

ENVIRONMENTAL QUALITY

CHAPTER 30

WATER QUALITY

Subchapter 5

Mixing Zones in Surface and Ground Water

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## Subchapter 5

## Mixing Zones in Surface and Ground Water

17.30.501 PURPOSE (1) The purpose of this subchapter is to implement 75-5-301(4), MCA, which requires the board to adopt rules governing the granting of mixing zones consistent with the provisions of 75-5-302 through 75-5-307 and 80-15-201, MCA. (History: 75-5-301, MCA; IMP, 75-5-301, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499.)

17.30.502 DEFINITIONS The following definitions, in addition to those in 75-5-103, MCA, and ARM Title 17, chapter 30, subchapters 6 and 7, apply throughout this subchapter:

(1) "Acute toxicity" means a condition in which ambient water concentrations exceed the applicable acute aquatic life standards given in department Circular DEQ-7.

(2) "Chronic toxicity" means a condition in which ambient water concentrations exceed the applicable chronic aquatic life standards given in department Circular DEQ-7.

(3) "Constructed wetland" means a wetland intentionally designed, constructed and operated for the primary purpose of wastewater or stormwater treatment or environmental remediation.

(4) "Currently available data" means data that is readily available to the department at the time a decision is made. It does not mean new data to be obtained as a result of departmental efforts or required of the applicant.

(5) "Human health standard" means the parameters listed as human health standards in department Circular DEQ-7.

(6) "Mixing zone" is defined in 75-5-103, MCA, and also means a limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and where water quality changes may occur and where certain water quality standards may be exceeded.

(7) "Nearly instantaneous mixing zone" means an area where dilution of a discharge to water by the receiving water occurs at a nearly instantaneous rate, with the result that its boundaries are either at the point of discharge or are within two stream widths downstream of the point of discharge.

(8) "Narrative standards" means those parameters listed as narrative standards in department Circular DEQ-7.

(9) "Numeric acute standards" means the parameters listed as acute aquatic life standards in department Circular DEQ-7.

(10) "Numeric chronic standards" means the parameters listed as chronic aquatic life standards in department Circular DEQ-7.

(11) "Standard mixing zone" means a mixing zone that meets the requirements of ARM 17.30.516 and 17.30.517 and involves less data collection and demonstration than required for a source specific mixing zone.

(12) "Wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

(13) "Zone of influence" means the area under which a well can be expected to remove water.

(14) The board adopts and incorporates by reference Department Circular DEQ-7, entitled "Montana Numeric Water Quality Standards" (October 2012 edition), which establishes water quality standards for toxic, carcinogenic, bioconcentrating, nutrient, radioactive, and harmful parameters. Copies of Department Circular DEQ-7 are available from the Department of Environmental Quality, P.O. Box 200901, Helena, MT 59620-0901. (History: 75-5-301, MCA; IMP, 75-5-301, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; AMD, 1995 MAR p. 1798, Eff. 9/15/95; AMD, 1996 MAR p. 555, Eff. 2/23/96; TRANS, from DHES, 1996 MAR p. 1499; AMD, 1998 MAR p. 2487, Eff. 9/11/98; AMD, 2002 MAR p. 387, Eff. 2/15/02; AMD, 2003 MAR p. 217, Eff. 2/14/03; AMD, 2004 MAR p. 725, Eff. 4/9/04; AMD, 2006 MAR p. 528, Eff. 2/24/06; AMD, 2008 MAR p. 946, Eff. 5/9/08; AMD, 2010 MAR p. 1796, Eff. 8/13/10; AMD, 2012 MAR p. 2060, Eff. 10/12/12.)

Rules 17.30.503 and 17.30.504 reserved

17.30.505 GENERAL CONSIDERATIONS FOR MIXING ZONE

DESIGNATIONS (1) After an assessment of information received from the applicant concerning the biological, chemical, and physical characteristics of the receiving water, as specified in ARM 17.30.506 or as requested by the department, the department will determine the applicability of a mixing zone and, if applicable, its size, configuration, and location. In defining a mixing zone, the department will consider the following principles:

(a) Mixing zones may be granted for individual parameters present in a discharge.

(b) For new or increased sources, changes in water quality at the boundary of a mixing zone must be nonsignificant as defined by ARM Title 17, chapter 30, subchapter 7, unless the change in water quality is authorized by the department pursuant to 75-5-303, MCA.

(c) For sources discharging under a permit issued by the department prior to April 29, 1993, any mixing zone allowed under the permit will remain in effect until renewal. Upon renewal, any previously allowed mixing zone will be designated in the renewed permit, unless there is evidence that the previously allowed mixing zone will impair existing or anticipated uses.

(d) In accordance with 75-5-306, MCA, it is not necessary that industrial wastes, sewage, or other wastes, as defined in 75-5-103, MCA, be treated to a purer condition than the natural condition of the receiving water as long as the minimum treatment requirements are met and provided all reasonable land, soil, and water conservation practices have been applied.

(e) Estimated parameter levels in the mixing zone area will be calculated, unless the department determines that monitoring is necessary due to the potential harm to the impacted water and its beneficial uses.

(f) In granting a mixing zone, the department may impose conditions as necessary to comply with the requirements of this subchapter.

(2) Where the department determines that allowing a mixing zone at a given level for a parameter would threaten or impair existing beneficial use pursuant to this subchapter, discharge limitations will be modified as necessary to prevent the interference with or threat to the beneficial use. If necessary, these modifications may require achieving applicable numeric water quality criteria at the end-of-pipe for the parameter so that no mixing zone will be necessary or granted. (History: 75-5-301, MCA; IMP, 75-5-301, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499.)

17.30.506 WATER QUALITY ASSESSMENT (1) No mixing zone will be granted if it would threaten or impair existing beneficial uses. Before any mixing zone is allowed, the applicant must provide information, as requested by the department, to determine whether a mixing zone will be allowed as well as the conditions which should be applied.

(2) In making its determination, the department will consider the following factors:

(a) Biologically important areas: the presence of fish spawning areas or shallow water nursery areas within the proposed mixing zone or a "shore hugging" effluent plume in an aquatic life segment will support a finding that the mixing zone may be inappropriate during the spawning or nursery periods.

(b) Drinking water or recreational activities: the existence of a drinking water intake, a zone of influence around a drinking water well or a well used for recreational purposes, or a recreational area within or immediately adjacent to the proposed mixing zone will support a finding that a mixing zone is not appropriate. For purposes of these rules, "recreational" refers to swimming and "recreational area" refers to a public beach or swimming area, including areas adjacent to streams or lakes.

(c) Attraction of aquatic life to the effluent plume: where currently available data support a conclusion that fish or other aquatic life would be attracted to the effluent plume, resulting in adverse effects such as acute or chronic toxicity, it may be appropriate to adjust a given mixing zone for substances believed to cause the toxic effects.

(d) Toxicity/persistence of the substance discharged: where a discharge of a parameter is at a concentration that is both toxic and persistent, it may be appropriate to deny a mixing zone. Toxicity and persistence will be given added weight to deny a mixing zone where the parameter is expected to remain biologically available and where a watershed-based solution has not been implemented. For ground water, this factor will also be considered in areas where the parameter may remain in the ground water for a period of years after the discharge ceases.

(e) Passage of aquatic organisms (including access to tributaries): where currently available data indicate that a mixing zone would inhibit migration of fish or other aquatic species, no mixing zone may be allowed for the parameters that inhibit migration. In making this determination, the department will consider whether any parameter in the effluent plume will block migration into tributary segments.

(f) Cumulative effects of multiple mixing zones: in some cases, the existence of multiple or overlapping mixing zones may threaten or impair the existing uses of the receiving water, so that any additional mixing zone will be limited or denied for the parameter of concern.

(g) Aquifer characteristics: when currently available data indicate that the movement of ground water or pollutants within the subsurface cannot be accurately predicted, such as the movement of ground water through fractures, and also indicate that this unpredictability might result in adverse impacts due to a particular concentration of a parameter in the mixing zone, it may be appropriate to deny the mixing zone for the parameter of concern.

(h) Ground water discharges to surface water: In the case of a discharge to ground water which in turn discharges to surface water within a reasonably short time or distance, the mixing zone may extend into the surface water, and the same considerations which apply to setting mixing zones for direct discharges to surface water will apply in determining the allowability and extent of the mixing zone in the surface water.

(i) Discharges to intermittent and ephemeral streams: the "natural condition" of these waters during periods of no flow will be the average quality that occurs during periods when flow is present. If a proposed discharge occurs when there is no flow, the quality of the discharge must be at or better than this quality. If variations in seasonal stream flow are known and a mixing zone is limited to use during periods when dilution is available, such a mixing zone may be allowed by the department. (History: 75-5-301, MCA; IMP, 75-5-301, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499.)

17.30.507 SPECIFIC RESTRICTIONS FOR SURFACE WATER MIXING ZONES (1) Mixing zones for surface waters are subject to the following water quality standards:

(a) narrative water quality standards, standards for harmful substances, numeric acute and chronic standards for aquatic life; standards in Department Circular DEQ-12A; and standards based on human health must not be exceeded beyond the boundaries of the surface water mixing zone;

(b) acute standards for aquatic life for any parameter may not be exceeded in any portion of a mixing zone, unless the department specifically finds that allowing minimal initial dilution will not threaten or impair existing beneficial uses.

(2) Discharges to wetlands (other than constructed wetlands) will not be granted a mixing zone for parameters for which the state has adopted numeric acute or chronic standards for aquatic life or for human health in the surface water quality standards, unless the following can be demonstrated to the satisfaction of the department:

(a) the standards referenced in (1) will not be exceeded beyond the boundaries of the mixing zone;

(b) existing beneficial uses will not be threatened or harmed; and

(c) the conditions in 75-5-303(3), MCA, are met.

(3) For discharges to surface water that first pass through the ground, such as discharges from infiltration systems or land application areas, the surface water mixing zone begins at the most upstream point of discharge into the receiving surface water. If the discharge continues to occur downstream beyond a distance equal to 10 times the stream width measured at the upstream discharge point at low flow, a standard mixing zone will not be granted. (History: 75-5-301, MCA; IMP, 75-5-301, 75-5-313, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499; AMD, 2014 MAR p. 1815, Eff. 8/8/14.)

17.30.508 SPECIFIC RESTRICTIONS FOR GROUND WATER MIXING ZONES (1) Mixing zones for ground water are to be limited and comply with the following water quality standards:

(a) Human health based ground water standards must not be exceeded beyond the boundaries of the mixing zone.

(2) No mixing zone for ground water will be allowed if the zone of influence of an existing drinking water supply well will intercept the mixing zone. (History: 75-5-301, MCA; IMP, 75-5-301, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499.)

Rules 17.30.509 through 17.30.514 reserved

17.30.515 DEPARTMENT PROCEDURES (1) The department will determine whether a mixing zone is appropriate for a particular discharge during the department's permit, permit renewal, approval, order, or authorization review process pursuant to the rules in this subchapter. The department may determine that:

(a) no mixing zone shall be granted;  
(b) the standard mixing zone applied for is appropriate;  
(c) the source specific mixing zone applied for is appropriate; or  
(d) an alternative or modified mixing zone, as defined by the department, is appropriate.

(2) A person applying to the department for a mixing zone must indicate the type of mixing zone applied for and supply sufficient detail for the department to make a determination regarding the authorization of the mixing zone under the rules of this subchapter.

(3) A source specific mixing zone may not be used unless approved by the department.

(4) In making a determination of nonsignificance under the rules in ARM Title 17, chapter 30, subchapter 7, a person may use a standard mixing zone without approval from the department or request that the department specifically designate a mixing zone, which may be either a standard or source specific mixing zone.

(5) Department determinations regarding mixing zones will be accomplished within the time frames required for the underlying permit, approval, or authorization, and the applicant will be notified of that determination according to those same requirements. In all other cases, department determinations will be made and the applicant notified within 30 days after receipt of a complete application.

(6) After receiving notification of the department's determination the applicant may:

(a) accept the department's determination;  
(b) modify the proposed mixing zone and reapply; or  
(c) appeal the department's decision pursuant to any applicable provision of law. (History: 75-5-301, MCA; IMP, 75-5-301, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499.)

17.30.516 STANDARD MIXING ZONES FOR SURFACE WATER (1) If a discharge to surface water is small in comparison to the volume of the receiving water or if the mixing is nearly instantaneous and the parameter(s) of concern will not threaten or impair existing uses as determined under ARM 17.30.506, a standard mixing zone may be used.

(2) A standard surface water mixing zone will not be granted for a new or increased discharge to a lake or wetland.

(3) Facilities that meet the terms and conditions in (a) through (e) qualify for a standard mixing zone as follows:

(a) Facilities that discharge a mean annual flow of less than one million gallons per day (MGD) to a stream segment with a dilution ratio greater than or equal to 100:1. For purposes of this procedure, the stream dilution ratio is defined as the seven-day, ten-year (7Q10) low flow of the stream segment without the discharge, divided by the mean annual flow of the discharge. In this case discharge limitations will be based on dilution with the 7Q10.

(b) Facilities that discharge a mean annual flow less than one MGD to a stream segment with a dilution less than 100:1. In cases where dilution is less than 100:1, discharge limitations will be based on dilution with 25 percent of the 7Q10.

(c) Facilities that discharge to surface waters through the ground may qualify for a standard surface water mixing zone.

(d) Facilities whose discharge results in a nearly instantaneous mixing zone. Discharge limitations shall be based on dilution with the seven-day, ten-year low flow of the receiving water except as limited by consideration of the factors listed in ARM 17.30.506. For surface waters, nearly instantaneous mixing will be assumed when there is an effluent diffuser which extends across the entire stream width (at low flow), or when the mean daily flow of the discharge exceeds the seven-day, ten-year low flow of the receiving water. A discharge may also be considered nearly instantaneous if the discharger so demonstrates in accordance with a study plan approved by the department. For the purposes of this demonstration nearly instantaneous mixing will be assumed when there will be not more than a ten percent difference in bank-to-bank concentrations at a downstream distance less than two stream/river widths.

(e) Facilities that discharge the parameters found in Department Circular DEQ-12A to surface water. Discharge limitations must be based on dilution with the entire seasonal 14-day, five-year (seasonal 14Q5) low flow of the receiving water without the discharge.

(4) The length of a standard mixing zone for flowing surface water, other than a nearly instantaneous mixing zone, must not extend downstream more than the one-half mixing width distance or extend downstream more than ten times the stream width, whichever is more restrictive. For purposes of making this determination, the stream width as well as the discharge limitations are considered at the 7Q10 or seasonal 14Q5 low flow. The seasonal 14Q5 low flow may be used only in conjunction with base numeric nutrient standards in Department Circular DEQ-12A. The recommended calculation to be used to determine the one-half mixing width distance downstream from a stream bank discharge is described below.

(a)  $A_{1/2} = [0.4(W/2)^2V]/L$ , where:

(i)  $A_{1/2}$  = one-half mixing width distance;

(ii)  $W$  = width in feet at the 7Q10 or seasonal 14Q5;

(iii)  $V$  = velocity of the stream at the 7Q10 or seasonal 14Q5 downstream of the discharge (in ft/second);

(iv)  $L$  = lateral dispersion coefficient for the 7Q10 or seasonal 14Q5 downstream of the discharge (in  $\text{ft}^2/\text{second}$ ), where:

(b)  $L = CDU$ , where:

(i)  $C$  = channel irregularity factor immediately downstream of the discharge, where:

- (A)  $C = 0.1$  for straight, rectangular streams;
- (B)  $C = 0.3$  for channelized streams;
- (C)  $C = 0.6$  for natural channels with moderate meandering;
- (D)  $C = 1.0$  for streams with significant meandering; and
- (E)  $C = 1.3$  for streams with sharp  $90^\circ$  or more bends;
- (ii)  $D$  = average water depth at the 7Q10 or seasonal 14Q5 downstream of the discharge (in feet);
- (iii)  $U$  = shear velocity (in ft/sec), where:
- (c)  $U = (32.2DS)^{1/2}$ , where:
  - (i) 32.2 is the acceleration due to gravity ( $32.2 \text{ ft/sec}^2$ );
  - (ii)  $D$  = average water depth at the 7Q10 or seasonal 14Q5 downstream of the discharge (in feet); and
  - (iii)  $S$  = slope of the channel downstream of the discharge (feet/feet).
- (5) Monitoring may be required at the downgradient boundary of a surface water mixing zone only when there is a site-specific, impact-related reason to require such monitoring.
- (6) A standard surface water mixing zone may be modified by the department on a case-by-case basis depending upon existing uses, flow regime, and the configuration of the stream channel. Where currently available data indicates that modifying a standard mixing zone would threaten or impair existing beneficial uses under ARM 17.30.506, the facility will not qualify for this modification procedure. (History: 75-5-301, MCA; IMP, 75-5-301, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499; AMD, 2006 MAR p. 528, Eff. 2/24/06; AMD, 2014 MAR p. 1815, Eff. 8/8/14.)

17.30.517 STANDARD MIXING ZONES FOR GROUND WATER (1) The following criteria apply to determine which discharges qualify for a standard ground water mixing zone:

- (a) A standard ground water mixing zone is generally applicable in unconfined aquifers, but may not be appropriate for semi-confined or confined aquifers or in aquifers where ground water moves through fractures.
- (b) Disposal systems that discharge to ground water through infiltration, drainfields, injection through a disposal well, leakage from an impoundment, seepage from a land application area, or other methods may qualify for a standard mixing zone.
- (c) To determine if the discharge qualifies for a standard ground water mixing zone, the person proposing the discharge must estimate the anticipated concentration of pollutants at the downgradient boundary of the mixing zone (aquatic life standards do not apply in ground water). If the estimated concentration meets the nonsignificance criteria at the boundary of the mixing zone, as specified in ARM Title 17, chapter 30, subchapter 7, the discharge qualifies for a standard mixing zone.

(d) The estimation required in (c) must be based on a calculation of the volume of water moving through a standard cross-section of aquifer. The calculated volume of water moving through the aquifer cross-section is hypothetically mixed with the known volume and concentration of the discharge to determine the resulting concentration at the boundary of the mixing zone. The recommended method to determine the resulting concentration at the boundary of a standard ground water mixing zone is described below:

(i) Computations of the volume of ground water available for mixing are based on the equation:  $Q = KIA$ , where:

- (A)  $Q$  = volume of flow;
- (B)  $K$  = hydraulic conductivity;
- (C)  $I$  = gradient; and
- (D)  $A$  = aquifer cross-section area.

(ii) Values for hydraulic conductivity ( $K$ ) and gradient ( $I$ ) may be obtained from field observations or estimated from other sources.

(iii) A specific depth and width are necessary to determine the aquifer cross-section area ( $A$ ) for a standard mixing zone. The aquifer cross-section area prescribed by the following lengths is used as the area ( $A$ ) in the equation:

(A) The depth of a standard ground water mixing zone extends from the top of the water table beneath the source down to 15 feet below the water table.

(B) The width of a standard mixing zone is equal to the width of the source plus the distance determined by the tangent of  $5^\circ$  times the length of the mixing zone on both sides of the source.

(iv) It is assumed that mixing between the discharge and the receiving ground water is complete at the aquifer cross-section area at the standard distance downgradient from the source.

(v) It is also assumed that pollutants discharged from the source do not change in volume or concentration as they migrate through the unsaturated zone down to the water table.

(vi) The concentration of the parameter in the ground water must be measured to determine the existing load present in the ground water. The calculated volume of ground water with a measured concentration is hypothetically mixed with the known volume and concentration of the discharge using the following procedure:

(A) Volume of ground water times the concentration of the parameter = existing load;

(B) Volume of discharge times the concentration of the parameter = waste load; and

(C)  $(\text{Existing load} + \text{waste load}) / \text{total volume} = \text{resulting concentration}$ .

(vii) If the resulting concentration does not exceed the nonsignificance criteria specified in ARM Title 17, chapter 30, subchapter 7, for new or increased sources at the mixing zone boundary, a standard mixing zone may be granted.

- (viii) The downgradient boundary of the standard mixing zone extends:
- (A) 100 feet for a single family septic system drainfield in towns or subdivisions where individual lots are less than two acres in size;
  - (B) 200 feet for a single family septic system in subdivisions of five to 10 acres where lots are two acres in size or larger;
  - (C) For subdivisions with centralized water service, to the exterior boundaries of the contiguous surrounding undeveloped land, if development of that land is prohibited in perpetuity and title evidence of this fact is provided to the department.
  - (D) 500 feet for any other source of waste discharging into ground water.
- (ix) Monitoring may be required at the downgradient boundary of the mixing zone to measure compliance for a ground water mixing zone established for other than a single family septic system drainfield, if there is an overriding site-specific impact-related reason to require monitoring and the mixing zone is within 500 feet of surface water, another ground water mixing zone, or a drinking water well, or if there is some other overriding site-specific, impact-related reason to require monitoring. (History: 75-5-301, MCA; IMP, 75-5-301, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499.)

17.30.518 SOURCE SPECIFIC MIXING ZONES (1) If adequate information regarding stream flow or ground water flow is not available or if a standard mixing zone is not applicable or desired by the applicant, an applicant may request a source specific mixing zone.

(2) A source specific surface or ground water mixing zone will only be granted after the applicant demonstrates to the department that the requested mixing zone will comply with the requirements of ARM 17.30.506 and 17.30.507 and the provisions of 75-5-303, MCA.

(3) For lakes, the area of a mixing zone must not exceed 5% of the area of the lake or extend more than a 200 foot radius from the discharge, whichever is more restrictive.

(4) For source specific mixing zones in other surface water, the applicant shall provide information adequate to demonstrate to the department that the requirements of 75-5-301(4), MCA, are satisfied. In addition, the applicant shall present a discussion of the mixing zone in the context of the restrictions and general considerations specified in ARM 17.30.506, and information addressing the following items, as applicable:

- (a) quantity, toxicity, and persistence of the pollutant;
- (b) rate of flow;
- (c) volume of flow;
- (d) concentration of pollutants within the mixing zone;
- (e) length of time pollutants will be present;
- (f) proposed boundaries of the mixing zone;
- (g) potential impacts to water uses;
- (h) potential compliance monitoring;
- (i) contingency plan if pollutants migrate beyond the mixing zone at concentrations greater than the allowed limits; and
- (j) specific explanation as to why the proposed mixing zone is the smallest practicable size and why it will have a minimum practicable effect on water users.

(5) For source specific mixing zones in ground water the applicant shall provide information adequate to demonstrate to the department that the requirements of 75-5-301(4), MCA, are satisfied. In addition, the applicant shall present a discussion of the mixing zone in the context of the restrictions and general considerations specified in ARM 17.30.506, and information addressing the following items, as applicable:

- (a) quantity, toxicity, and persistence of the pollutant;
  - (b) water-bearing characteristics of subsurface materials;
  - (c) rate and direction of ground water flow;
  - (d) pollutant migration;
  - (e) volume of ground water and area available for mixing;
  - (f) concentration of pollutants within the mixing zone;
  - (g) length of time pollutants will be present;
  - (h) proposed boundaries of the mixing zone;
  - (i) potential impacts to water uses;
  - (j) compliance monitoring;
  - (k) contingency plan if pollutants migrate beyond the mixing zone at concentrations greater than the allowed limits; and
  - (l) specific explanation as to why the proposed mixing zone is the smallest practicable size and why it will have a minimum practicable effect on water users.
- (History: 75-5-301, MCA; IMP, 75-5-301, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499.)

