By: TAC - McBee Date: 9/14/87

The cost estimate for each alternative is comprised of detailed, separate work items. These cost breakdowns are part of the working files and are available as background information. However, the work items requested are not normally part of the final CADSAR document.

Plans for Implementation:

None.

SECTION 3

Confirmation of Implementation:

Checked by:_____, Date:_____

Approved by:_____, Date:_____