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A Preliminary Assessment of Mineralogical Criteria on the Utility of Argillaceous Rocks and Minerals for High-Level Radioactive Waste Disposal

Otto C. Kopp

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A PRELIMINARY ASSESSMENT OF MINERALOGICAL CRITERIA ON THE UTILITY OF ARGILLACEOUS ROCKS AND MINERALS FOR HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL

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A PRELIMINARY ASSESSMENT OF MINERALOGICAL CRITERIA ON THE UTILITY OF ARGILLACEOUS ROCKS AND MINERALS FOR HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL

Otto C. Kopp

ABSTRACT

Shales and clay-rich rocks possess very favorable properties for the isolation and containment of high-level radioactive waste. Clays and mixtures of clay minerals with other substances also appear to be among the most suitable materials for buffers and backfill in underground repositories.

The purpose of this study was to review available data concerning the properties reported for these rocks and minerals to determine whether such information could be instrumental in selecting the more favorable assemblages of clays for waste repository purposes.

Literature searches were conducted for reports dealing with the properties of these argillaceous materials. The properties that were obtained from appropriate references were recorded in an Appleworks Database (Appendix A). The data are divided into five major groups: chemical properties, general physical properties, hydrologic properties, mechanical properties, and thermal properties. The Database includes such information as the type of material, formation name, geological age, location, depth, test conditions, results, and reference(s). Partial data are recorded in separate Appendixes based on property (Appendix B), material (Appendix C), and formation name (Appendix D).

In general, noticeable correlations were not apparent when mineralogical information was compared with various properties using plots of the data for each individual property. The best correlations were obtained for chemical and certain mechanical and hydrologic properties. Thermal properties appear to be least influenced by clay mineral composition.

An important reason for the inability to correlate mineralogical compositions with most properties was the lack of uniformity of test methods, test conditions, and even the units used for reporting the final data. Also, there was very limited information concerning the mineralogical compositions of most of the shales tested.

The potential exists for identifying the more suitable formations (or specific horizons within formations) using mineralogical data; however, in order to make such selections, it will be necessary to collect future data using standardized

test methods and conditions. The mineralogical compositions of the samples tested need to be determined quantitatively rather than qualitatively. In addition, information relative to the character of argillaceous rocks (e.g., degree of preferred orientation of the clay flakes, and the nature and extent of cementation) will aid our understanding of the relationships between mineralogical composition and rock properties.

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1. INTRODUCTION

The Oak Ridge National Laboratory (ORNL) recently completed a comparative evaluation of five sedimentary rocks (CROFF 1986a, 1986b, and 1986c), notably shales, carbonates, sandstones, anhydrite, and chalk, to determine their relative potential as host media for the disposal of high-level radioactive wastes. On the basis of generic features and characteristics, shale was determined to have the greatest potential for waste repository development.

Thick and extensive deposits of shale underlie most regions of the United States (GONZALES 1985). These possess a wide range of chemical, hydrologic, mechanical, and thermal properties. Furthermore, shales consist, for the most part, of clay minerals or clay-sized mineral grains. The most common groups of these clays are illite, smectite, chlorite, and kaolinite. With variations in the types and quantities of clays as well as nonclay constituents, such as quartz, it is not unexpected that shales show wide differences in properties and behavior. With increasing age, temperature, and pressure, illitic clays tend to dominate in shale deposits while smectitic clays are frequently most abundant in younger sediments. Carbonate and carbon contents are usually low in shales but, in certain deposits, may range up to 50% for the former and 15% for the latter. Thus, the type and amount of clay, organic content, and carbonate content are the greatest variables in shale compositions.

In order to select shales that possess the most favorable characteristics for repository utility, it is apparent that data on the chemical, hydrologic, mechanical, and thermal properties of various shale types are needed, along with the mineralogical compositions of these shales. The initial step in this investigation was to survey the literature for measured values of material properties and to attempt to correlate them with the main group of mineralogical assemblages.

Several difficulties were apparent while trying to utilize the available literature data for comparing the compositions of shales and other clay-rich material with various properties. There was a lack of uniformity in the test methods and conditions, as well as the units used for reporting the results. These problems will be addressed in detail later.

2. CLAY MINERAL PROPERTIES

The intention of this report is to review the relationships between mineralogical composition and the properties of shaley rocks. For details concerning the mineralogic aspects of clay minerals, the interested reader is referred to standard clay mineralogy texts (e.g., GRIM 1968; MILLOT 1970; NEMECZ 1981) or to recent reports (e.g., WEAVER 1979; MEYER 1983) concerning the disposal of radioactive wastes.

Clay mineral properties can be difficult to measure accurately for several reasons. First, pure clay minerals are rather rare. Other constituents, such as quartz, feldspars, aluminum and/or iron oxides and hydroxides, organic matter, and other minor minerals, are usually present. Unless steps are taken to remove all impurities first, the test results will apply to a mixture of minerals rather than to a pure clay. On the other hand, if attempts are made to purify the clay, it is generally necessary to separate the impurities through mechanical and chemical treatments, and the resulting "pure" clay may differ from the material present in the rocks at a waste repository. Second, many important properties must be measured over long time intervals and/or distances. Attempts to measure such properties in the laboratory in small samples and in relatively short time periods may give results that are unrealistic when actual repository conditions are considered. Third, the interaction of clays with pore fluids of various compositions may result in changes in physical and/or chemical properties. Fourth, universally accepted laboratory methods are not available for many important properties; hence, even when splits* of the same material are tested, different workers may get different results. Fifth, the fact that different terms are sometimes used for essentially the same measured property and the lack of uniformity in the units used to express the results (especially in the older literature) make it difficult to compare and evaluate data obtained from different sources or measured at different times.

The nature of clay mineral properties will be outlined first because we need to know what these properties are, how they are determined, and how valid the determinations may be. Only then can we review the present state of knowledge about clays to see if the desired pieces of information are available, missing, or not well known.

Clay mineral properties may be divided into five major groups: chemical, general physical, hydrologic, mechanical, and thermal. The reader should bear in mind that many individual properties are closely interrelated. For example, two specimens of the same clay mineral compacted at two different pressures and/or moisture contents (hence having different densities) will differ in hydraulic conductivity. Likewise, hydraulic conductivity is strongly influenced by chemical bonds with water molecules at clay mineral surfaces and the nature of other chemical species present in the pore fluids.

The Database presented in Appendix A was prepared using the following references: BEALL 1982; BOCOLA 1981; BRADLEY 1983; CHAPMAN 1985; CROFF 1986a, 1986b, and 1986c; COUTURE 1983; DOE 1980, 1981; GONZALES 1985; GRAY 1984; KIBBE 1978; LOMENICK 1983; MEYER 1983; MOAK 1981; NEA 1979a, 1979b, 1981; OSCARSON 1983; PUSCH 1977, 1978; ROY 1982; SOUDEK 1983; WEAVER 1973, 1976, 1979; and WOOD 1981. Several other reports and report abstracts were examined but omitted because they contained no apparent useful information for this review.

Chemical properties (Appendix A.1) include batch distribution ratio, diffusivity, ion-exchange capacity, and sorption coefficient.

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*A split is defined here as a representative portion of a sample having the same mineralogy, chemical composition, and textural characteristics as similar portions of the same sample used for measuring other properties.

General physical properties (Appendix A.2) include density, moisture content (or water content), porosity, specific gravity, specific surface, and void ratio.

Hydrologic properties (Appendix A.3) include groundwater travel distance, hydraulic conductivity (and permeability), inflow, specific storage, and travel time.

Mechanical properties (Appendix A.4) include bulk modulus, cohesion, compressive strength, friction angle, plasticity (liquid limit, plastic limit, plastic or plasticity index, and shrinkage limit), Poisson's ratio, shear modulus, shear strength, swelling, swelling distance, swelling pressure, tensile strength, and Young's (elastic) modulus.

Thermal properties (Appendix A.5) include coefficient of linear expansion, heat capacity and specific heat capacity, thermal conductivity (heat conductivity), and thermal diffusivity.

A discussion of these individual properties follows.

3. CHEMICAL PROPERTIES

Chemical properties include batch distribution ratio (Rd) and sorption coefficient (Kd), ion-exchange capacity, and diffusivity. The first two properties are closely related and are measured by determining both the quantity of specific ions sorbed by the clays and clay-rich rocks being studied and the quantities of those ions remaining in the fluid phase. The appropriate equation is:

$$Kd = \frac{\text{g radionuclide on sorbent/g sorbent}}{\text{g radionuclide in fluid/mL fluid}} .$$

[Note: Kd describes the distribution of a trace element between two substances measured at equilibrium. In those cases where equilibrium is not proven, the term Rd may be used instead of Kd. Many of the values stated in the literature as Kd's are probably actually Rd's.]

These measurements are very sensitive to experimental conditions (temperature, pH, Eh, concentration, valence states, nature and concentrations of other ions present, etc.) and often show quite a range of values even for a single mineral species or rock type. Ion-exchange capacity (either cation or anion) is a related property but, in a strict sense, refers only to those ions that can be adsorbed onto exchange sites. There is no obvious mathematical relationship between batch distribution ratio or sorption coefficient and ion-exchange capacity; however, minerals that possess large ion-exchange capacities are likely to have large sorption coefficients.

Mass transport depends on hydraulic conductivity and the effective mass diffusion coefficient (OSCARSON 1983). If hydraulic conductivity is low, diffusion may be the dominant mechanism. Diffusion is strongly influenced by the Kd and is difficult to measure; hence, there are few values for properties such as diffusivity available.

Chemical properties will be very important in the selection of sites for waste disposal. The waste containers, buffers, and other nearby materials that may be used to isolate radioactive wastes may be breached by mechanical means or through corrosion. In that event, the surrounding host rock will act as the ultimate container, retarding the flow of fluids (into and/or out of the containers) and sorbing the radionuclides from any fluids that might escape. Many clay minerals do not have good sorption properties for anions such as iodine. Some workers (e.g., BEALL 1982) have suggested that other minerals (e.g., cinnabar, galena, and chalcocite) may be added to the buffer to sorb such anionic species.

The role of organics is also thought to be important. Organic compounds may react directly with some radionuclides. In addition, the presence of organic matter may influence the pH and Eh of the local environment and lead to changes in the valence states of certain radionuclides, which in turn could significantly change their solubilities and sorption behavior.

4. GENERAL PHYSICAL PROPERTIES

Density (the mass per unit volume of a substance) is an important property of clays and clay-rich rocks. The density value reflects not only the proportions of mineral matter and void spaces, but it can also be used to estimate the depth of burial of shale or as an indicator of the stress applied to clay-rich material (e.g., artificially compacted material).

Note that density can be determined for material that has been air-dried or oven-dried, is moist (as taken from saturated material), has been equilibrated with moist air, etc., or the density of the grains that comprise the sample can be measured. If the specific type of density determined was stated, it is listed in Appendix A.2. However, since the type of density may not be stated, caution is advised when comparing the results from several different sources. In some cases, tests were performed on clay minerals to which specific amounts of water had been added. (This is usually stated.) Caution is also advised if there is any evidence that the material was oven-dried since the properties of clay minerals, such as the smectites and halloysite, may be irrevocably changed if dried above certain temperatures in air. The results for samples of shales and other clay-rich rocks that were exposed to the atmosphere for extended periods prior to the determination of density will not represent the in situ values for the rocks. (The same statement applies to any properties measured on samples that have been allowed to dry out.) Values listed for specific gravity are normally dimensionless but can be readily converted to density values.

Several other important parameters, such as its hydraulic and thermal properties, are influenced directly or indirectly by the density of a rock sample. In fact, many important physical and chemical parameters are interrelated. Unfortunately, when various materials are tested, it is not feasible to change all of the possible variables; hence, specific tests relating two variables may be determined at only one or two temperatures, at a given pH, or under some other set of fixed conditions. In many cases, the experimental conditions are not stated in the reports examined. (However, some of this information may be available in the original references.)

Porosity and void ratio measure the amount of pore (open) space left between the solid mineral grains. Porosity expresses the percentage of pore space as compared with the total volume of the sample (total volume of pores divided by total volume of sample, multiplied by 100%). The meaning of effective porosity is less well defined but is taken here to be similar to that of porosity except that the pore space measured is limited to interconnected pore space from which fluids can migrate or into which fluids can enter. Like porosity, effective porosity is expressed as a percentage. For a given sample, effective porosity cannot exceed porosity; and, in general, the effective porosity is a much smaller percentage. In some reports, no dimensions are stated. Void ratio is a dimensionless number that expresses the ratio of the total volume of the pore spaces to the total volume of the solid (note that the ratio is not compared with the total volume of the sample).

Accurate determination of porosity is not easily accomplished. One technique uses mercury under pressure, which is forced into ever-smaller pore spaces. Porosity changes with depth and degree of cementation and, therefore, is markedly affected by grain size and shape distributions. Like bulk density, porosity is interrelated with many physical and chemical properties. For example, the amount of porosity and the nature of the substances that fill the pores of a rock will influence both its hydrologic and thermal properties.

Moisture content (or water content) designates the amount of water (usually in weight percent) contained in a clay or clay-rich rock. In some cases, the value represents the amount of water added to a clay or rock by the investigator in order to change its properties.

5. HYDROLOGIC PROPERTIES

The two most frequent measurements are hydraulic conductivity (K) and permeability (or intrinsic permeability) (k). Permeability, which is a measure of the ability of a substance to transmit fluids, is determined by several factors, including the rate of flow of the fluid (q), the cross-sectional area of the porous medium (A), the pressure drop along the length of the sample (Δp), the length of the sample (L), and the viscosity of the fluid (μ). The relationship among these variables is:

$$q = \frac{kA\Delta p}{\mu L} ,$$

where μ is in centipoises.

More recently, most investigators use K to characterize the flow of fluids through porous media. Hydraulic conductivity is determined by the density of the fluid (ρ_w), the acceleration due to gravity (g), the permeability of the solid (k), and the viscosity of the fluid (μ). The relationship among these variables is:

$$K = (k\rho_w g)/\mu \ ,$$

where k is given in square centimeters.

The terms permeability and hydraulic conductivity are often used interchangeably; hence, it is important to look at the units of measurement to determine which property was measured. They are related by:

$$K = 9.6 \times 10^{-7} \ k$$

and

$$k = 1.033 \times 10^{6} \ K.$$

Physical factors that influence hydraulic properties include grain packing, compaction history, grain size, grain size distribution, and the grain shapes. Morgenstern has presented evidence to show that in fine-grained rocks the particle arrangement dominates the hydraulic flow properties (RIEKE 1974).

Less information is available for specific storage, which refers to the volume of water taken into storage, or discharged, per unit volume of rock for a unit change in hydrostatic head. The equation for specific storage is:

$$S_s = \rho_w g(1/E_s + \phi/E_w) \ ,$$

where

S_s = specific storage,

g = weight of a unit volume of interstitial fluid,

E_s = modulus of compression of matrix,

ϕ = porosity, and

E_w = bulk modulus of the interstitial fluid.

Specific storage is related to the elastic properties of sediments and water. Few of the reports checked thus far have made reference to this property, but it may be a useful measurement in future studies of waste disposal sites.

Only limited references were made to properties such as groundwater travel distance, inflow, travel time, and hydraulic diffusivity. Groundwater travel distance is the distance (in meters) that groundwater will travel in 100,000 years. Inflow is an estimate (calculated) of the rate at which groundwater will flow into mined openings, making certain assumptions about the size of the opening, the hydraulic head, and extent of the saturated zone. Travel time is the length of time (years) that it will take (calculated) for groundwater to travel between the disturbed zone and the accessible environment.

6. MECHANICAL PROPERTIES

Strength, elasticity, and plasticity are very important mechanical properties of clays and clay-rich rocks. These properties can help us to resolve important questions concerning waste disposal such as: (1) will an underground opening remain open for a given period of time while materials are being emplaced; (2) will a substrate be capable of supporting vehicles being used to transport material; (3) will a substrate be capable of supporting canisters in a predetermined position; and (4) will manufactured materials (preformed blocks) maintain their shape during handling? There have been a number of recent studies and summaries of past studies concerning these properties. The reader's attention is especially directed to RIEKE (1974), a work which provides detailed explanations of many of the properties of argillaceous materials. Much of this information was developed by researchers during investigations of the sedimentary rocks found in oil fields. Here, vast quantities of argillaceous rocks were subjected to wide ranges of temperature, pressure, and time.

Strength, elasticity, plasticity, and other mechanical properties are affected by many of the other characteristics of clay-rich materials, including the clay mineral composition, the percentage of clays present, the presence of cements and other minerals, the grain size and shape distribution, the density and/or porosity, the amount of fluids present and the chemical species present in those fluids, the previous compactional history of the material, and the temperature. In many laboratory tests, only two or three variables are measured under a range of conditions. This makes it difficult to compare the results presented by different researchers. These properties will be, in part, site-specific (dominated by the properties of the host rocks) and, in part, determined by the materials and processes used to prepare materials for the buffer and backfill. Published reports of data on various strength properties can only give us ideas concerning the ranges that might be anticipated for clay-rich material.

Young's (elastic) modulus, modulus of rigidity, bulk modulus, and Poisson's ratio have been discussed in detail (RIEKE 1974). These researchers note several reasons why laboratory results (static and destructive) are subject to inaccuracies and why dynamic (nondestructive and/or in situ) measurements are more likely to reflect the true properties of a rock. Equations relating the elastic constants in an isotropic sedimentary rock body are summarized below:

Modulus of elasticity (Young's modulus): $E = 2G(1 + \gamma)$,

Modulus of rigidity (Shear modulus): $G = \dfrac{E}{2(1 - \gamma)}$,

Bulk modulus: $k = \dfrac{E}{3(1 - 2\gamma)}$,

Poisson's ratio: γ = ratio of lateral to longitudinal strain ,

where E is the slope of the stress-strain curve.

Compressive strength, shear strength, and tensile strength may be measured under several different sets of experimental conditions that are not always clearly stated in reports. The presence, or absence, of friction reducers on the platens can have a significant effect on the test results. In general, the "strength" of a material is determined by measuring the stress that is needed to cause failure. Failure may be manifested by cracking, rupture, shearing, and loss of load-bearing capacity. Data concerning unconfined compression tests of clay-rich material are fairly common; however, such information has limited application to conditions in waste repositories where the material will be mechanically compacted either during emplacement or by stress applied by the overburden within a geologically short time after a repository has been sealed. The strength of clay-rich material is affected primarily by its moisture content and plasticity. In addition, the clay mineralogy, the nature of the exchange sites and the manner in which water is oriented on the clay surfaces, stress history, grain size and shape distribution, confining pressure, temperature, rate of loading, and deformation are all factors that influence strength.

Plasticity can be measured in several different ways. A common method involves measuring the behavior of clays as water is added to the system. The various limits are collectively known as the Atterburg Limits, which are usually determined for soils or unconsolidated material. The plastic limit is given by the minimum weight percent water at which the material exhibits plastic behavior. The plastic behavior begins when enough water has been added to overcome the attractive forces between the individual clay grains and the shear strength of the clay diminishes significantly. The liquid limit is the minimum weight percent water at which the material behaves like a liquid. The plastic, or plasticity, index (liquid limit minus plastic limit) defines the limits of plastic behavior. The shrinkage limit is the weight percent water at which the volume decrease is no longer linearly proportional to the water content.

Plasticity will probably have little influence on the choice of deep disposal sites because of the preexisting compacted nature of the burial formation. These properties could be significant, however, in the selection of shallower sites (or less-compacted formations such as the Gulf Coast clays), and they could also be very important in the selection of buffer and/or backfill materials. For example, through proper selection, the behavior of the buffer and/or backfill could be modified to facilitate emplacement by making relatively small changes in water content.

Conversely, improperly selected material might give a false sense of security. Its strength might be diminished significantly if a small amount of water were added to the system by any means.

Volume stability (swelling and shrinking) is an important aspect of buffers and backfill material, as well as material which may be used to form a seal when a repository is closed. On the one hand, excessive swelling can generate pressure which might damage canisters or surrounding materials. On the other hand, excessive shrinkage might destroy the effectiveness of a seal and admit fluids from external sources or release fluids from within the repository site. Volume stability is affected by clay mineralogy, mineral content, volume of fluids present and their chemistry, porosity (void ratio), grain size and shape distribution, stress history, and temperature. Swelling is a measure of the amount (in percent) of volume change that occurs if water is added to an unsaturated clay under negligible confining pressure. Swelling pressure results if the clay-water mixture is confined. The more plastic clays, such as the smectites, tend to develop higher swelling pressures. Conversely, such clays are apt to undergo the greatest shrinkage when water is removed. Swelling distance refers to the distance that a clay will intrude into a small fracture in the surrounding rock.

7. THERMAL PROPERTIES

Thermal properties that have been measured for clays and clay-rich rocks include the coefficient of linear expansion, heat capacity and/or specific heat (two properties which are closely related), thermal conductivity (k or λ), and thermal diffusivity (D or a). These properties are related to each other by the equation:

$$D = k/C\rho \ ,$$

where

C = specific heat, and

ρ = density.

Thermal properties are very important because the heat generated by the radioactive wastes must be dissipated through the canisters, buffer, backfill, and the surrounding rock rapidly so that the localized effects are minimized. At the very least, there might be structural changes in nearby clay minerals (which might release water into the system).

Thermal properties can be measured in situ or in the laboratory, or calculated, taking into account the specific heat of the material being tested as well as other physical conditions of a hypothetical repository. Although a modest amount of thermal data is available, there appear to be only a few results derived from the testing of large samples.

8. DISCUSSION

A primary purpose of this investigation was to determine whether data from the literature could be used to select suitable shales or assemblages of clays for high-level waste repositories. Initially, it was thought that sufficient information would be available for a wide variety of materials so that the effects of mineralogical composition on most properties could be evaluated with confidence. In some cases, it may be possible to infer these relationships with a degree of confidence; however, in other cases, it would be foolhardy to try to judge relationships to mineralogy on the basis of the incomplete information presently available. Much of the information in the Database (Appendix A) was obtained from reports that summarized the data rather than being taken from the original references. Thus, it may be desirable to review selected original references to determine whether some of the needed information may be found there.

Several factors contribute to the problems encountered while attempting to establish any relationships. First, although the mineral content is known for many materials tested in laboratory studies of relatively pure minerals (and their mixtures with other minerals and rocks), the mineralogy of rock samples is frequently not given or is only stated in general terms (e.g., "illite-smectite dominant, plus lesser illite, kaolinite and chlorite"), which can only be used qualitatively. Second, the conditions used in the studies are not always stated, and even when this information is included, it is rare to find many samples that were tested under identical conditions. For example, it is difficult to make a valid comparison of the properties of two samples when one was tested at 25 MPa while "wet" and the other was tested at 200 MPa while "dry." The lack of consistency in units required the use of conversion factors, which introduces the possibility of mathematical error; and, in several cases, the units used for the property were not valid (e.g., thermal conductivity given in W/kg•K). Finally, for some properties (e.g., swelling distance), so few data sets were available that no meaningful comparisons could be made. This task would have been immeasurably easier if everyone who tests materials had a set of guidelines stipulating the information needed concerning the material, test methods, etc., and the units to be used in reporting the results.

8.1 CHEMICAL PROPERTIES

Plots were prepared for two groups of data: batch distribution ratio (Fig. 1) and cation-exchange capacity (Fig. 2). No sorption coefficient plot was prepared at this time because the data are so voluminous and the reported values cover a wide range. No attempt was made to interpret the single data set found for diffusivity.

The available data strongly suggest that the batch distribution ratio and the exchange capacities of clays, shales, etc., can be "predicted" to a high degree if their mineralogical compositions are known. In general, those samples that contain smectite minerals (or bentonite) and smectite-rich mixed-layer clays typically have the best capability for exchanging (or sorbing) cations. Although limited data were available for vermiculite, the same conclusion will probably hold true for this mineral as well as any rocks/soils that contain it as an important constituent.

While kaolinite and illite are generally considered to have less desirable chemical properties, they may have selective properties for certain ion species (e.g., illite for cesium). In general, the sorption coefficients for most clays for anionic species (such as iodine) are low, and it may be necessary to add other materials to correct this deficiency if clays are used in buffers or backfill.

Several other factors should be taken into consideration since they may also influence the behavior of any given material that might be

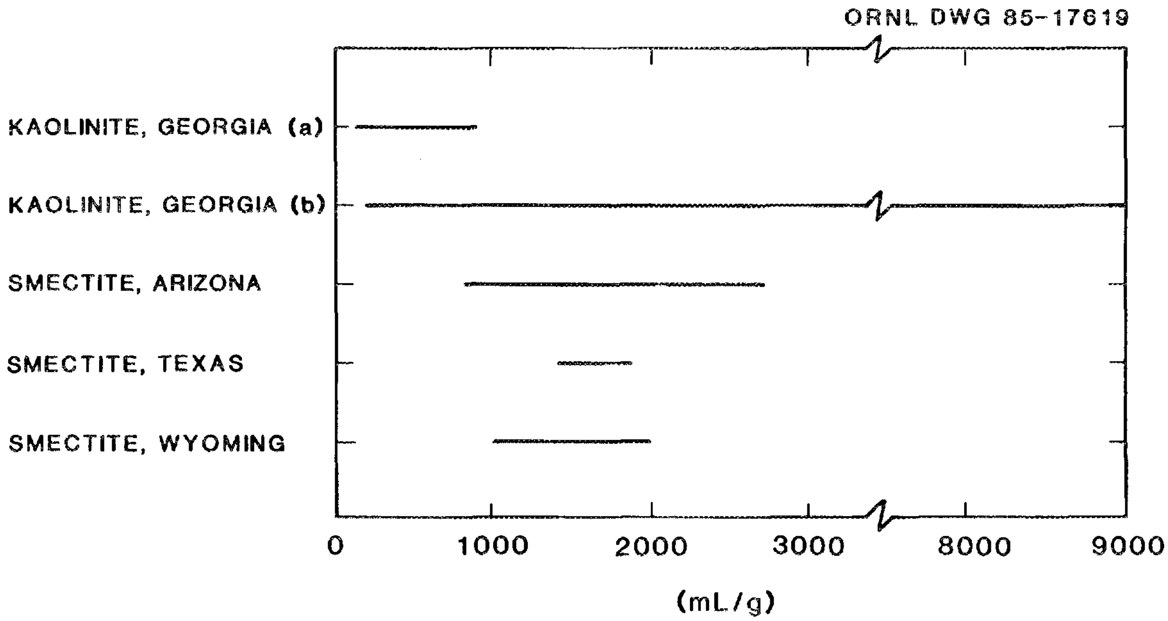

Fig. 1. Batch distribution ratio.

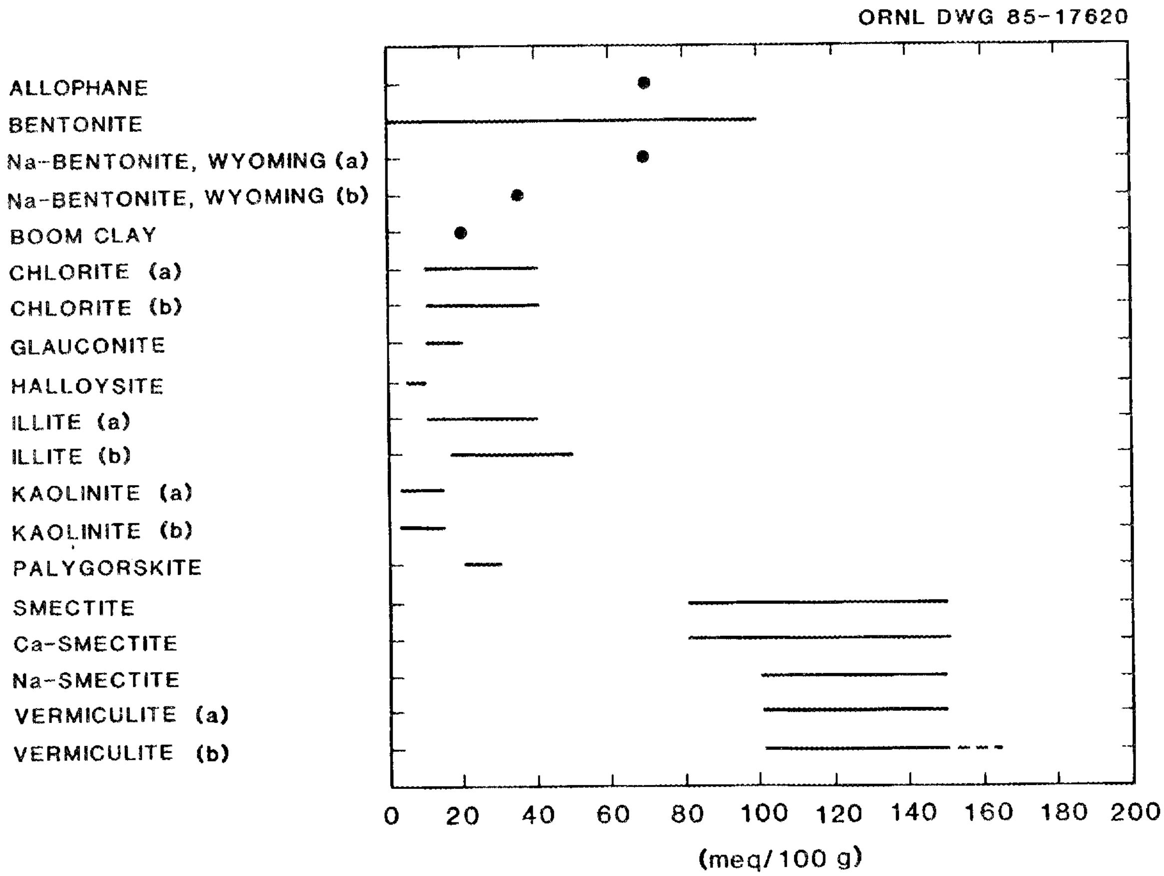

Fig. 2. Cation-exchange capacity.

evaluated. Both the density and the effective porosity of the material will affect its sorptive capacity, as will factors such as the ambient temperature and the physical and chemical conditions of the pore fluids (e.g., pH, Eh, and ion species present).

8.2 GENERAL PHYSICAL PROPERTIES

Plots were prepared for several groups of data, including density (type unspecified) (Fig. 3), density (bulk, natural, grain, etc.) (Fig. 4), density (dry) (Fig. 5), specific gravity (Fig. 6), moisture or water content (Fig. 7), porosity (several types) (Fig. 8), effective porosity (Fig. 9), specific surface (Fig. 10), and void ratio (Fig. 11). Limited data for wet density were not plotted.

The terminology for the several types of density and porosity shows considerable ambiguity. An attempt was made to reduce the number of types, but the nature of the property was also listed on the plots in case it is significant.

Most physical properties are not useful, per se, in predicting the suitability of specific rock bodies as host formations; however, for a given rock type (or mixture of minerals), the physical properties will change as other physical conditions change. For example, density generally increases with depth and/or pressure applied by some compacting device; porosity is usually affected in the opposite manner. Density and porosity are also influenced by the mineralogical composition and factors such as the grain size distribution, grain orientations, presence of pore fluids, and presence of cements.

What is potentially most useful is the fact that, for a given material, other properties will vary with respect to properties such as density. One might observe, for example, that for a given mixture of smectite and grains of sand (or crushed granite), the hydraulic conductivity will decrease (rate of flow will diminish) as the material is compacted and the density increases (and, conversely, the porosity decreases).

We may expect to find at least two relationships in natural systems (and be able to control them to some degree in artificial systems):

1. With increasing depth of burial, density will increase and any other properties (whether chemical, hydrologic, mechanical, or thermal) that

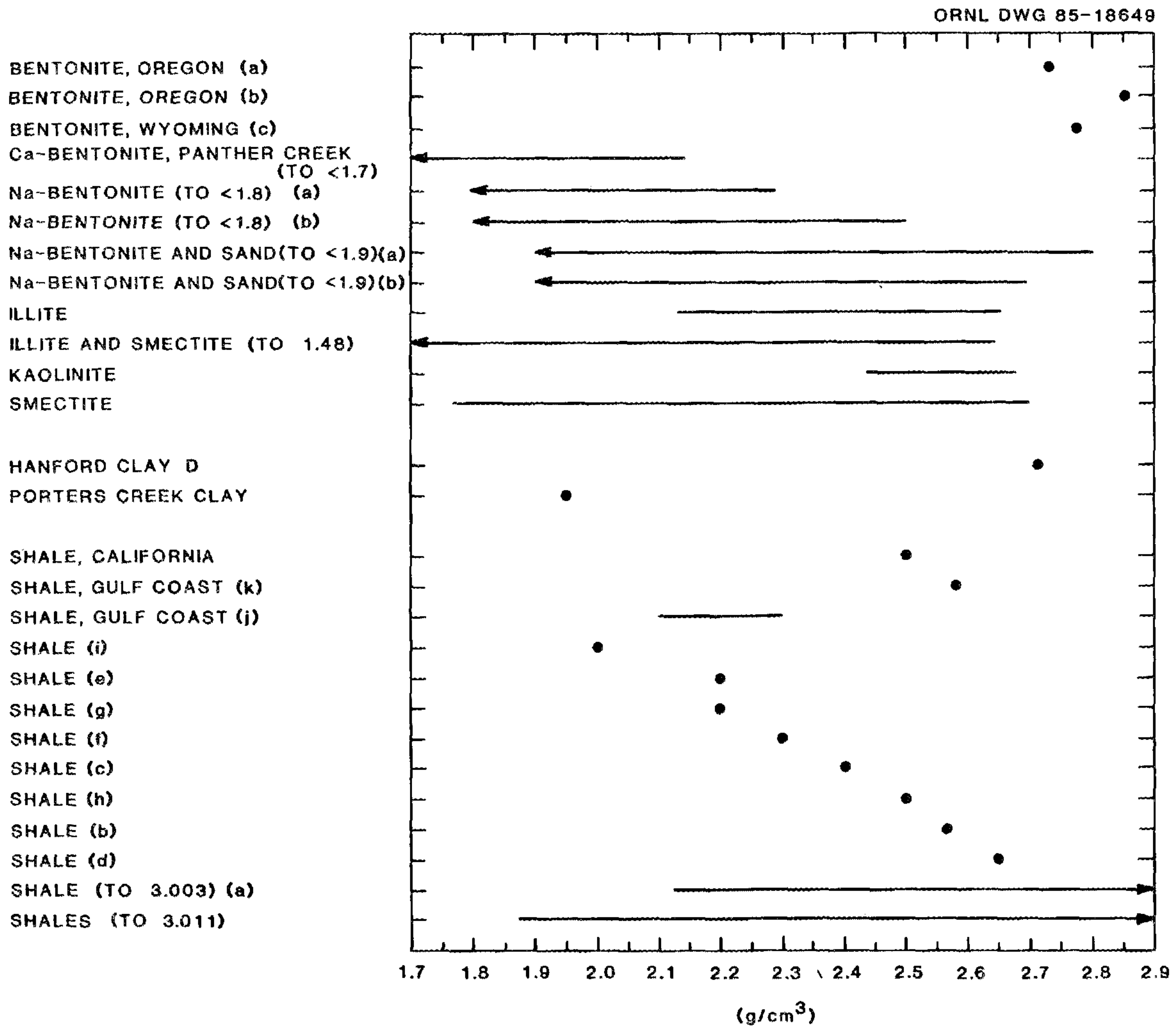

Fig. 3. Density (type not specified).

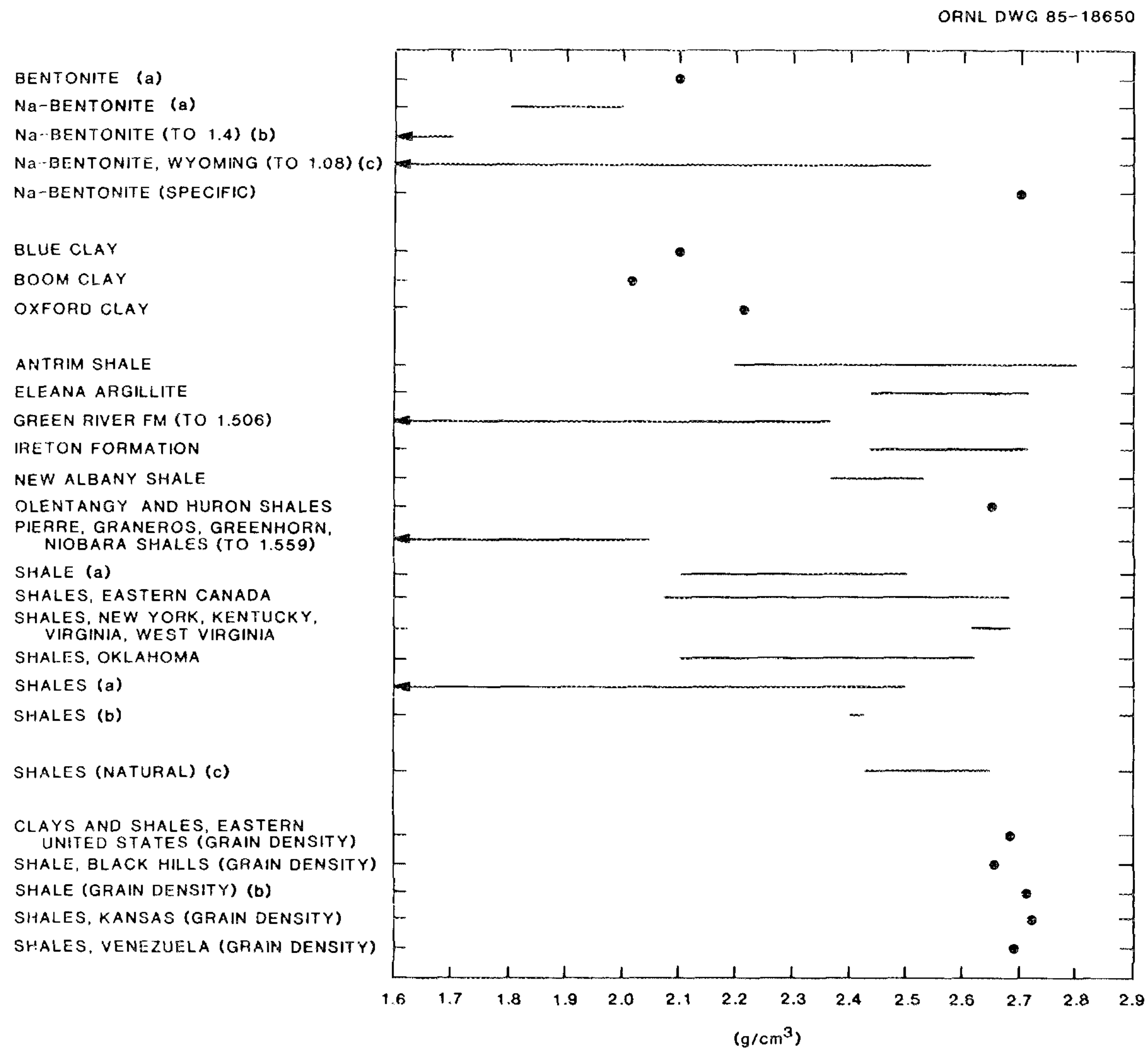

Fig. 4. Density (bulk, natural, grain, etc.).

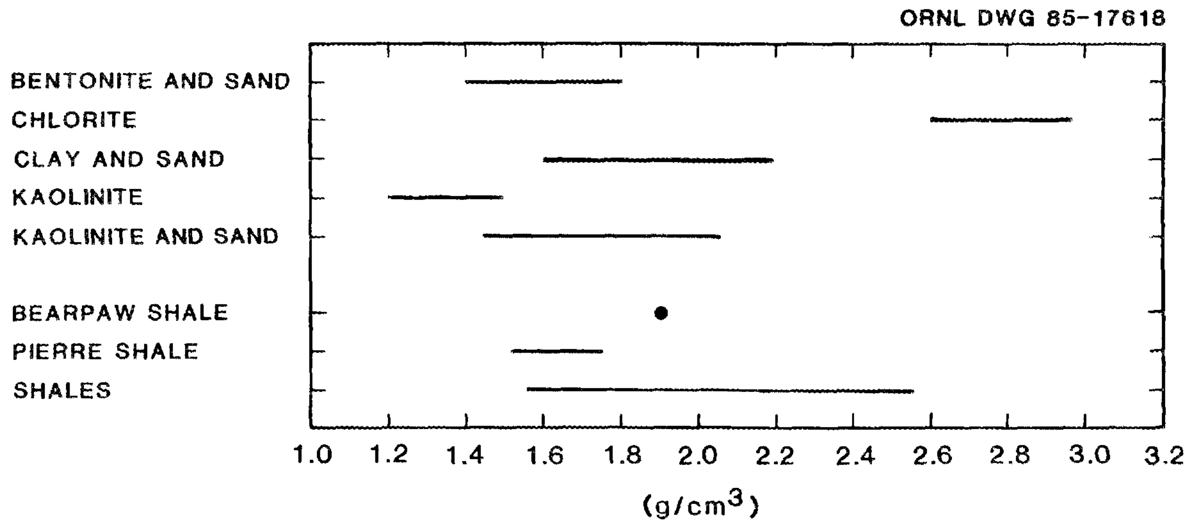

Fig. 5. Density (dry).

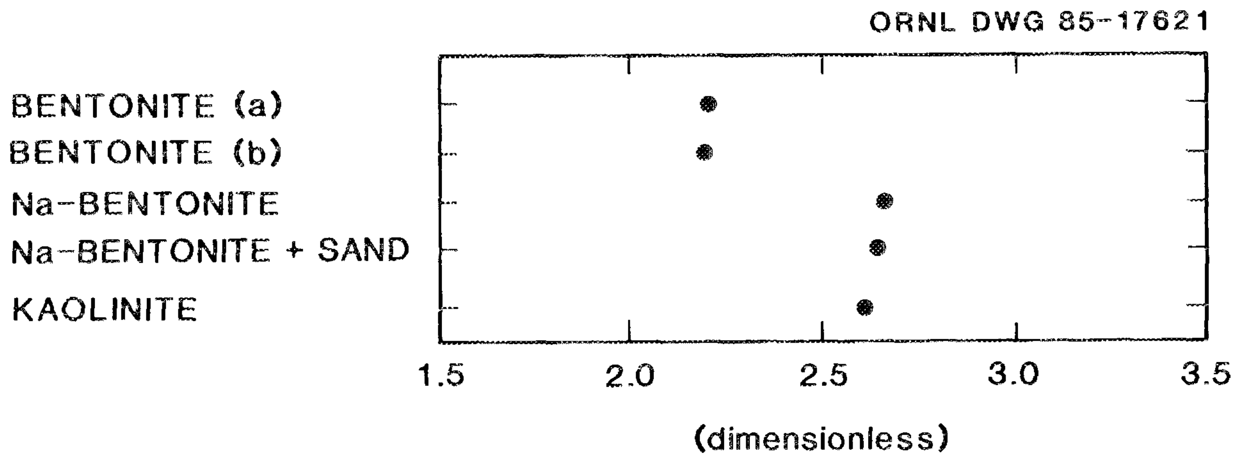

Fig. 6. Specific gravity.

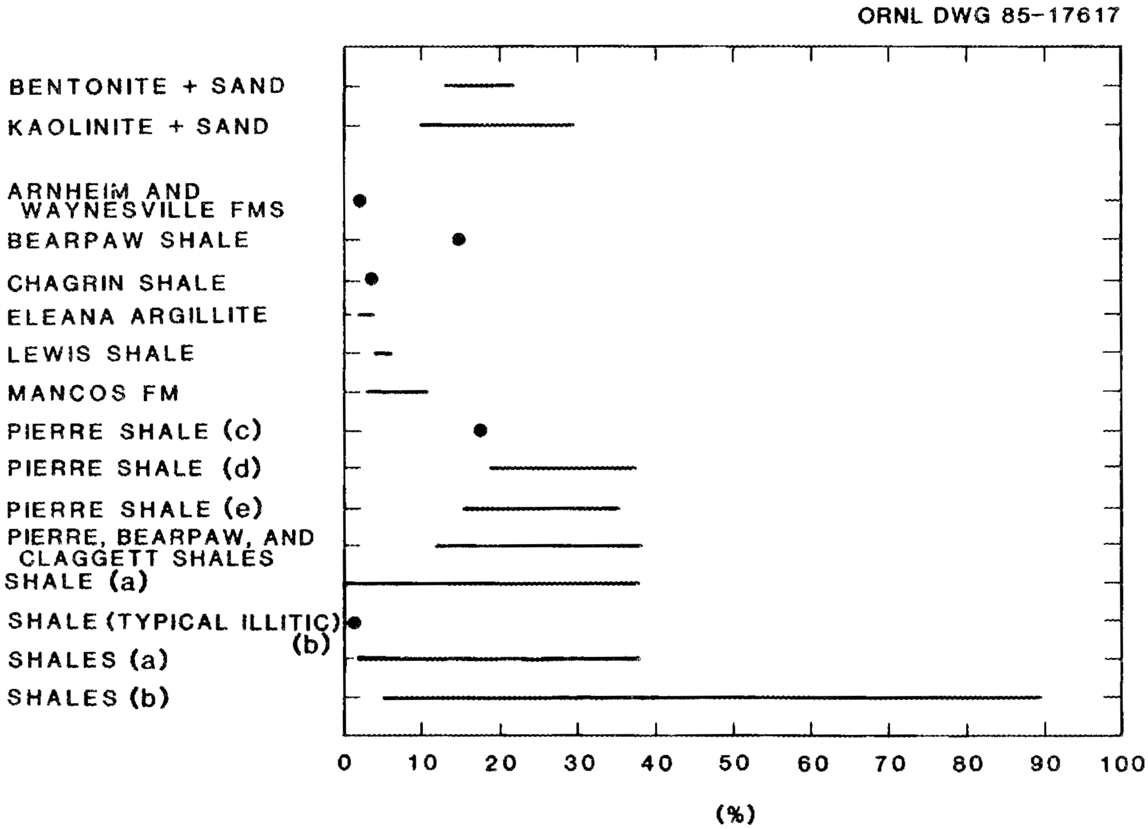

Fig. 7. Moisture (water) content.

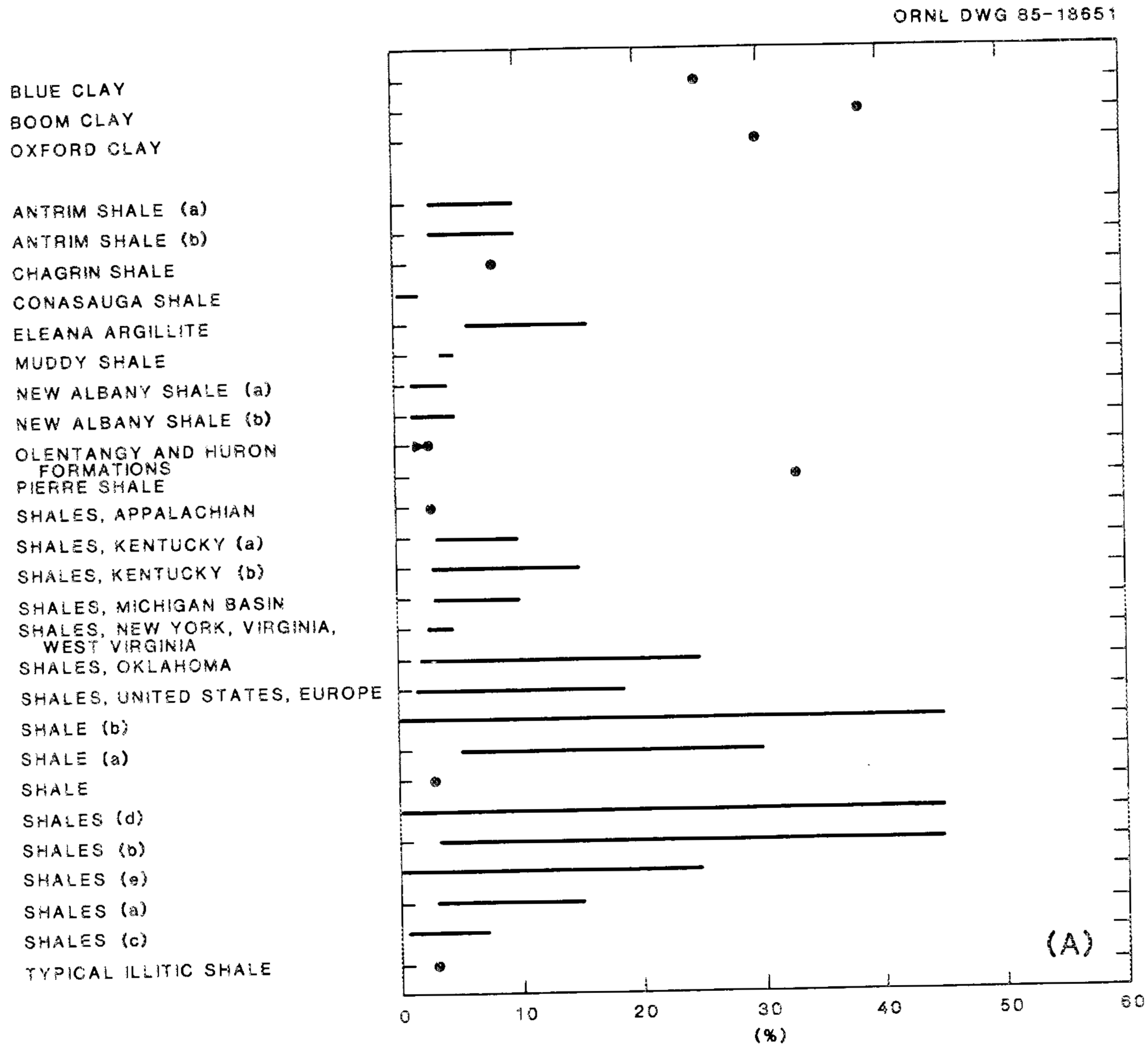

Fig. 8. Porosity (average, primary, rock mass, total, etc.) in (A) % and (B) units not stated.

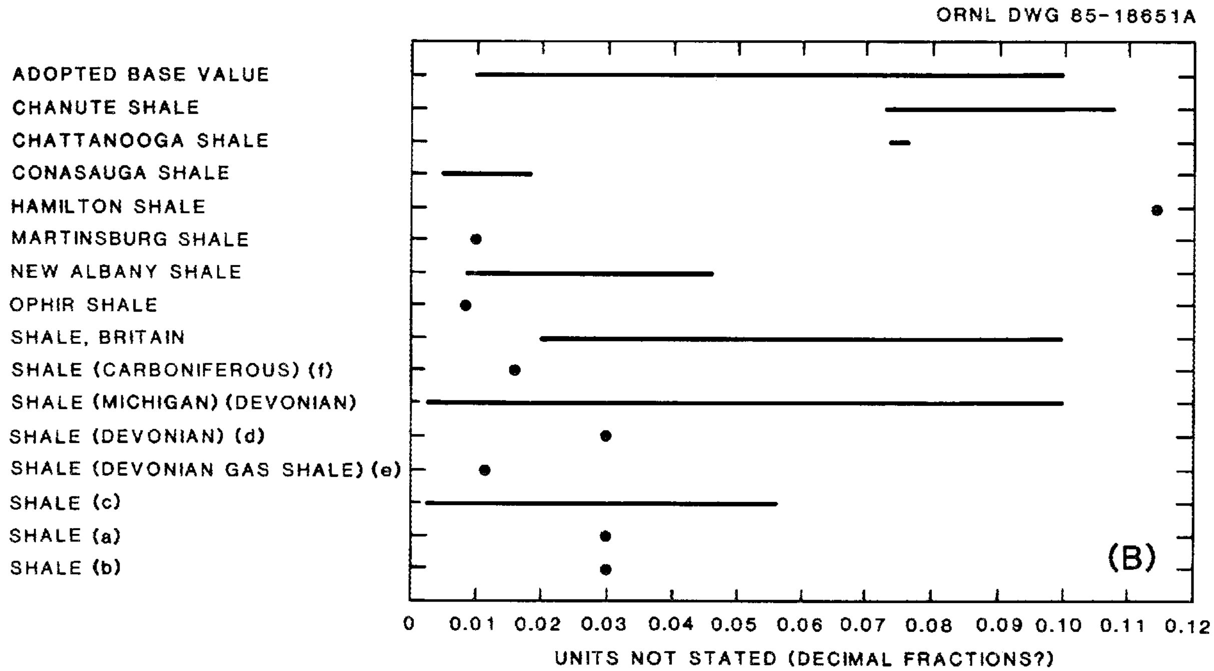

Fig. 8 (Continued).

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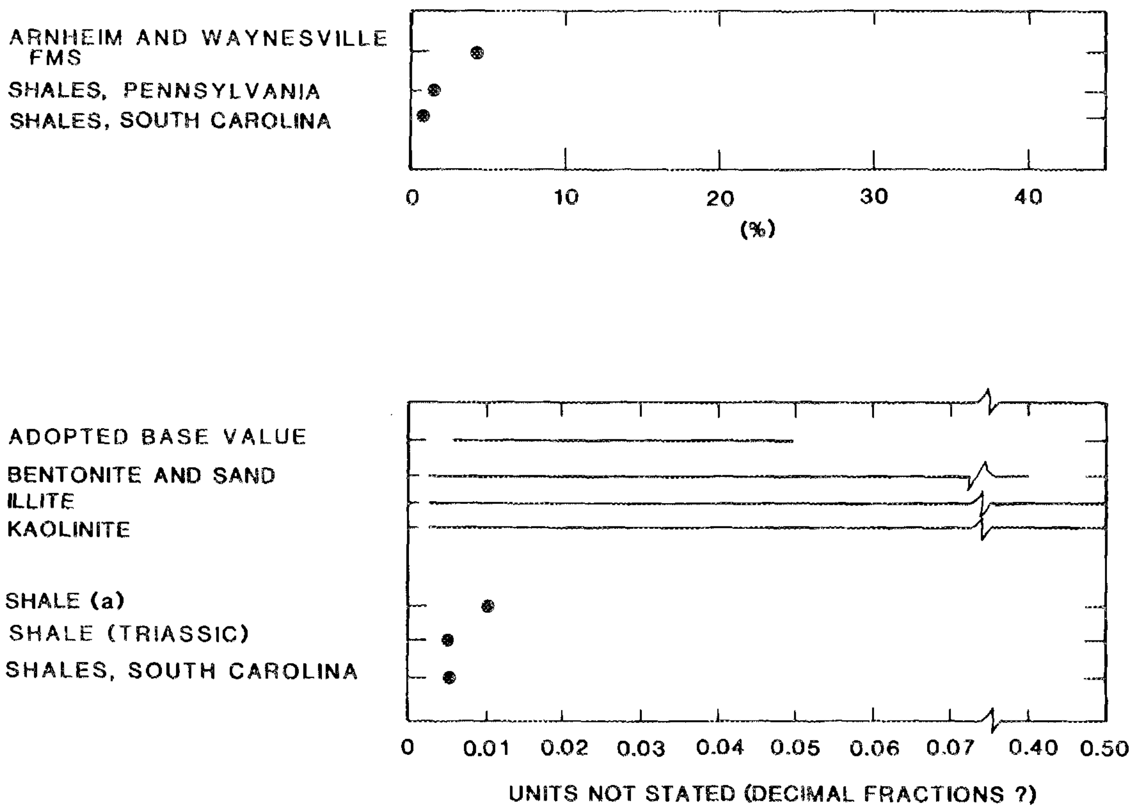

Fig. 9. Porosity (effective).

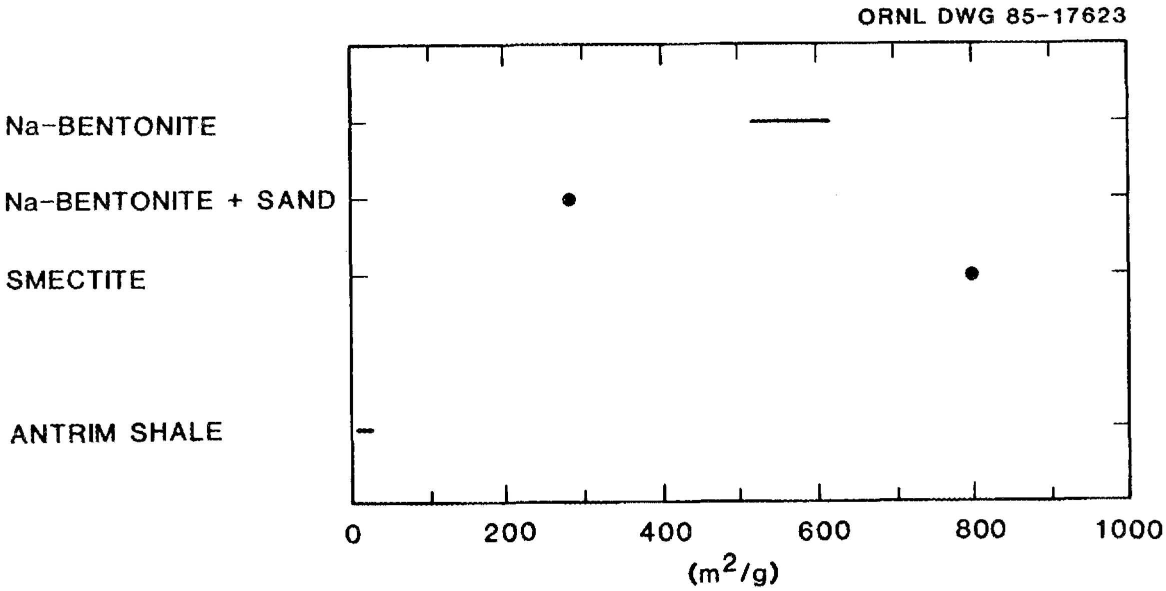

Fig. 10. Specific surface.

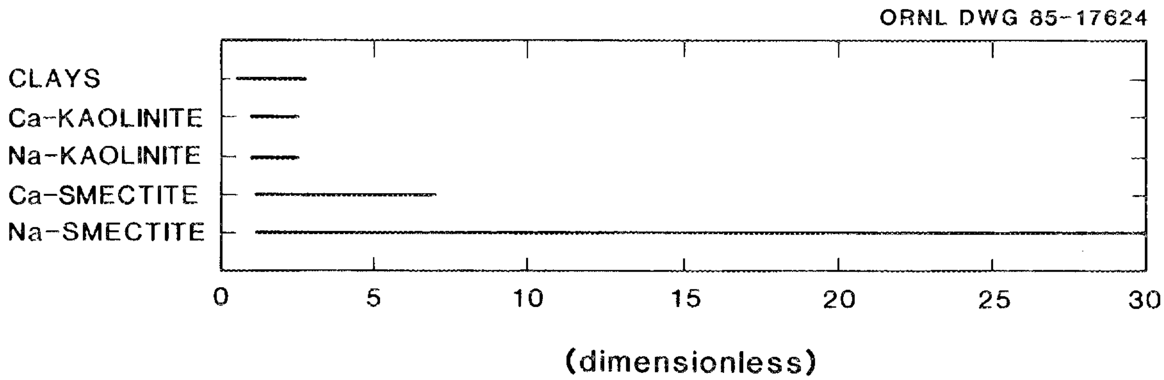

Fig. 11. Void ratio.

are related to density will also change as a function of depth of burial or degree of compaction.

2. We might look for similar relationships with respect to age; that is, older rocks may have greater density and less porosity, and their other properties will be related to these higher or lower values. Preliminary examination of some other property data does not always bear this out; however, the inconsistency in sample collection and test methods is too great to allow us to draw firm conclusions. These relationships are worth exploring as more carefully collected data become available.

In general, most shales have densities between 2.0 and 2.7 g/cm^3 (Figs. 3–5); higher or lower values may reflect unusual mineralogical composition, depth of burial, near-surface weathering for samples taken at shallow depths, etc. The data suggest that smectites and (bentonite)-rich materials have slightly lower densities (Figs. 3 and 4). Some of the younger and/or shallower shales and clays also have higher porosity values.

Effective porosity (Fig. 9) is a more important property than either porosity or density; however, it is more difficult to measure and the units reported in the literature are often unclear and inconsistent.

Only limited data were available for "specific surface" (Fig. 10). The few values available suggest that smectite-rich material has much higher values than typical shales.

8.3 HYDROLOGIC PROPERTIES

Several different types of hydrologic properties were recorded in the reports surveyed; however, the information on groundwater travel distance, inflow, specific storage, and travel time was so scant that no interpretation was attempted.

The property that has received the most attention is hydraulic conductivity (and/or permeability, which is directly related to that property). Unfortunately, the lack of uniformity of test methods, experimental conditions, and units used for reporting the results make attempts at interpretation difficult. Most of the available data were determined in an unspecified direction or in the horizontal direction (i.e., parallel to the bedding). Only a few data were reported for the vertical direction. Most workers report vertical conductivity values as much as an order of magnitude smaller than those in the horizontal direction (i.e., fluids flow through rocks such as shales more rapidly in the horizontal direction than in the vertical direction due to the preferred orientation of the platy clay grains).

All of the hydraulic conductivity and permeability values found in the literature were converted to cm/s. Note that several workers use m/s as well as several other units, including ft/year, m^2, millidarcies, and microdarcies. A wide range of values was reported. For plotting purposes, the data were divided into two groups for preliminary evaluation. The first group includes rocks (shales, argillites, etc.; see Figs. 12 and 13), while the second group includes clay minerals and mixtures of clays with other materials such as sand (Fig. 14). The data for rocks were divided into "direction unspecified" (Fig. 12) and "horizontal" (Fig. 13).

Interpretation of the plots is difficult because of the many data points and ranges of values for summary data sets. The ever-present uncertainty about the quality of the analyses and unit conversions and the general lack of good mineralogical information about the samples tested (a major uncertainty) also tend to complicate matters.

From the available data, we can identify several relationships:

1. Considering rocks (Figs. 12 and 13), there appears to be a wide range of values from approximately 10^{-12} to $>10^{-6}$ cm/s which do not bear any obvious relationship to age. Values for Paleozoic shales differ by three orders of magnitude. Specific mineralogical data appear to be limited, making it difficult to discern mineralogical trends. The values that have been reported for illite-rich (and presumed illite-rich) rocks are both relatively high and low (e.g., samples of the Antrim Shale range from $\sim10^{-9}$ to 10^{-6}, and the Conasauga Shale ranges from $\sim10^{-11}$ to 10^{-9} cm/s). Age and depth of burial may be responsible for the observed differences. The large volume of data available would seem to warrant a closer look, carefully evaluating all of the information concerning sample depth and the conditions under which the hydraulic conductivities were measured. It is important to realize that properties such as hydraulic conductivity can be changed when samples are removed for testing. Field (in situ) testing of the properties of shales is definitely needed.

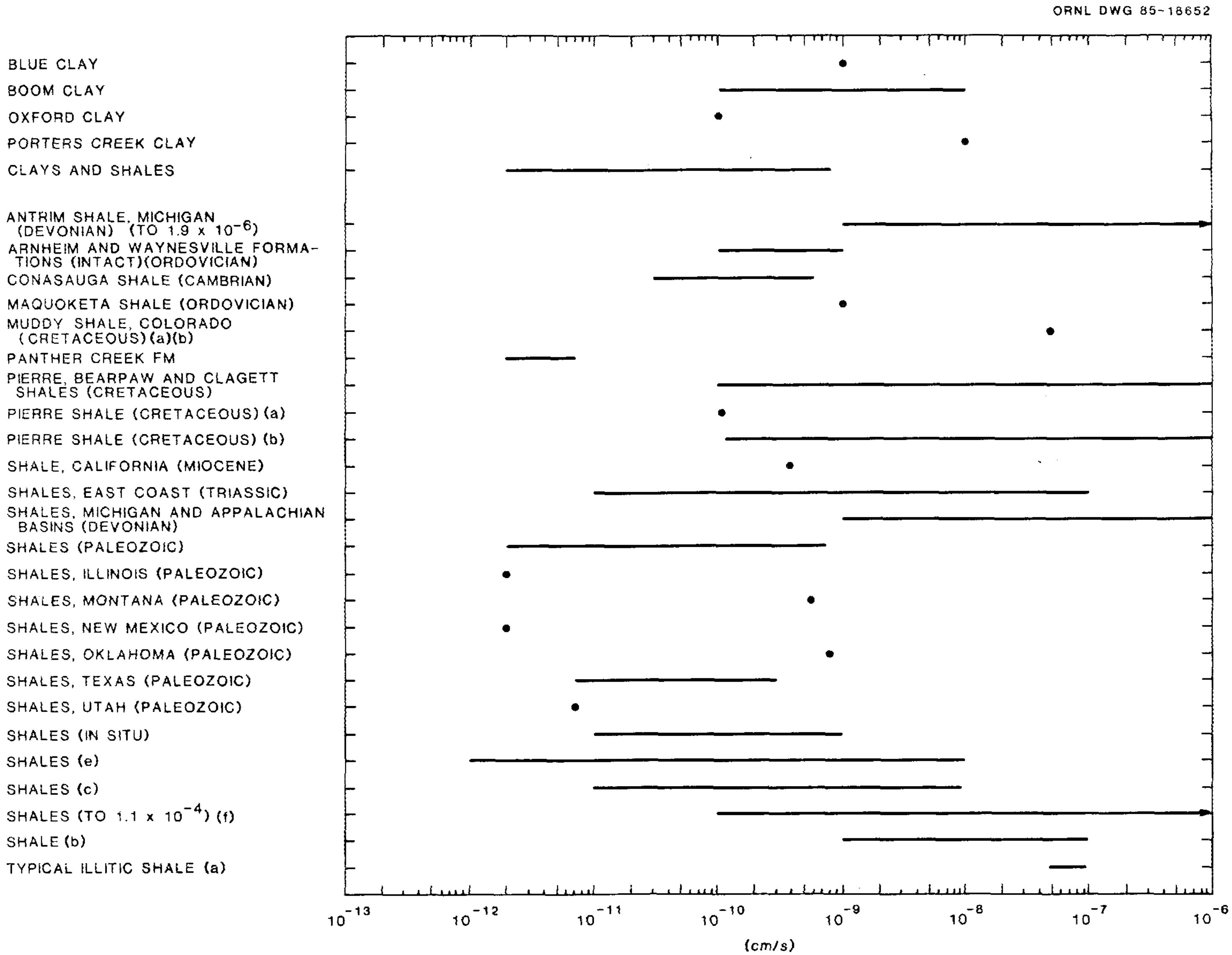

Fig. 12. Hydraulic conductivities for rocks (direction not specified).

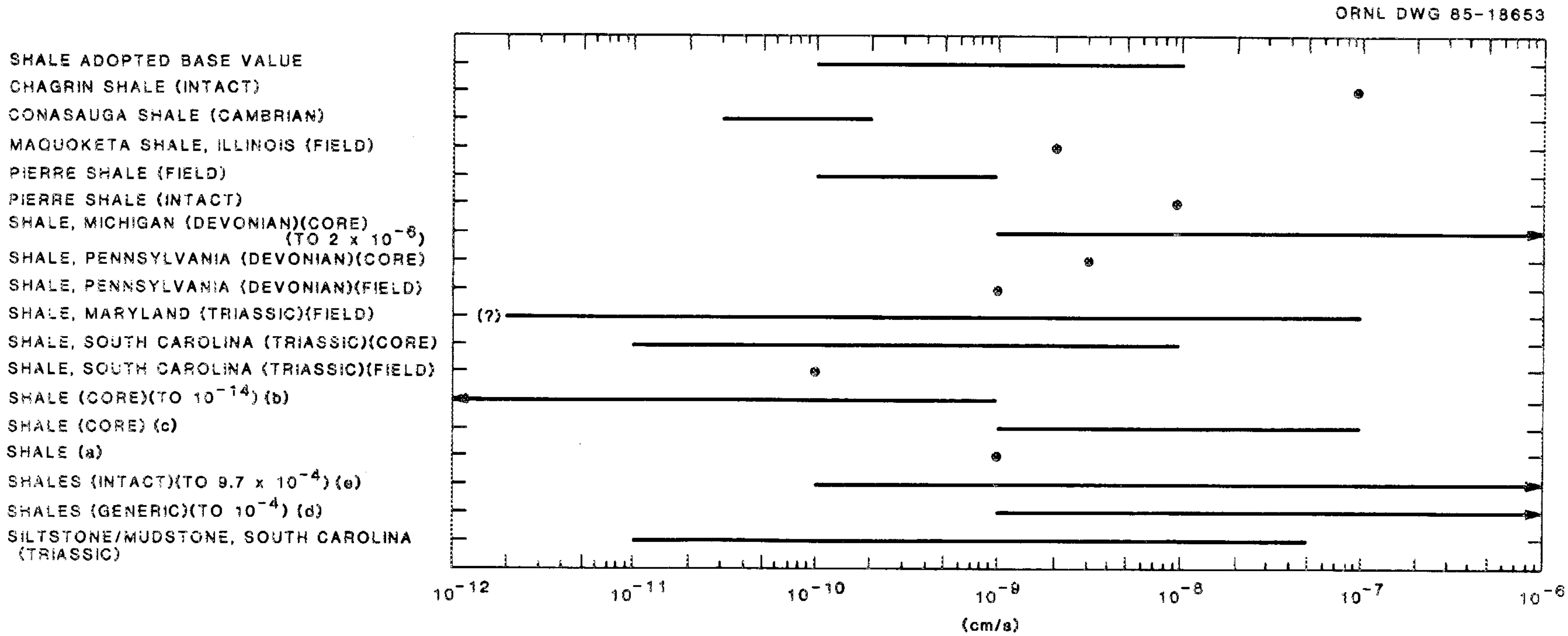

Fig. 13. Hydraulic conductivities for rocks (horizontal).

2. Examination of the data for relatively pure minerals (bentonite samples were included here, and bentonite is considered to be a form of smectite) and mixtures with other materials (Fig. 14) suggests that most smectites have hydraulic conductivities in the range of 10^{-12} to 10^{-11} cm/s, while illites and kaolinites have values that are often $>10^{-10}$. The values for the smectites and bentonites are affected by the degree of compaction, water content, irradiation history, and the extent of mixing with sand and gravel. Mixing with sand and gravel is done to increase thermal conductivity. At the same time, such mixtures tend to have less desirable hydraulic conductivities. The limitations imposed by such inversely related hydraulic and thermal properties will call for a careful balancing act if similar mixtures are used for buffers and backfill.

As a first approximation, it appears that the presence of smectite (and/or bentonite and/or smectitic mixed-layer clays) in shales and related rocks will improve the hydrologic properties of those rocks. At the same time, caution must be exercised because various other mineralogical and physical factors may also have a positive (or a negative) effect on such properties. These factors include the nature of all the minerals present (and not just the clays) and the degree or compaction (including the effective porosity, degree of preferred orientation of the grains, presence of cements, etc.).

All future measurements of hydrologic properties should be made under uniform conditions on carefully selected samples. Field tests will be essential in the selection of any potential sites. Mineralogical analyses should be performed on sample splits.

8.4 MECHANICAL PROPERTIES

Considering the five property groups, mechanical properties have the largest number of different types of measurements and one of the largest sets of data in the Database (Appendix A). Attempts at interpretation were hampered by inconsistencies in the terminology and units used, as well as the lack of information about experimental conditions used for the tests. Individual properties were plotted and are discussed below.

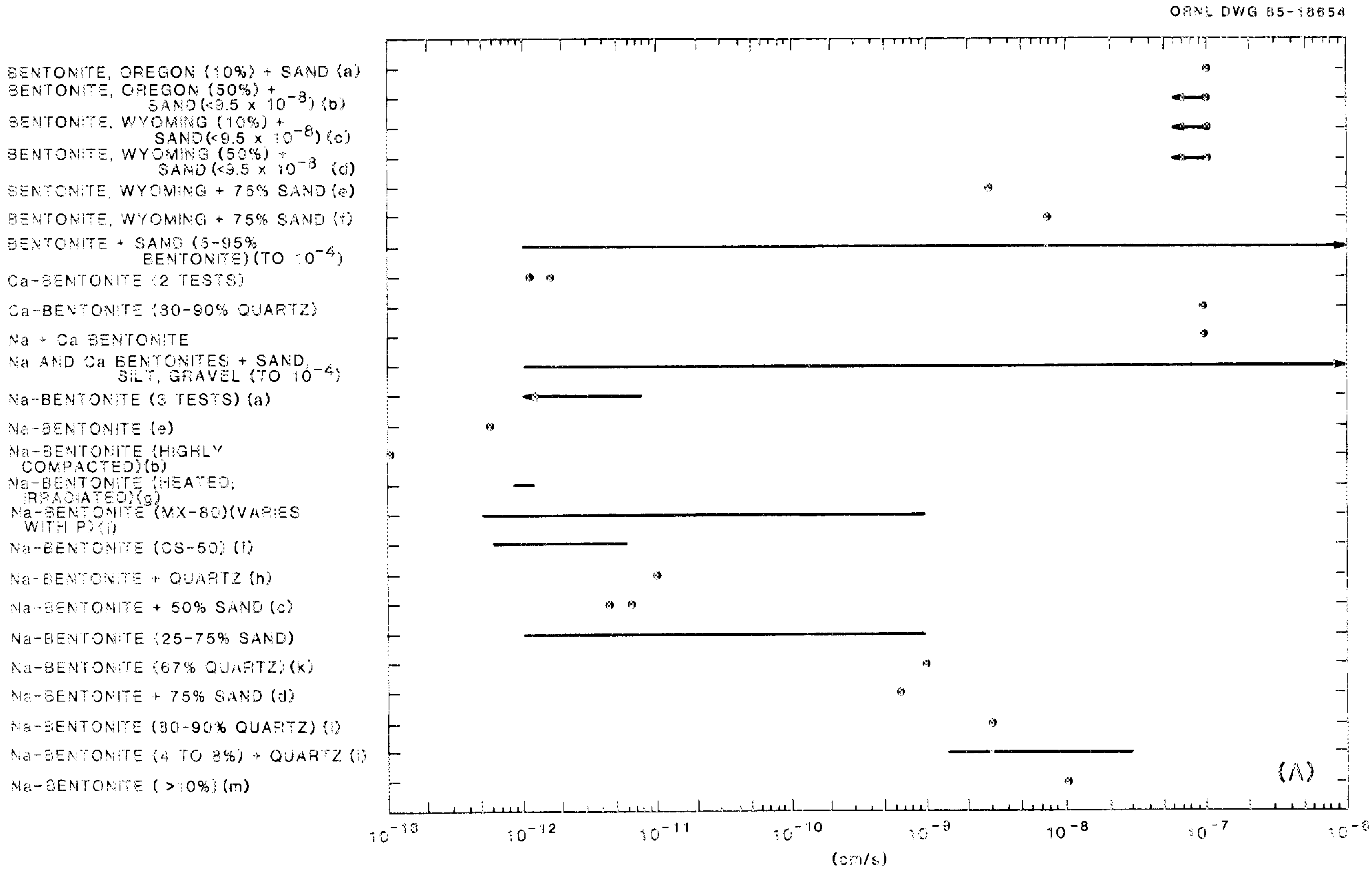

Fig. 14. Hydraulic conductivities (direction not specified) for (A) bentonites and (B) other minerals.

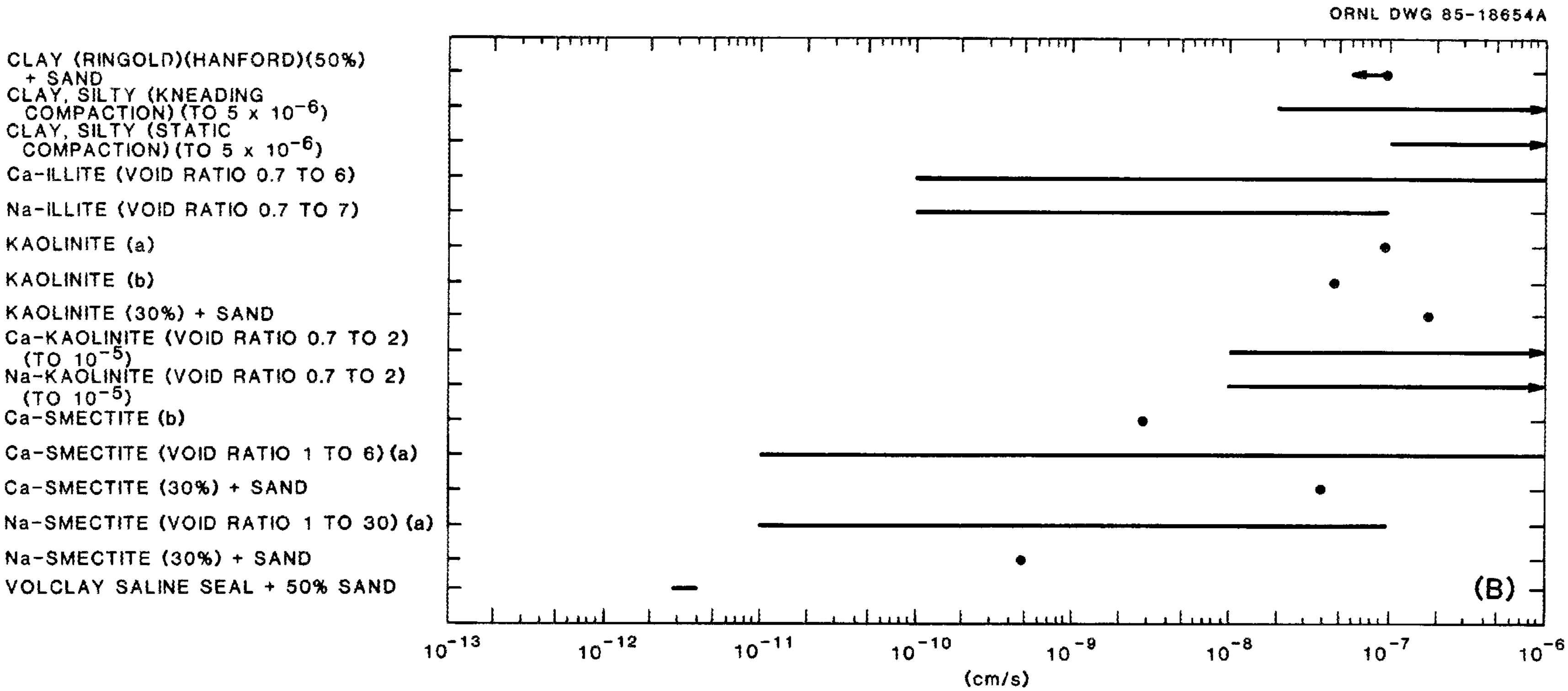

Fig. 14 (Continued).

Only a few sets of data were available for bulk modulus (Fig. 15); however, there appears to be a general increase in the value of bulk modulus with age (and presumably the depth of burial). The nature of some shales with higher values of bulk modulus than the Eleana Argillite (which had been slightly metamorphosed) needs to be investigated.

Cohesion values (Fig. 16) are generally low (<100 MPa). Poorly consolidated materials have lower values than older shales; however, there are inconsistencies in some values (e.g., reported values for the Pierre Shale range over two orders of magnitude), perhaps as a result of the methods used for taking or storing the samples prior to testing.

The values reported for compressive strength (Fig. 17) show a wide variability. An obvious difference is noted when rock values are compared with mineral and mineral mixture values. Older and/or more illitic (relative to more smectite-rich) shales appear to have slightly higher compressive strength values.

The values of friction angle (Figs. 18 and 19) also cover a wide range. In addition, the use of various descriptive modifiers (shear resistance, internal, dilation) makes it difficult to compare the results without further interpretation of the data.

All of the plasticity values (liquid limit, Fig. 20; plastic or plasticity index, Fig. 21; plastic limit, Fig. 22; and shrinkage limit, Fig. 23) are influenced by mineralogy. In fact, these plots provide some of the clearest evidence of mineralogical influence on mechanical properties. The presence of smectite (bentonite) produces large increases in the liquid limit and the plasticity index. Insufficient data were available to interpret the shrinkage limit.

Values of the Poisson's ratio for samples tested (Fig. 24) range from ~0.03 to 0.77. Shales cover most of this range, and there is no obvious relationship to mineralogy.

The data for shear modulus and shear strength (Fig. 25) confirm that shales have much higher values than compacted clays or bentonites. There are some suggestions that older and/or more illitic shales have higher values (to ~10^6 MPa) of shear modulus.

Swelling and swelling potential (Fig. 26) are influenced by mineralogy. Smectite and/or bentonite swell up to several times as much as illite and kaolinite. Insufficient data were available for swelling distance.

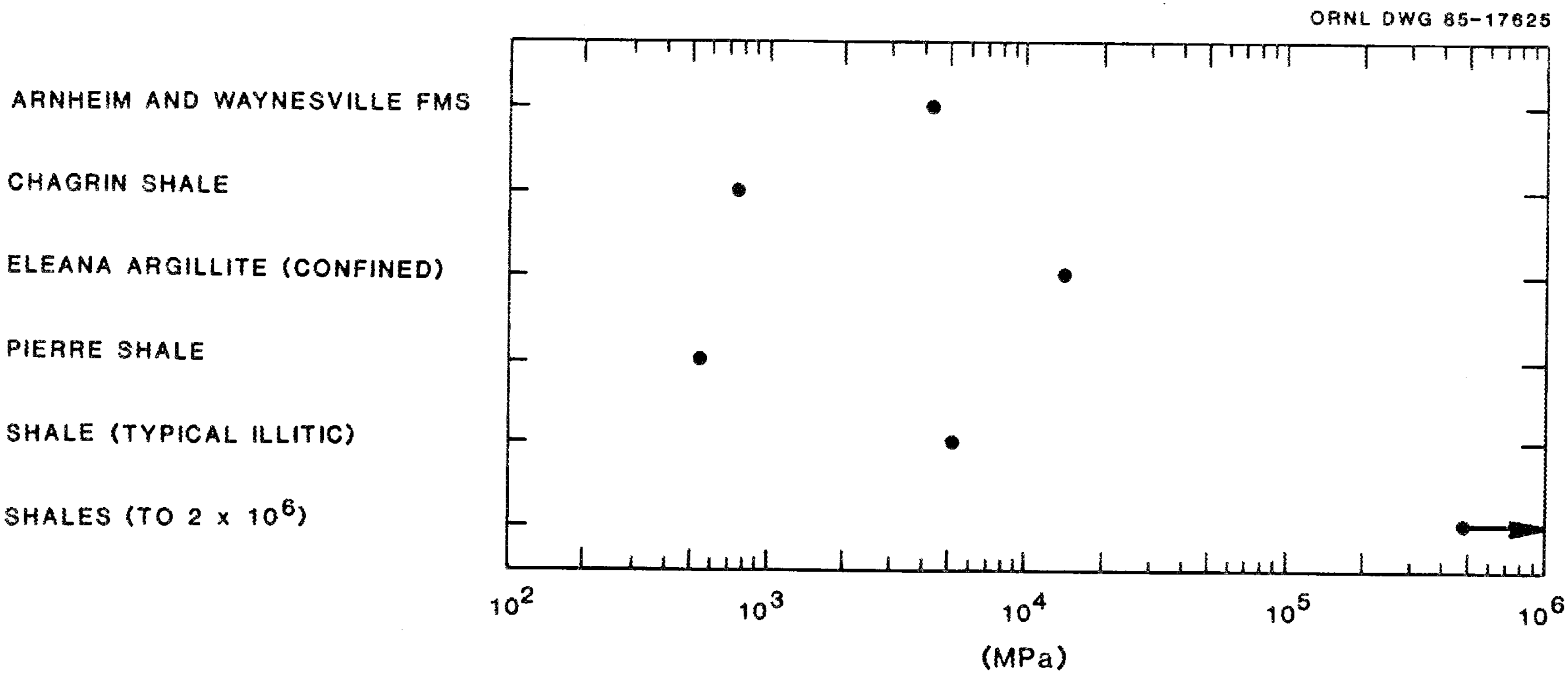

Fig. 15. Bulk modulus.

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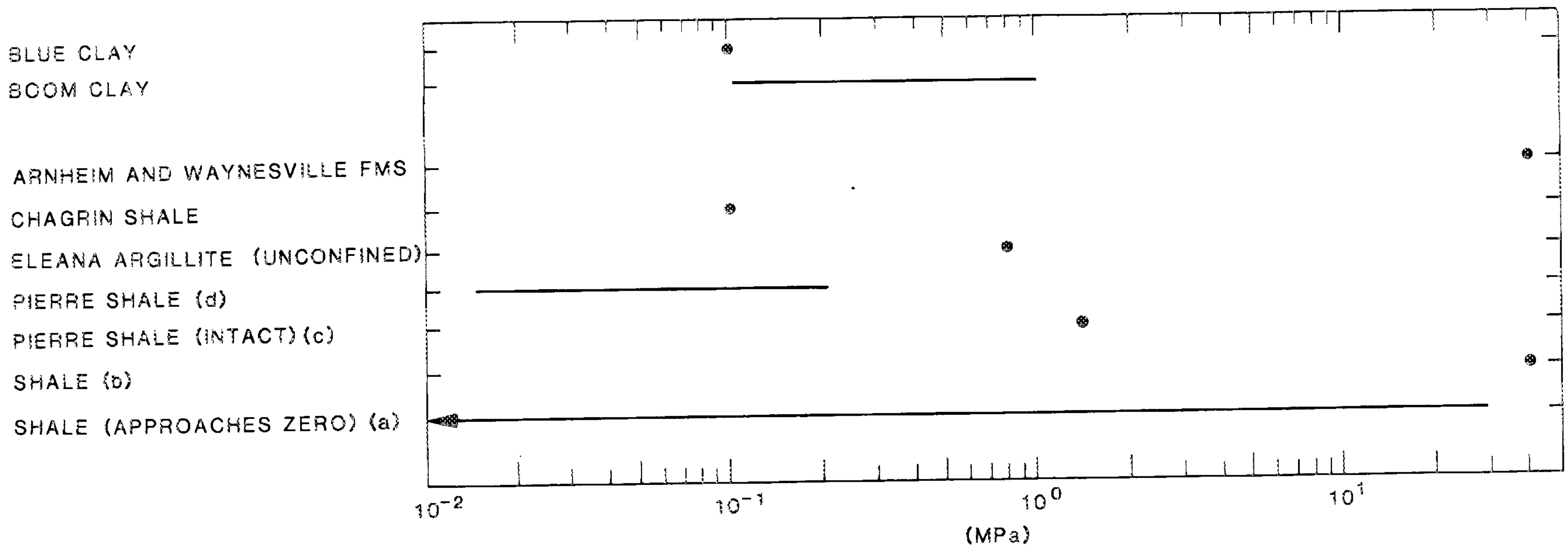

Fig. 16. Cohesion.

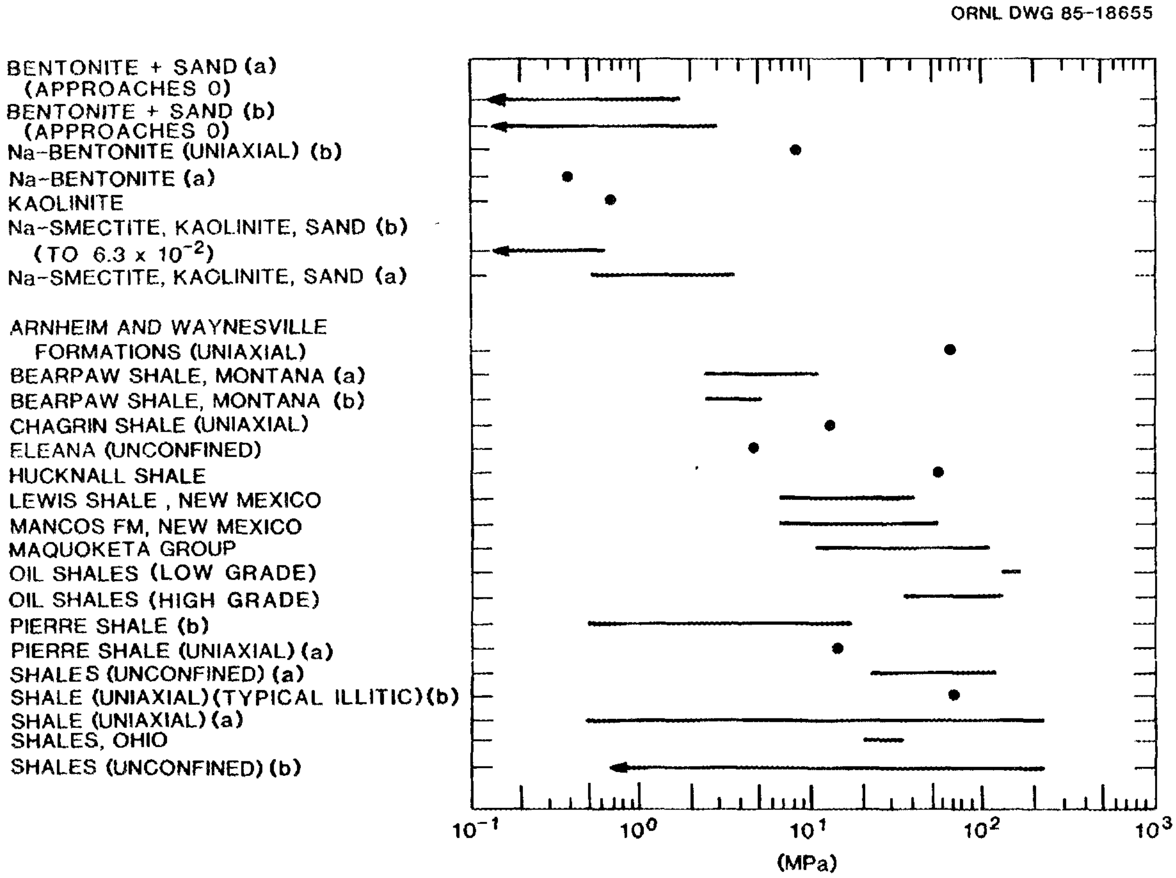

Fig. 17. Compressive strength.

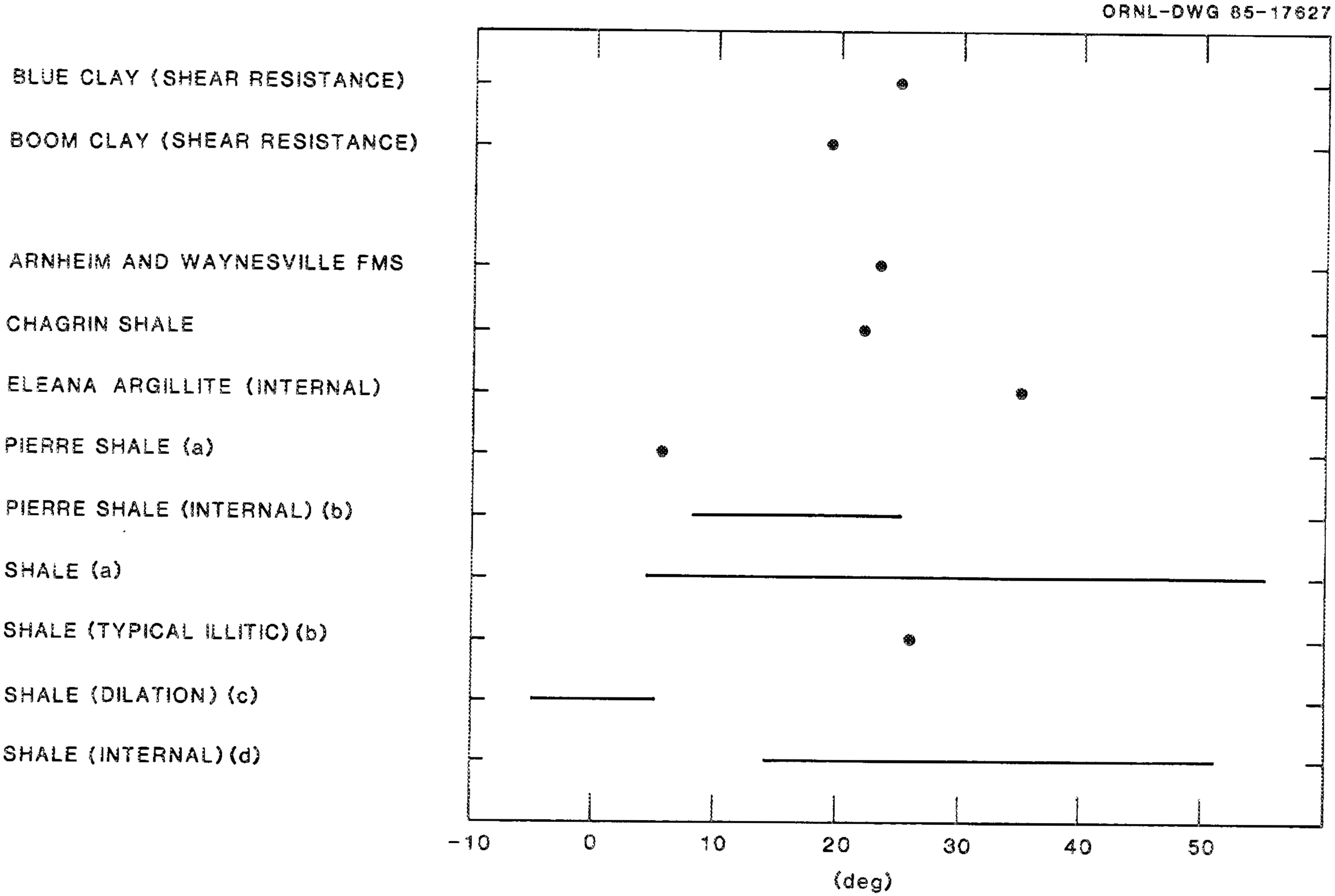

Fig. 18. Friction angle.

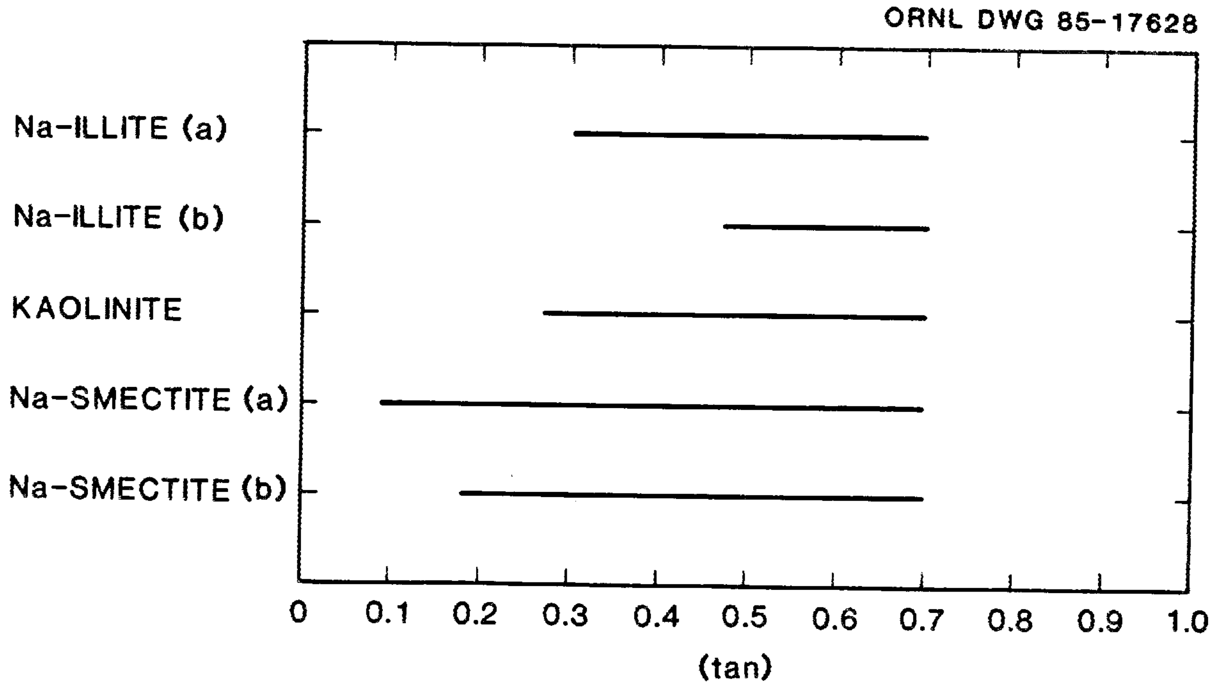

Fig. 19. Friction angle (residual).

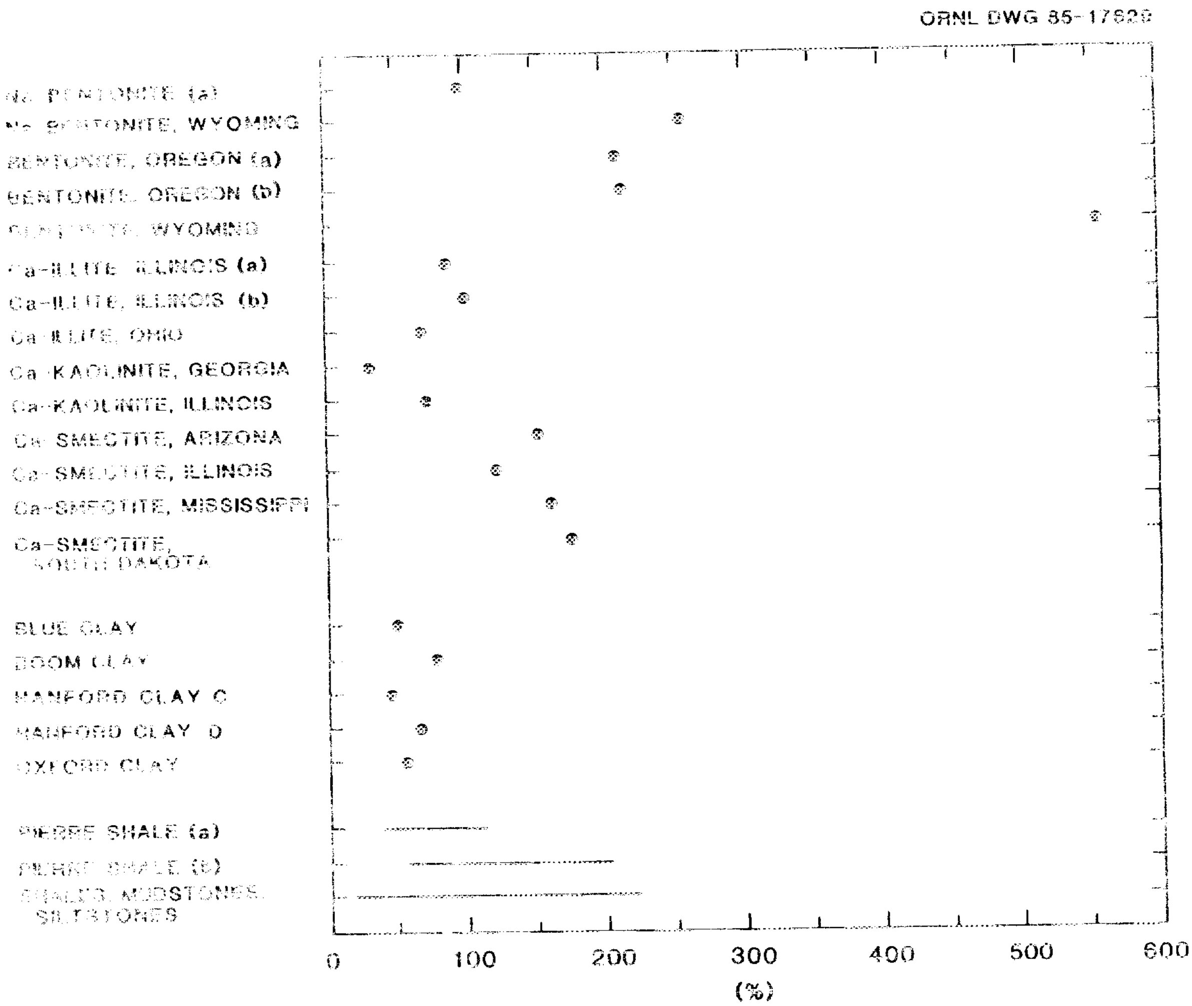

Fig. 20. Plasticity (liquid limit).

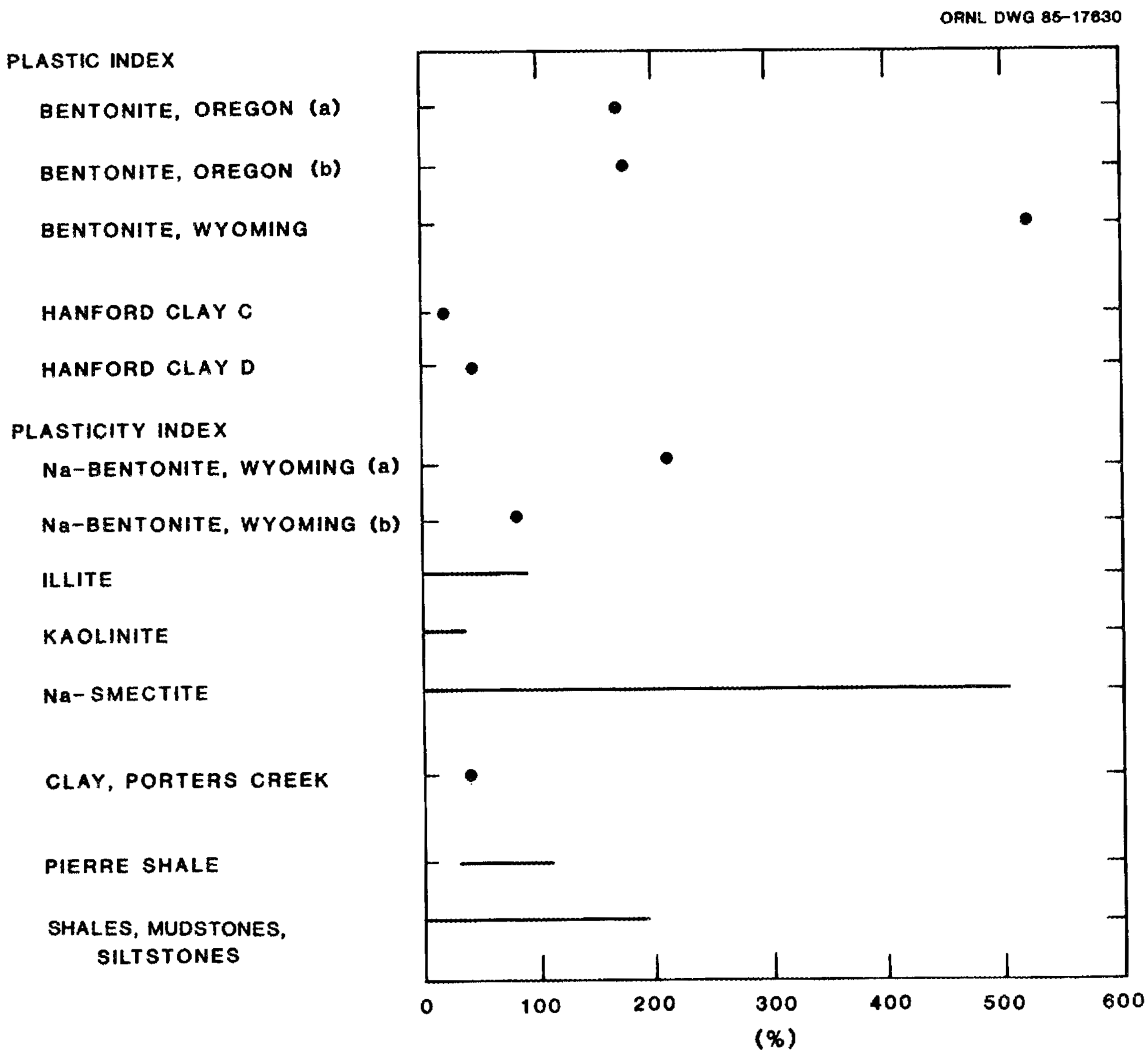

Fig. 21. Plasticity (plastic index, plasticity index).

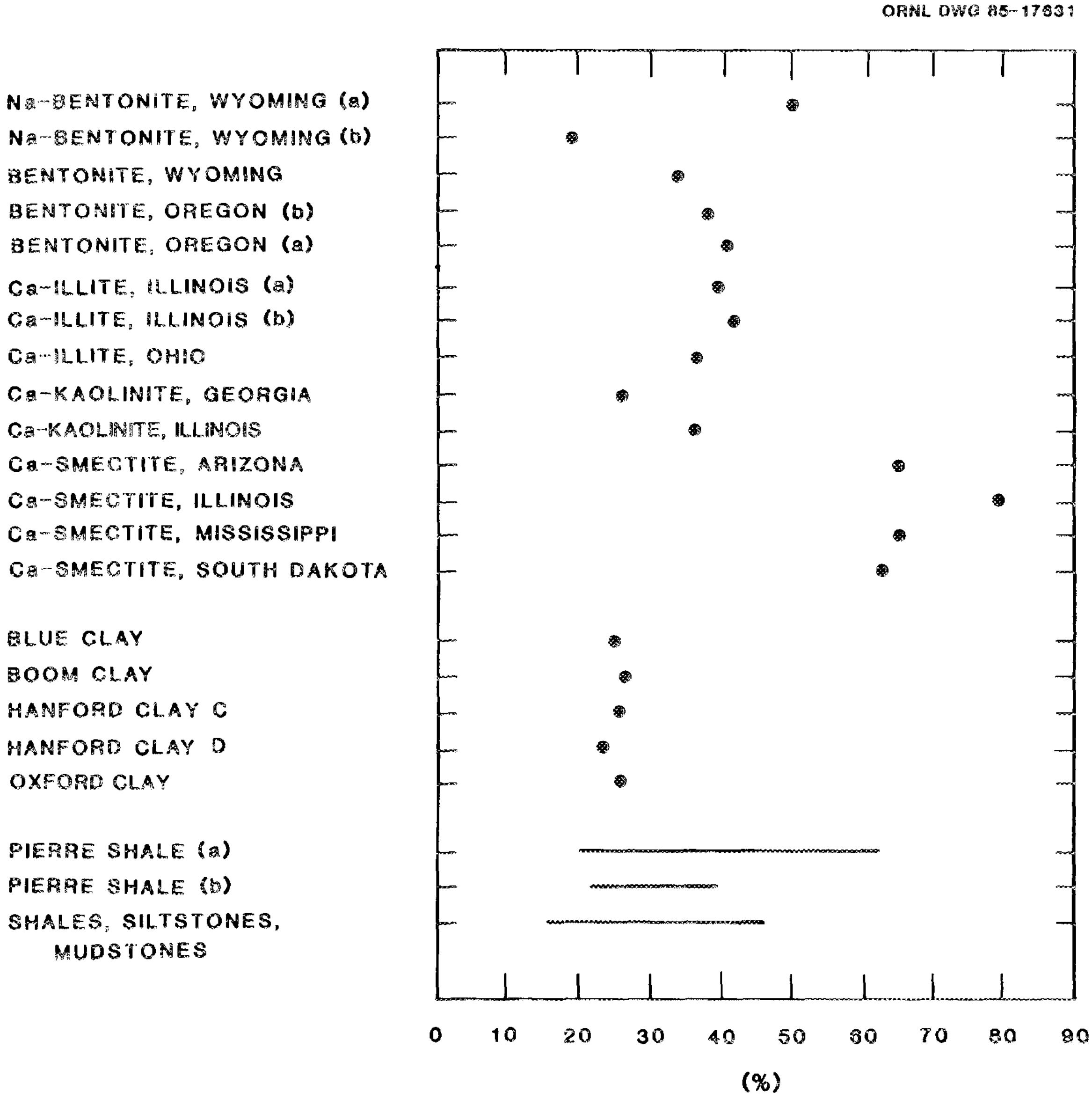

Fig. 22. Plasticity (plastic limit).

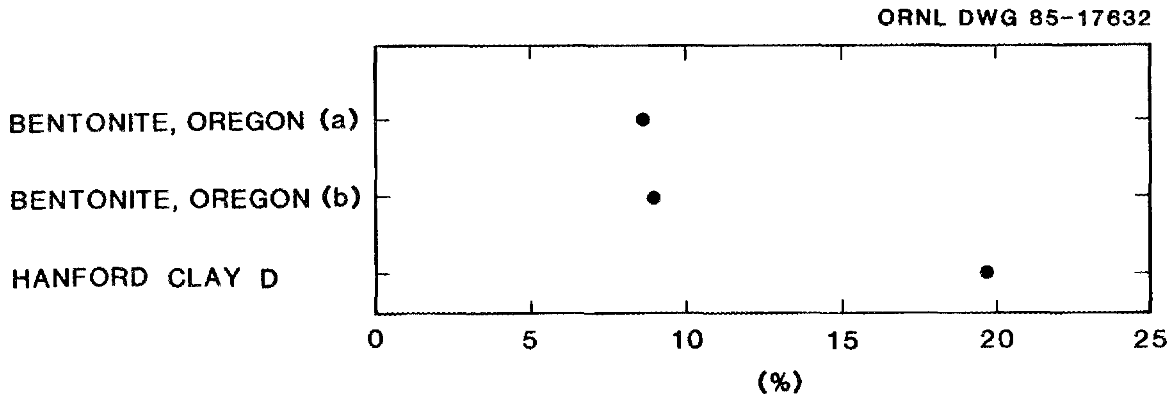

Fig. 23. Plasticity (shrinkage limit).

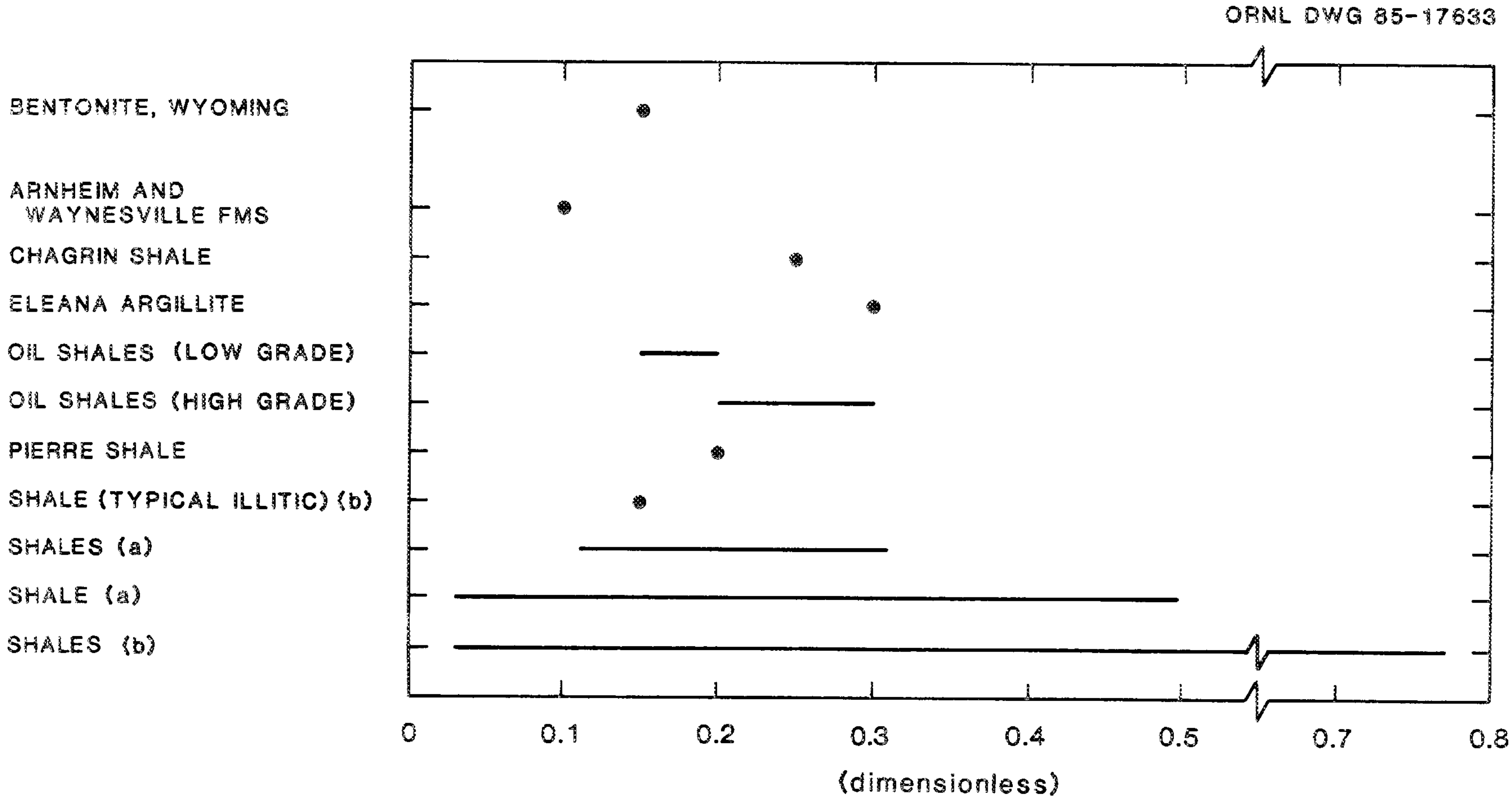

Fig. 24. Poisson's ratio.

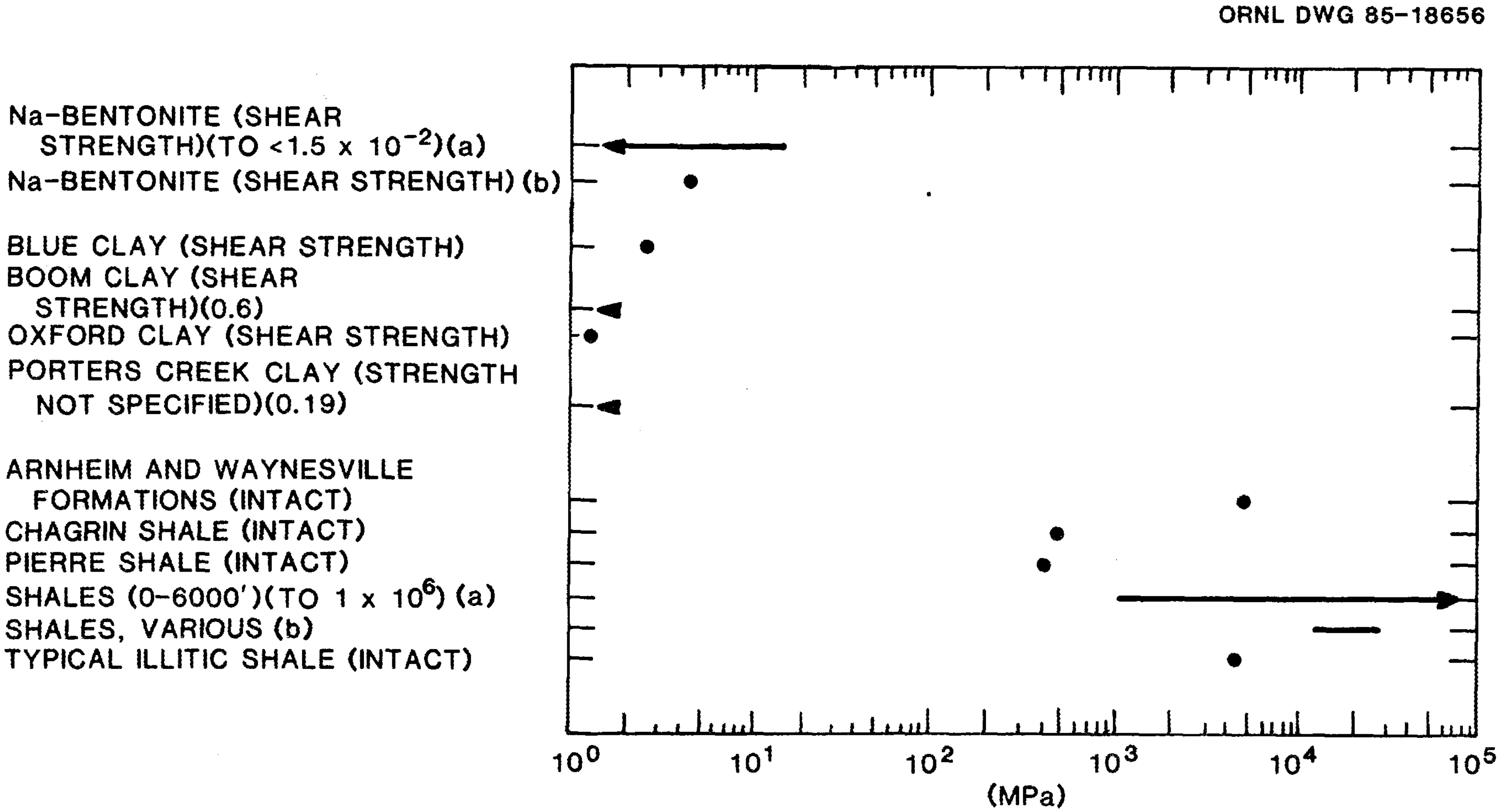

Fig. 25. Shear modulus and shear strength.

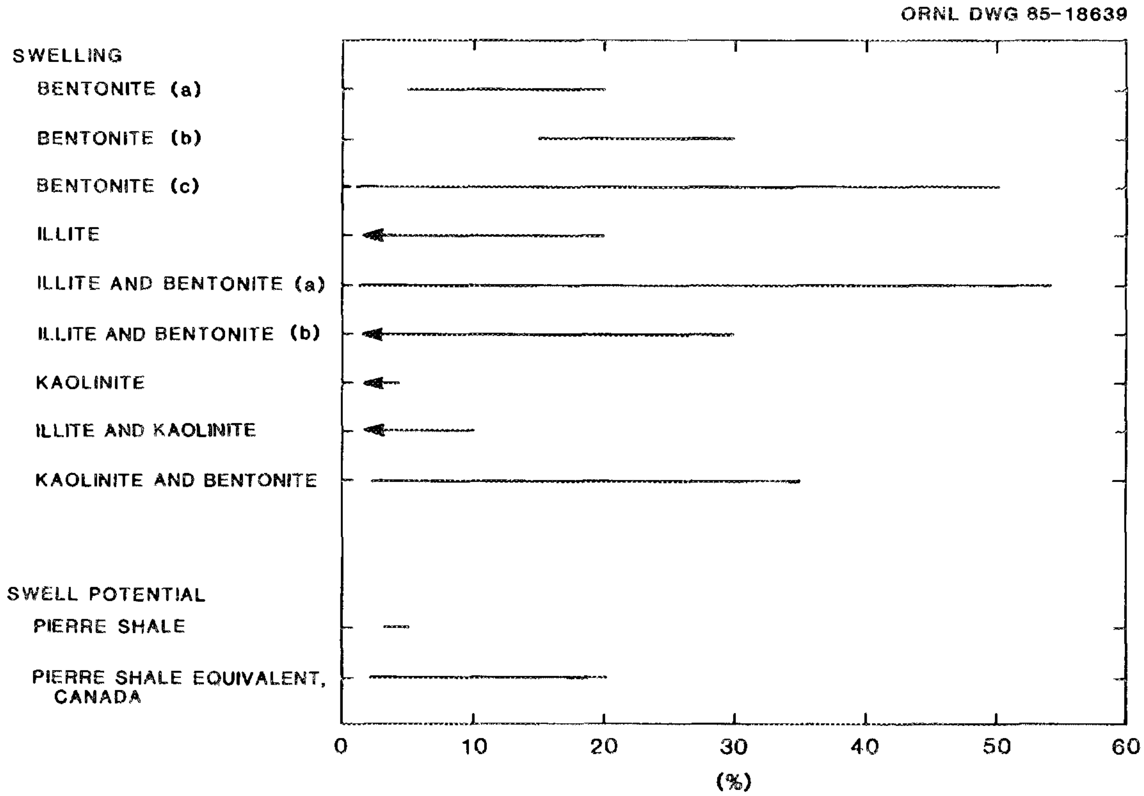

Fig. 26. Swelling and swell potential.

Most of the measurements for swelling pressure (Fig. 27) were made for smectite (bentonite)-rich samples. Swelling pressure decreased when sand was added. The value determined for a shale sample is also relatively low.

A few values were found for tensile strength (Fig. 28). Values for shales ranged up to 10 MPa, but the data were insufficient to establish any trends.

Young's (elastic) modulus values (Fig. 29) range from ~10 to 10^6 MPa. The values for older, more illitic shales appear to be higher than for shales like the Pierre, the Boom and Blue Clay, and bentonite-sand mixtures.

Overall, the mechanical properties appear to be influenced by the clay mineral content of the material tested. In general, the older, and typically more illitic, rocks that have been slightly metamorphosed possess greater strength.

8.5 THERMAL PROPERTIES

Only a limited number of types of thermal properties were found in the reports reviewed. These include the coefficient of linear (thermal) expansion, heat capacity and specific heat (capacity), thermal (heat) conductivity, and thermal diffusivity.

A plot of the coefficients of linear thermal expansion (Fig. 30) reveals that most values are for shales and typically fall into the range from ~2 to 16 $K^{-1} \times 10^{-6}$. No trends were obvious; however, no values were found for smectite-rich samples.

The plots for heat capacity and specific heat (capacity) (Fig. 31) show that the values fall in a very narrow range from ~5×10^2 to 1.2×10^3 J/kg•K. Again, the sample compositions were very limited, and no trends could be seen. Two values for the Blue and Boom Clays fall in the typical range for the shales tested.

The greatest volume of data was available for thermal conductivity (or heat conductivity) (Fig. 32). The most obvious distinction was found between rock samples and mineral samples and/or soils; the values for some soils are lower by as much as an order of magnitude. Some other trends could also be established. The measurements (for a set of related samples) showed a gradual increase in thermal conductivity with increasing sample

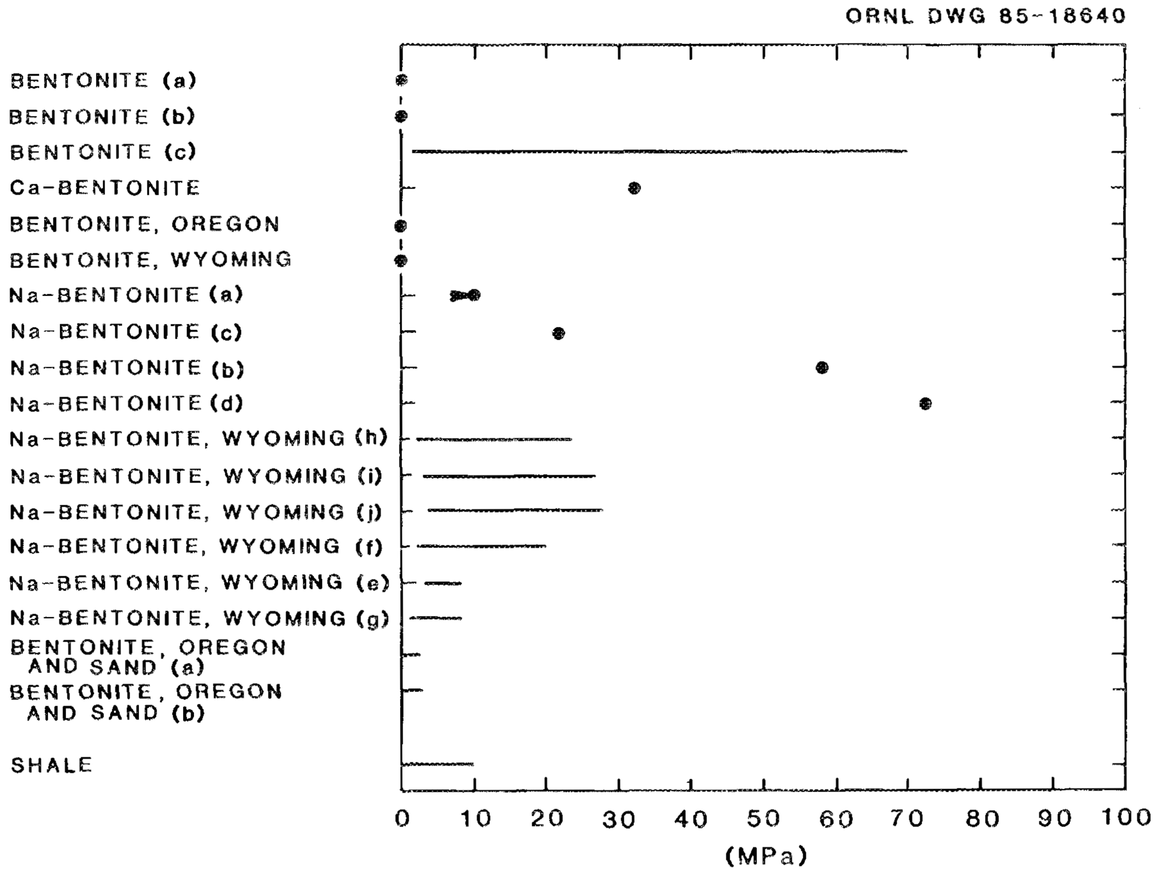

Fig. 27. Swelling pressure.

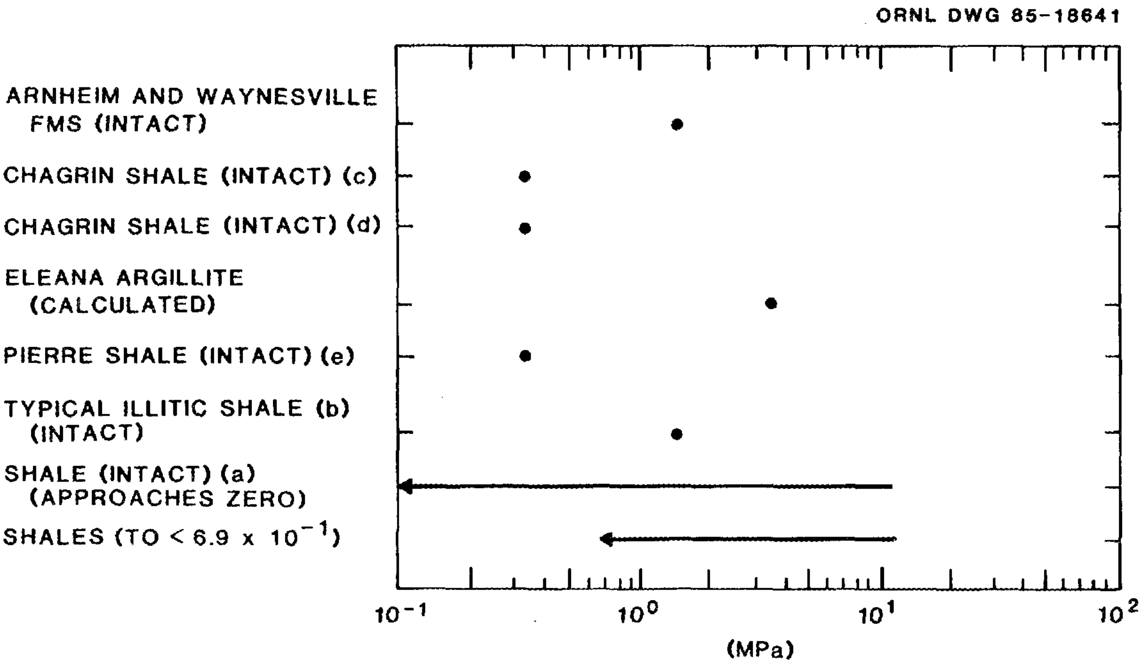

Fig. 28. Tensile strength.

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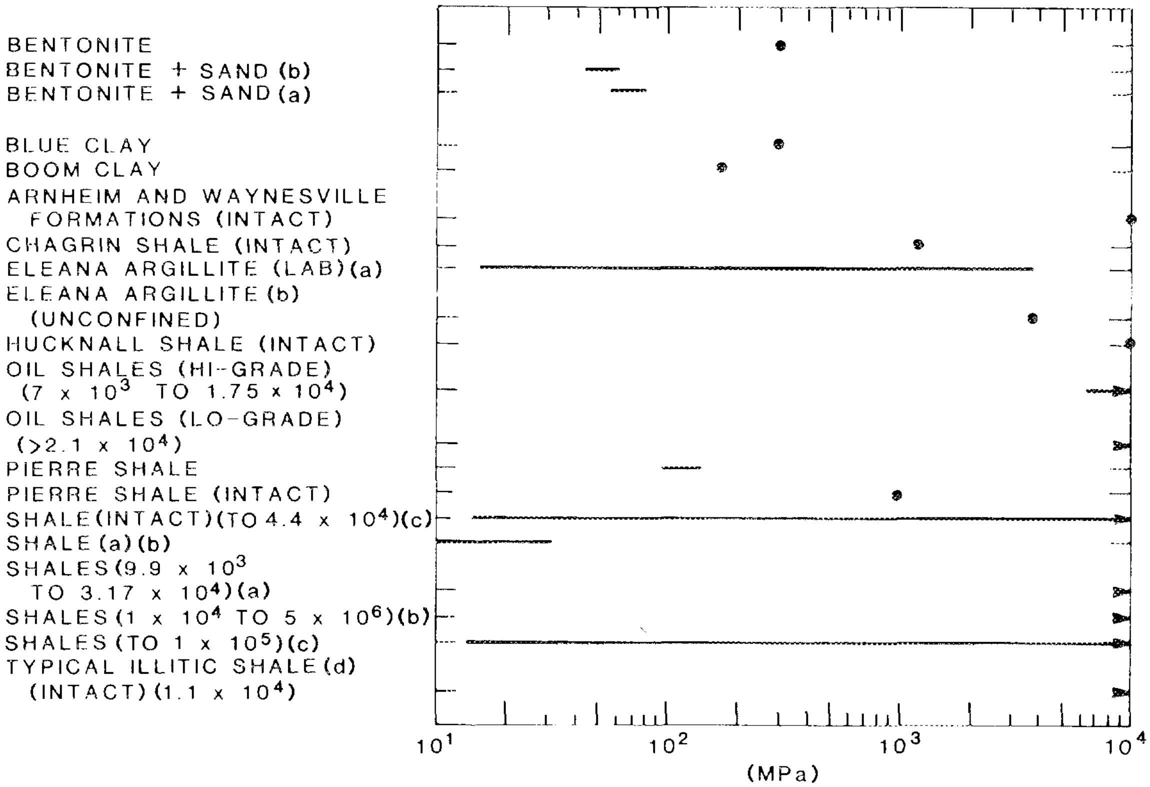

Fig. 29. Young's (elastic) modulus.

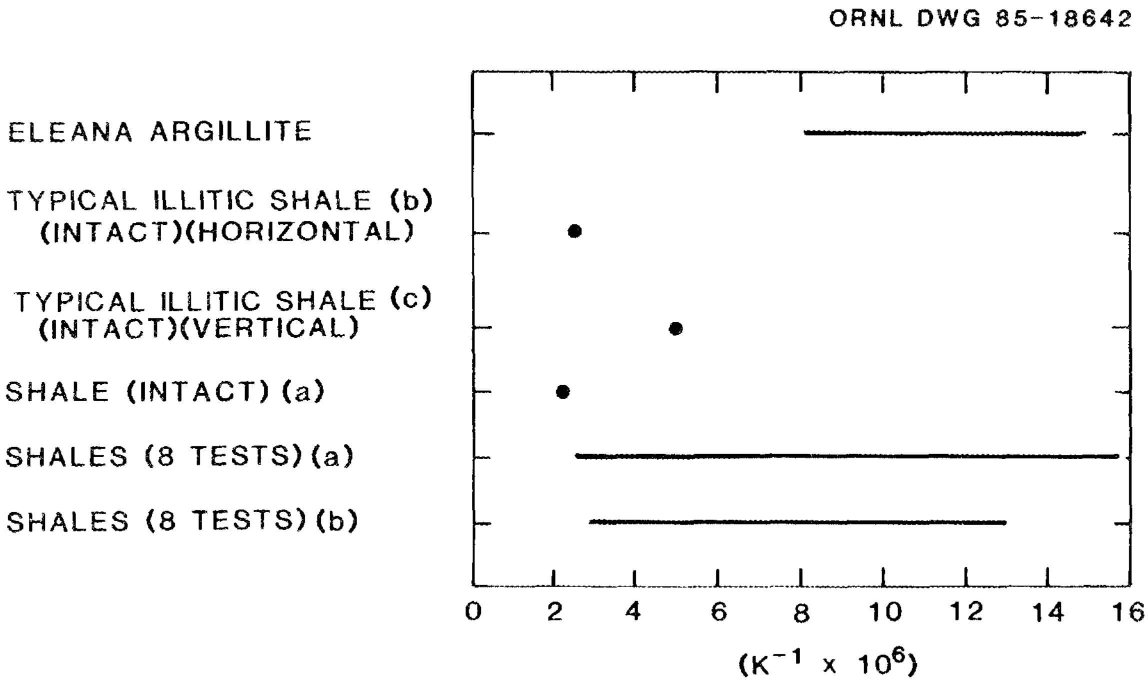

Fig. 30. Coefficient of linear (thermal) expansion.

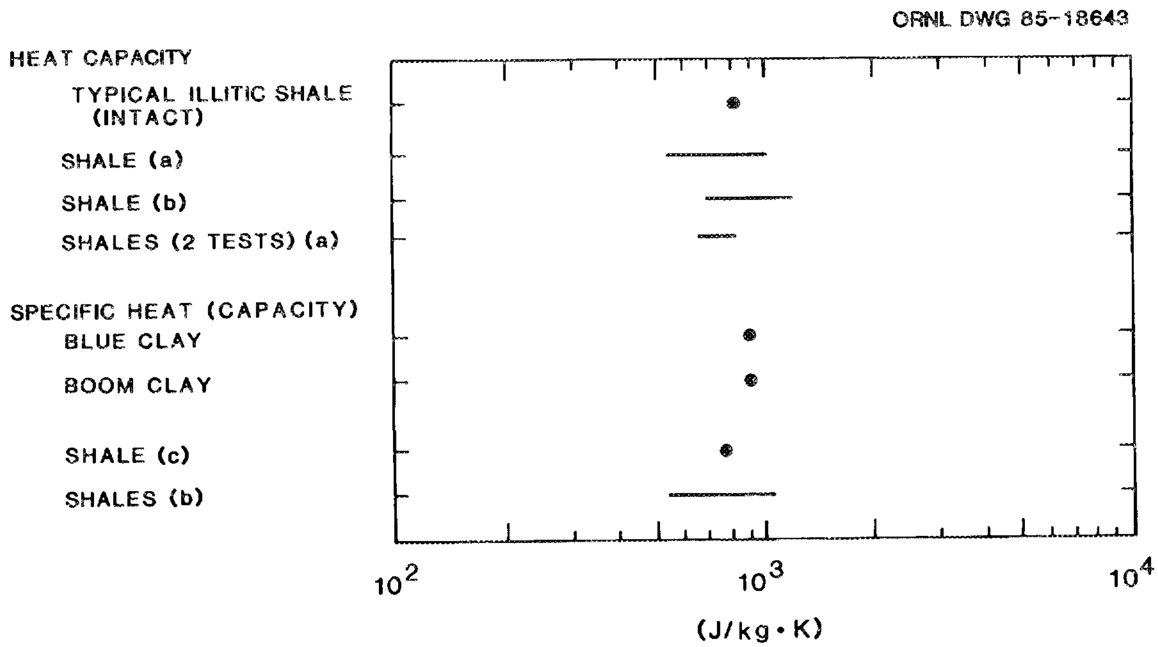

Fig. 31. Heat capacity and specific heat (capacity).

density. In almost every case where the amounts of water were known, the thermal conductivity increased as the water content increased. Thermal conductivities also appeared to increase as the nonclay (sand, granite, etc.) fraction was increased. Most thermal conductivities for clay-rich rocks fall within the range from ~0.5 to 3 W/m•K, although a few higher values were recorded.

Only a few values for thermal diffusivity (Fig. 33) were available for some soils, a sodium bentonite, and the Blue and Boom Clays. The latter two materials had the highest values of the group.

The ranges for thermal properties appear to be narrower, in general, than those for mechanical properties; however, the difference between 0.5 and 3 W/m•K could be quite significant when trying to determine the thermal loading of a repository. The effect of clay mineral composition may be overshadowed by the amount of quartz present (often the most abundant mineral in shales), the amount of moisture present (the most common pore fluid in shales), and/or the degree of packing of the constituent grains in the rock. The weight percent of quartz in a shale might be important as an indicator of its thermal conductivity.

9. COMPARISON OF SELECTED PROPERTIES FOR SOME SPECIFIC FORMATIONS

In some cases, formations were identified in the reports that were used in this study, and some information about their mineral compositions were reported in a few cases. Additional data of this type may be available in the original references. Information concerning the Conasauga Shale, some Devonian Shales (e.g., the Antrim and the Chagrin), and the Pierre Shale (with lesser information on the Eleana Argillite, some "oil shales," and shales that were identified as "typical illitic shales") was plotted for the following properties: hydraulic conductivity (Fig. 34), bulk modulus (Fig. 35), cohesion (Fig. 36), compressive strength (Fig. 37), shear modulus (Fig. 38), tensile strength (Fig. 39), Young's (elastic) modulus (Fig. 40), and thermal conductivity (Fig. 41). The results, which are discussed below, should be considered preliminary and used with caution because (1) the data available for plotting each figure is rather limited,

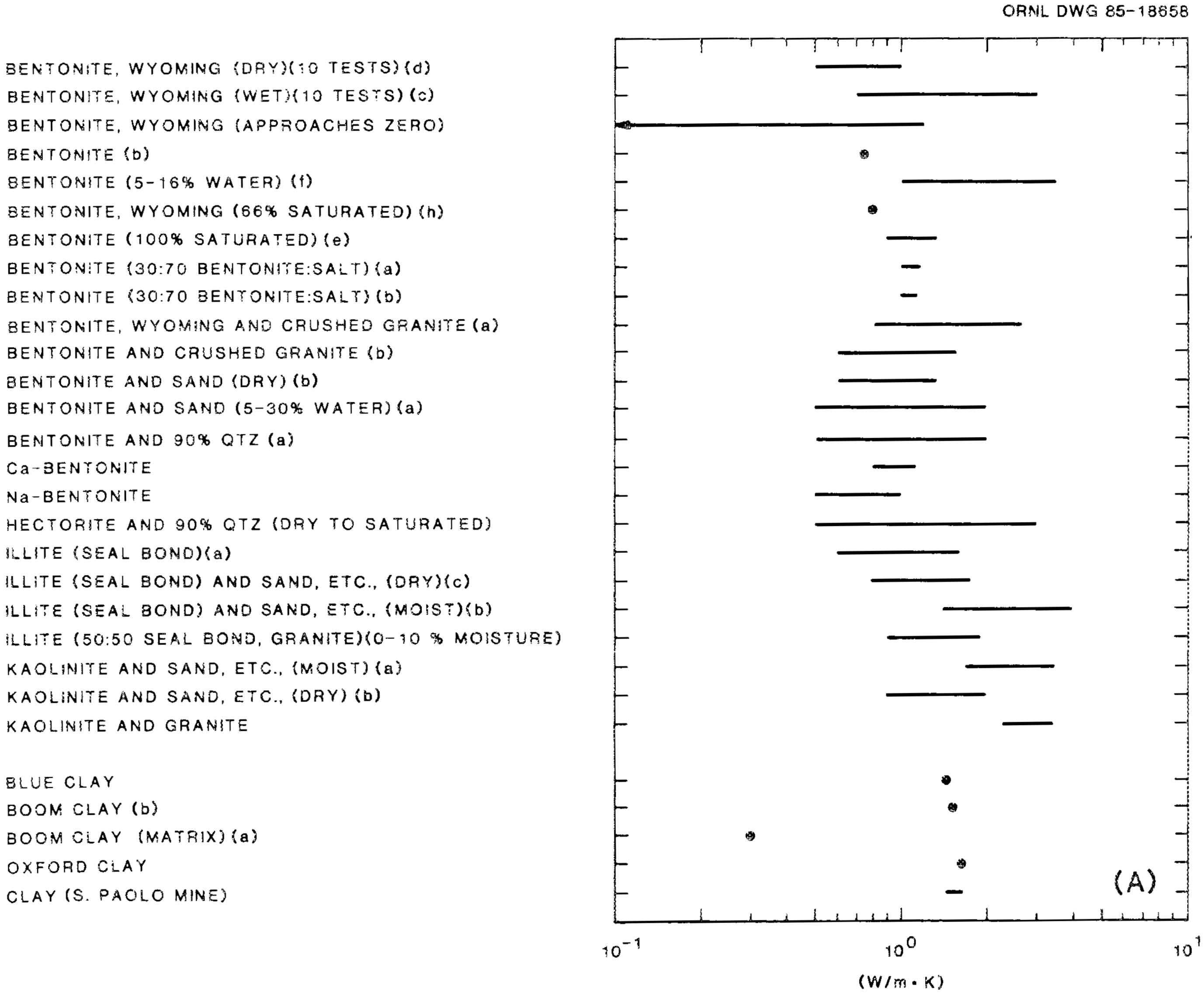

Fig. 32. Thermal (heat) conductivity for (A) bentonites and clays and (B) soils and shales.

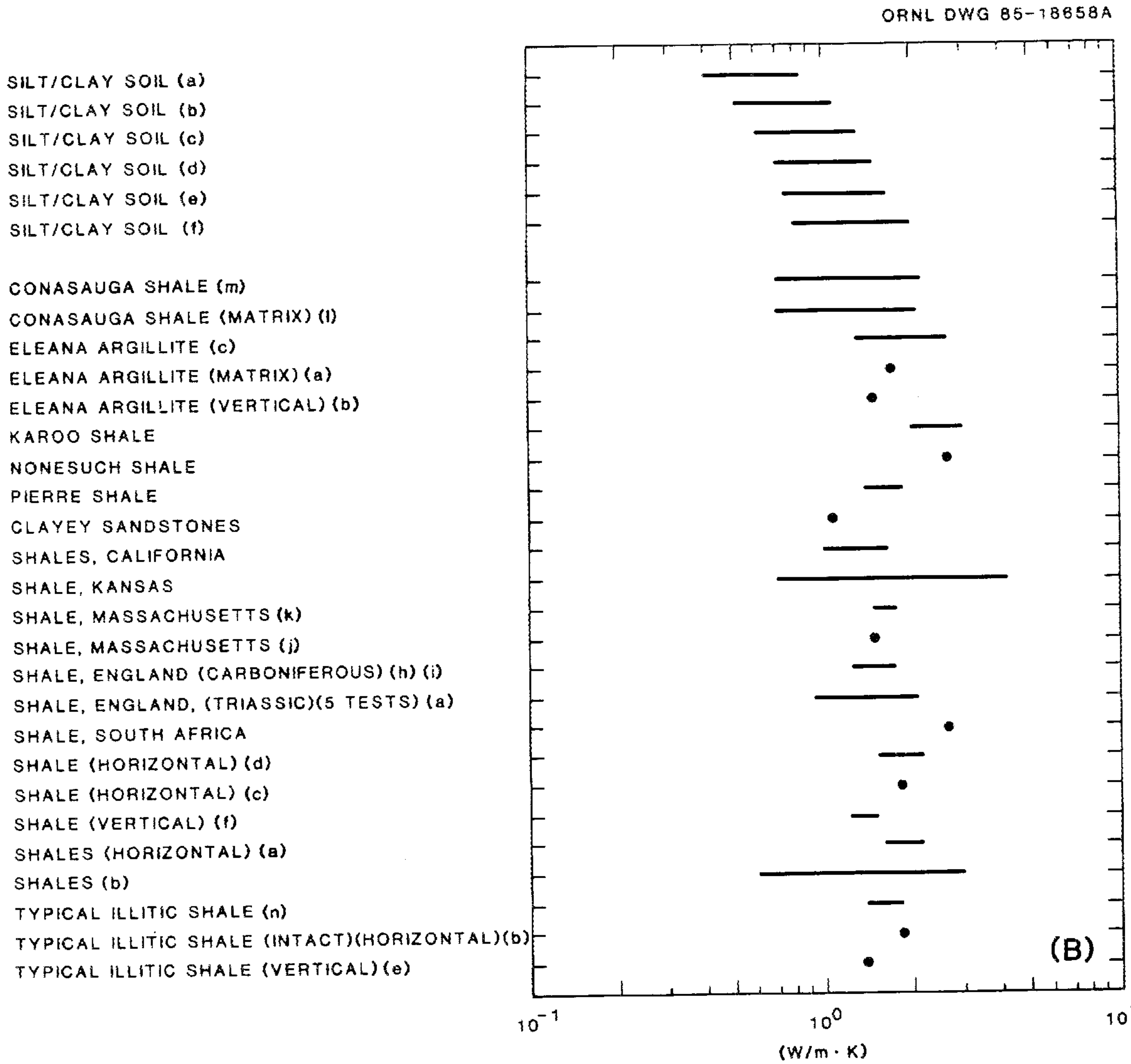

Fig. 32 (Continued).

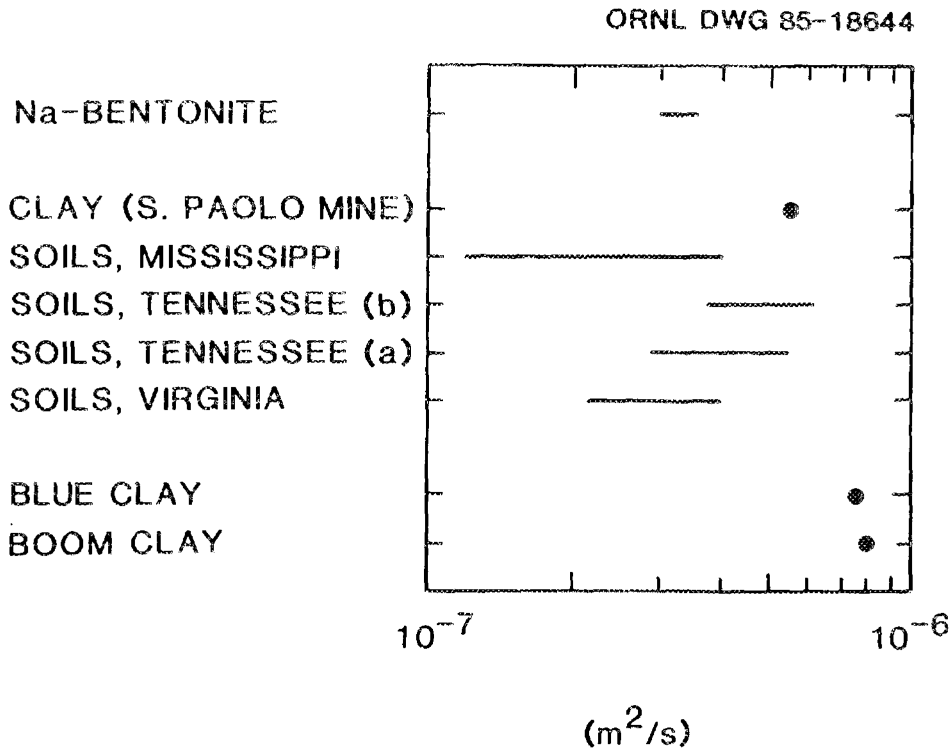

Fig. 33. Thermal diffusivity.

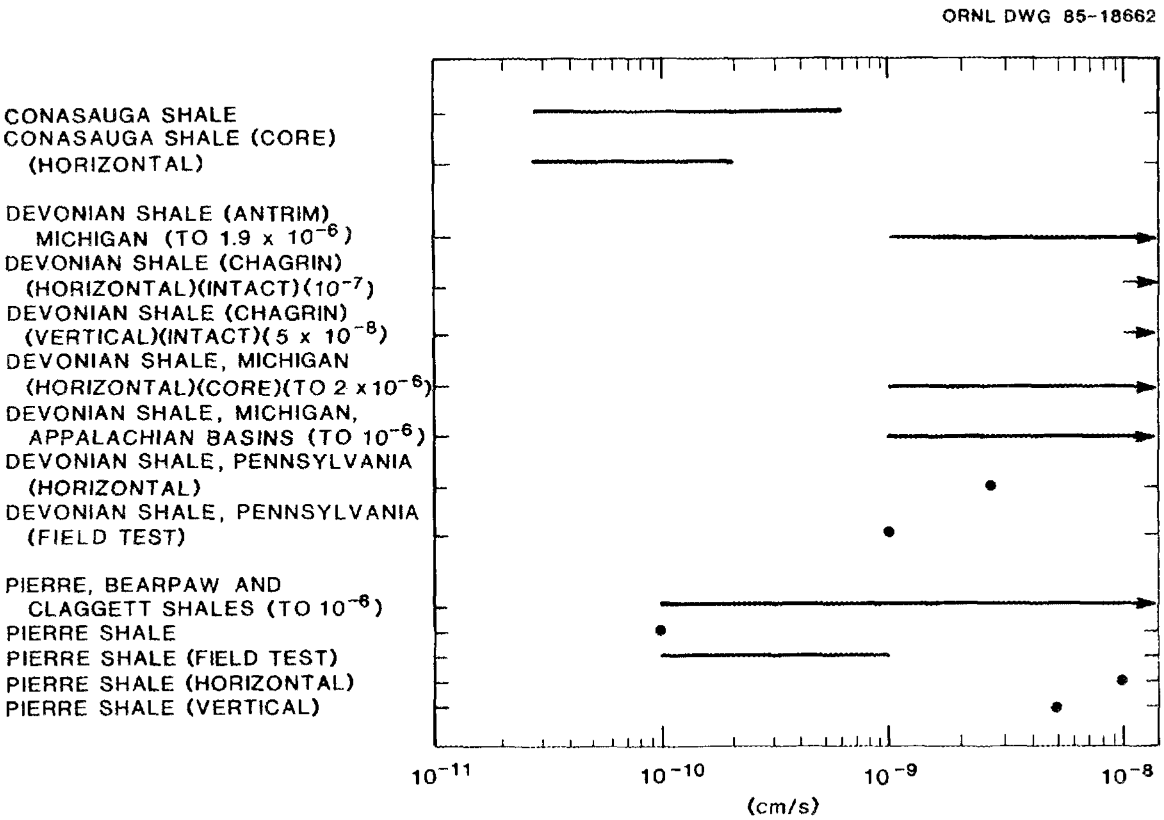

Fig. 34. Hydraulic conductivity for selected samples.

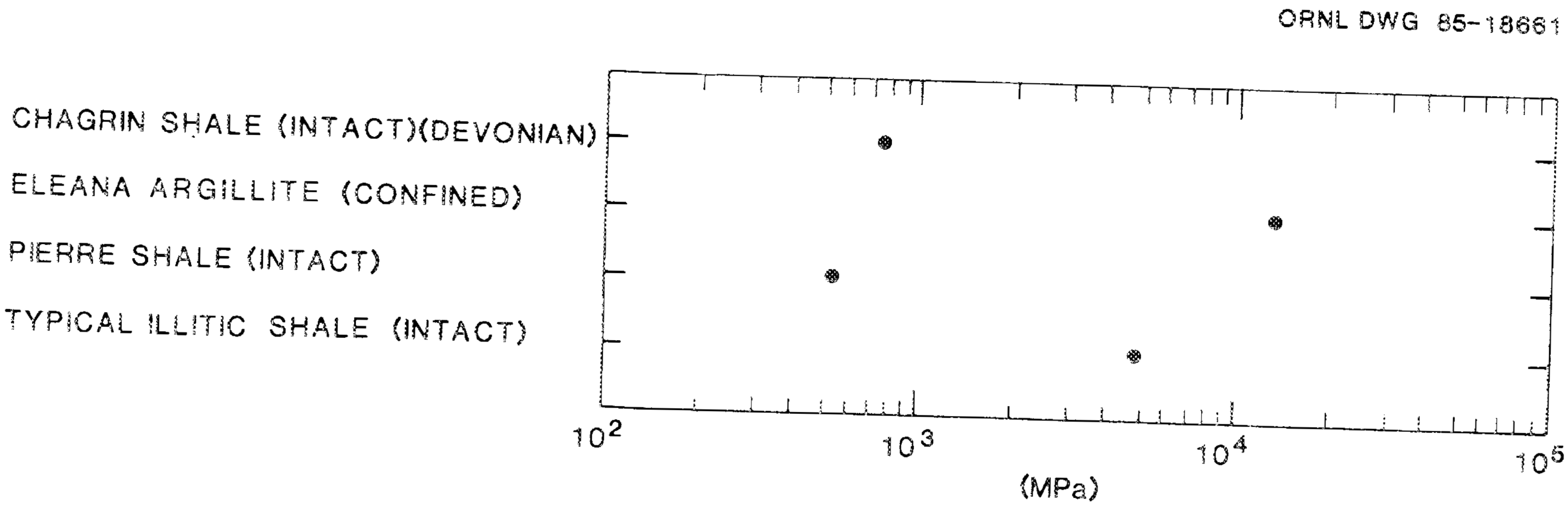

Fig. 35. Bulk modulus values for selected samples.

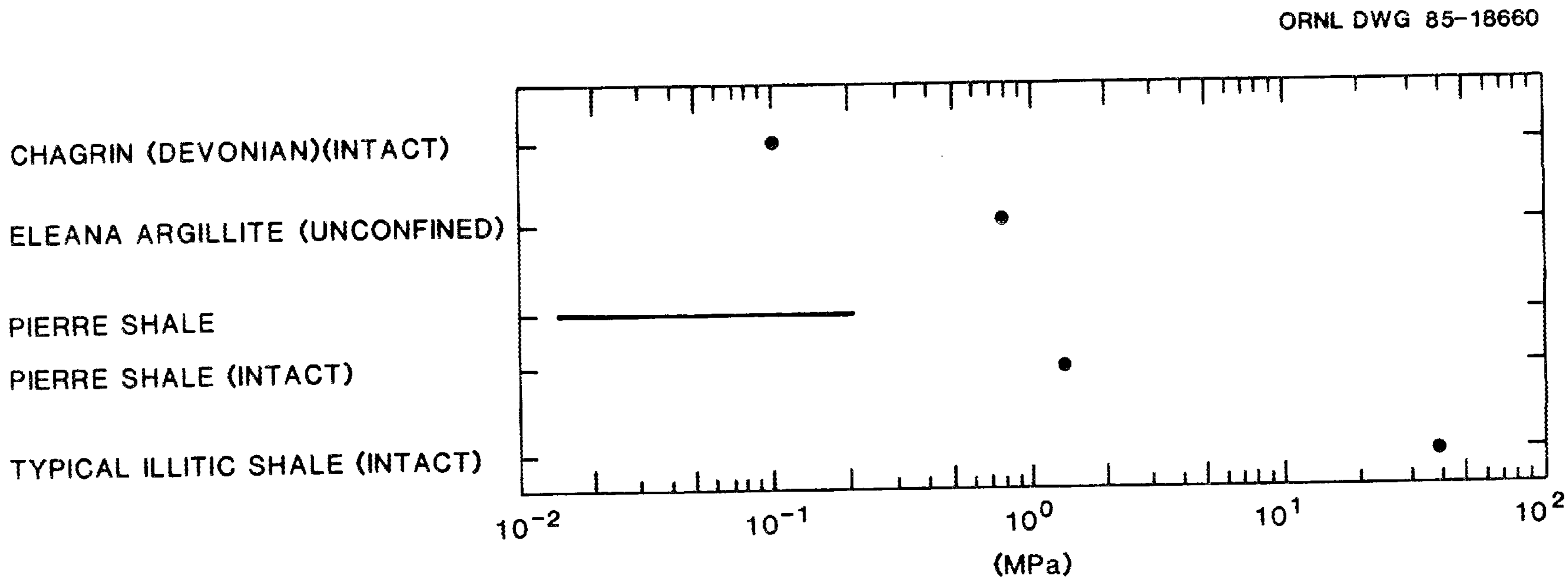

Fig. 36. Cohesion values for selected samples.

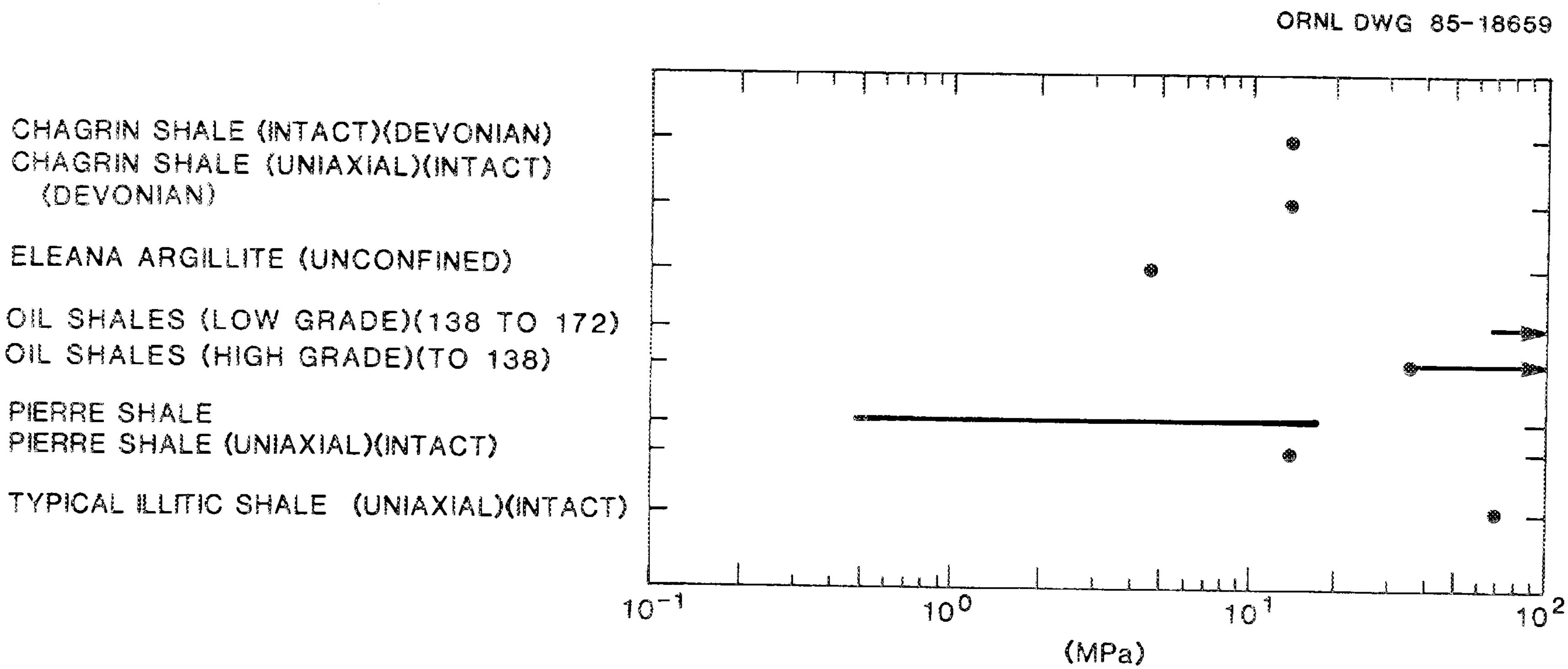

Fig. 37. Compressive strengths for selected samples.

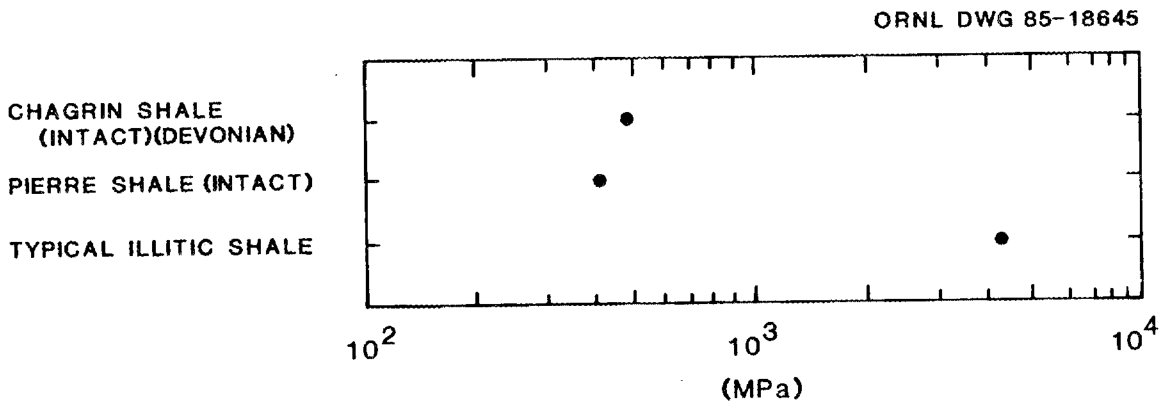

Fig. 38. Shear modulus values for selected samples.

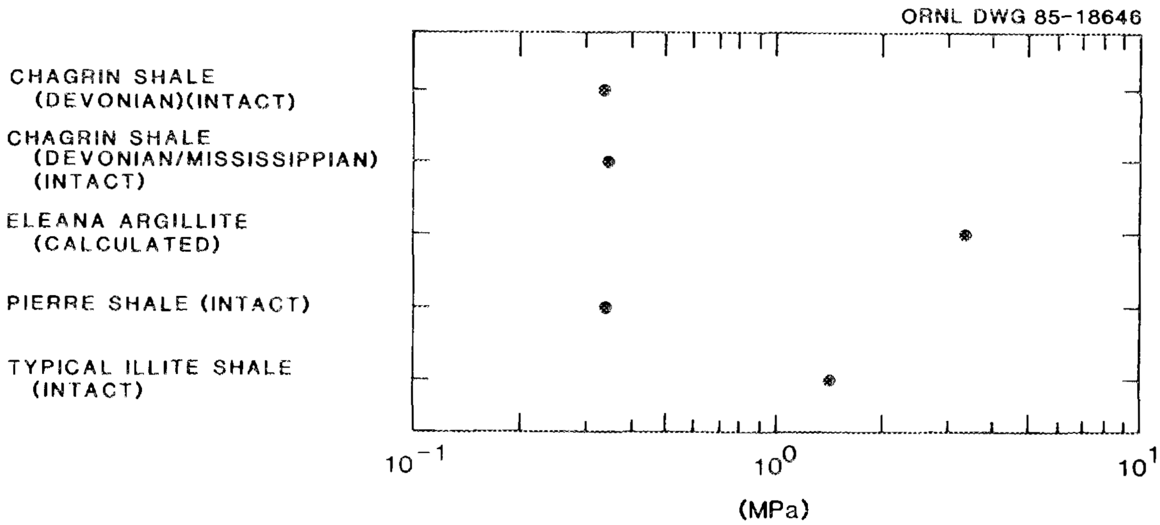

Fig. 39. Tensile strengths for selected samples.

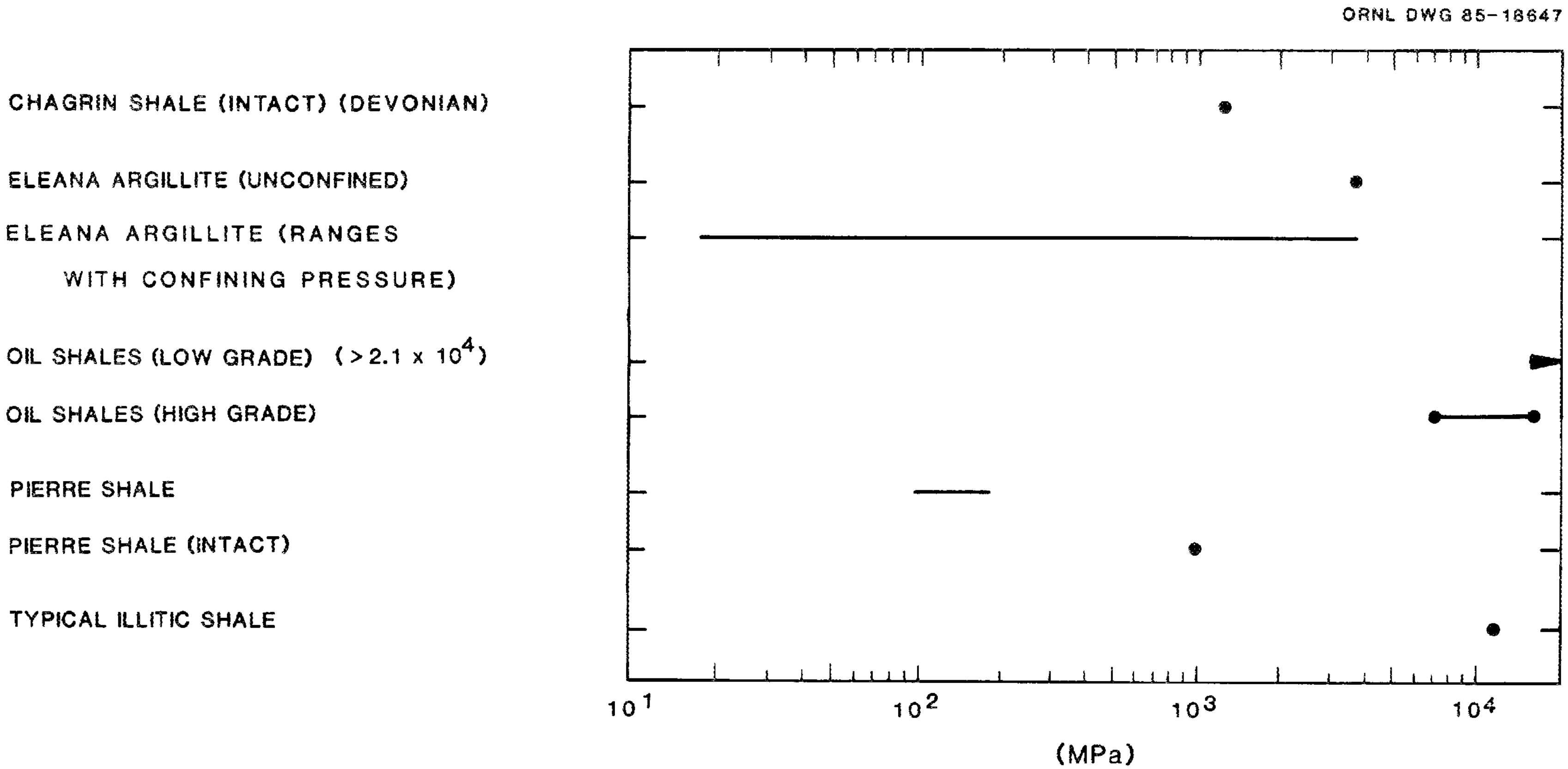

Fig. 40. Young's (elastic) modulus values for selected samples.

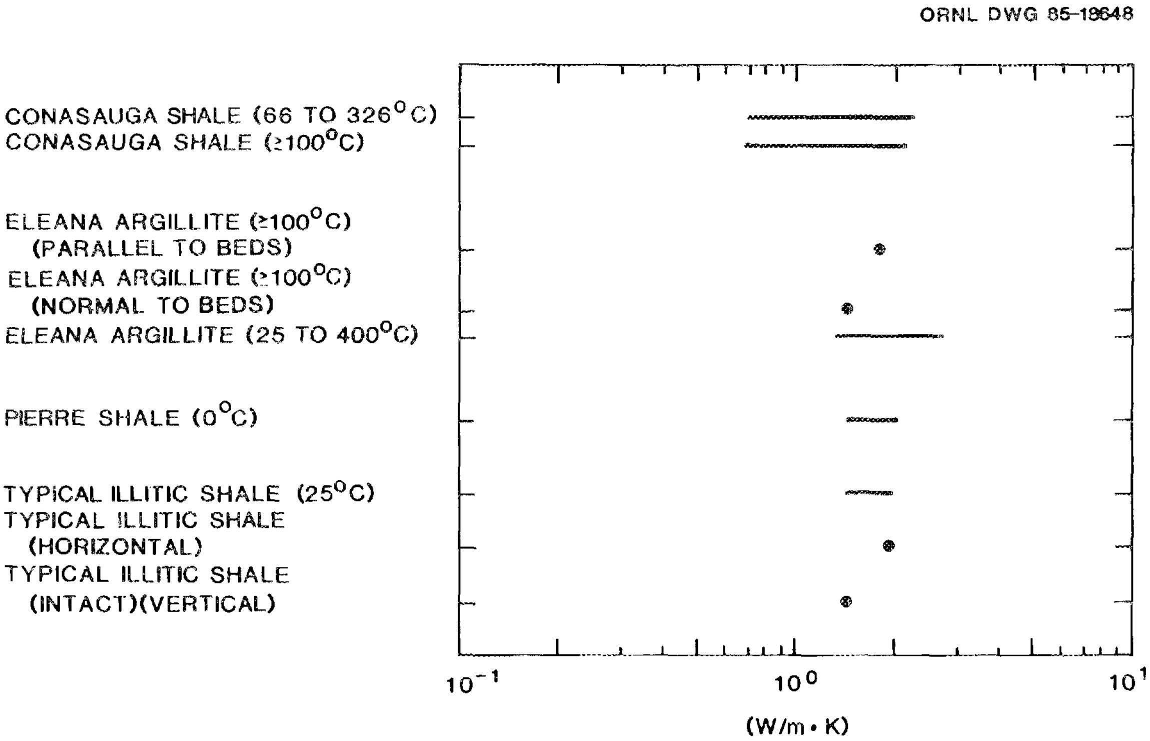

Fig. 41. Thermal conductivities for selected samples.

and (2) uncertainty remains as to whether test results obtained by different investigators (often under different experimental conditions) can be directly compared.

The Conasauga, Devonian, and Pierre Shales appear to have distinctly different ranges of hydraulic conductivities (Fig. 34). The data indicate that the Conasauga has a hydraulic conductivity an order of magnitude lower than that of the Pierre, and the Pierre's conductivity is an order of magnitude lower than that of the Devonian shales. One might have anticipated that Devonian shales would have values intermediate between the Conasauga and the Pierre; however, two rock features might produce the observed order. First, the Devonian shales were probably never buried as deeply as the Conasauga Shale; hence, they would be less compact (or dense), resulting in higher values of porosity and permeability. Second, the Pierre (although much younger and possibly buried less deeply than the Devonian shales) is composed of mixed-layer smectite-illite, smectites, etc., which tend to adsorb water and swell, reducing the rate at which water can pass through the rocks.

Only limited data were available for bulk modulus, cohesion, and shear modulus (Figs. 35, 36, and 38). In general, the Eleana Argillite (of Devonian-Mississippian age) which was subjected to some metamorphism and more illitic shales have higher values for these properties (within two orders of magnitude), suggesting that strength not only increases as a result of compaction but also through recrystallization, grain growth, etc. Note that considerably different values may be obtained when "intact" specimens are tested (e.g., see the values of cohesion for the Pierre in Fig. 36). Unfortunately, the test conditions are not always stated. The values of tensile strength (Fig. 39) are also greater for the Eleana Argillite and "typical illitic shale" than for the Pierre and Devonian shales, presumably for the same reasons.

Several sets of data were available for compressive strength (Fig. 37), but the experimental conditions were quite varied. Some specimens were tested under confined conditions, while others were unconfined (or the experimental conditions were not specified). The Eleana (unconfined) appears weaker than the Pierre and some Devonian shales under confined conditions. Even so, the value for "typical illitic shale" is nearly an order of magnitude greater than that for the Pierre or the Devonian shales. The compressive strength values for the Pierre range over nearly two orders of magnitude. Based on the mineralogical character of the Pierre, this wide range may be due to factors such as the degree to which specimens have been allowed to air-dry prior to testing. The values reported for "oil shales" (Fig. 37) suggest that they are stronger than (typically organic-rich) Devonian shales. Oil shales with less organic matter (kerogen) appear to be slightly stronger than those that contain more organic matter.

Young's (elastic) modulus values were available for a relatively large number of identified formations (Fig. 40). The values for the Eleana Argillite cover three orders of magnitude (this was said to be related to differences in the confining pressure). The highest values are associated with illite-rich rocks and those rich in organic (kerogen) matter.

The range of values for thermal conductivity (Fig. 41) appears to be very narrow (less than an order of magnitude) and generally unrelated to clay mineralogy and/or age. The Conasauga Shales, which are older, have the lowest values recorded here; however, the experimental conditions vary widely with respect to ambient temperature, test direction, etc., making comparisons difficult. Other studies suggest that the presence of larger grains of quartz or other rocks, density, and the presence of pore fluids may influence the thermal properties of shales to a greater extent than the composition of the individual clay minerals present.

10. SUMMARY AND RECOMMENDATIONS

The primary goal of this study was to determine the viability of making preliminary selections of shales and other clay-rich materials for the disposal of radioactve wastes on the basis of their clay mineral composition, as reported in the literature. The results of this study show that some properties of these rocks can be predicted on the basis of the amounts and types of clay minerals present. Examples were given to illustrate the role that clay minerals play in determining certain chemical, hydrologic, and mechanical properties. Overall, thermal properties appeared to be least affected by clay mineral composition. It should be even easier to select materials for use in buffers and backfills, based on the properties that have been determined for specific clays and other minerals.

Several difficulties were encountered during the course of this study. One of the major difficulties was the lack of uniformity in, and lack of information about, the test methods used. The results of tests made on several different materials cannot be compared with confidence when the experimental conditions (e.g., temperature, nature of fluids present, confining stresses) are not identical or nearly so. Also, the lack of uniformity of units used to report the results mandated the use of conversion factors and introduced the possibility of errors. There were comparatively few cases for which the mineral composition of the material being tested was stated. Even when compositions were stated, they were rarely quantified; and they were probably determined on other samples, which may not have been taken at the same locality as the test specimens.

It is suggested that two things be done:

1. The present study should be extended for selected formations (e.g., the Conasauga Shale, Pierre Shale) by using the original references, rather than reports that may exclude important background information, to fill in gaps that may exist in the data (e.g., specific sample locations, depths, and formation names, which are often omitted when data are summarized).
2. Emphasis should be placed on uniformity in laboratory methods, experimental conditions, report formats, and reporting units for all samples to be tested in the future. Reports should include mineralogical analyses of sample splits, as well as petrologic and SEM studies to determine the extent of cementation and grain orientations. When the results of chemical, hydrologic, mechanical, and thermal tests are compared with respect to the mineralogical and petrologic character of the samples, we should be better able to select specific shale formations or other clay-rich rocks if it should become desirable to use shales as potential host rocks for radioactive waste disposal. The necessity for in situ testing of properties such as hydraulic conductivity cannot be overemphasized.

Some of the information reported here refers to specific clay minerals or mixtures which might be used for buffers and/or backfill. Such material can be characterized more readily than natural shales and argillites. Although additional work will be needed, the available information suggests that it will be possible to produce buffers and backfills that have the chemical, hydrologic, mechanical, and thermal properties necessary to safely contain specific kinds of radioactive wastes. Although the host formation will remain the ultimate barrier, tailored buffers and backfills can reduce the likelihood that waste products will reach the host formation for very long times.

11. CONVERSION FACTORS USED

To convert from:	To:	Multiply by:
Btu/lb•°F	J/kg•K	4.185×10^{3}
Btu/h•ft•°F	W/m•K	1.730×10^{0}
cal/cm•s•°C	W/m•K	4.184×10^{2}
cm^2/h	m^2/s	2.780×10^{-8}
cm^2/s	m^2/s	1.000×10^{-4}
°F	°C	5.560×10^{-1}
ft/s	cm/s	3.048×10^{1}
ft/year	cm/s	9.664×10^{-7}
ft^2/h	m^2/s	2.580×10^{-5}
J/s•m•°C	W/m•K	1.000×10^{0}
kg/cm^2	Pa	9.810×10^{4}
kg/m^3	g/cm^3	1.000×10^{-3}
lb/ft^3	g/cm^3	16.018×10^{-3}
md	cm/s	9.600×10^{-7}
metric ton (tonne)	kg	1.000×10^{3}
metric ton (tonne)	g	1.000×10^{6}
Mg/m^3	g/cm^3	1.000×10^{0}
m/s	cm/s	1.000×10^{2}
m^2	cm/s	9.700×10^{8}
psi	Pa	6.890×10^{3}
W/cm•°C	W/m•K	1.000×10^{2}

Note: k = kilo = $\times 10^3$; M = mega = $\times 10^6$; G = giga = $\times 10^9$.

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13. APPENDIXES

Summaries of the information contained in reports cited earlier are presented in Appendixes A, B, C, and D, which follow. Appendix A, which is the most complete of these, is divided into five sections: chemical properties (Database A.1), general physical properties (Database A.2), hydrologic properties (Database A.3), mechanical properties (Database A.4), and thermal properties (Database A.5).

The categories in the Databases are alphabetized; the last four categories to be alphabetized were: location, formation, material, and property class. For most purposes, the last two categories are the most important [e.g., all the information found for the property class "hydraulic conductivity (minerals)" is listed under its "material" name in alphabetical order]. Note that lower-case letters, for example, (a), (b), (c), which follow some material names, were added to facilitate the location of a set of data shown in a specific figure in the body of this report. These letters do not cross-reference materials from one category to any other category.

Insofar as possible, an attempt was made to retain the original terminology and units presented in the report from which the information was derived. If the terminology and/or units used were acceptable, only that information is given; however, in many cases the terms and/or units reported either were not uniform or are not currently accepted. Where possible, the proper terms were added and the units were corrected by multiplying by an appropriate conversion factor (see Sect. 11) so that the values can be compared directly in Figs. 1–41. For example, the term "permeability" may be followed by the term "(hydraulic conductivity)" if that is appropriate for the property reported. Similarly, if the report gave a value for pressure in English units, such as psi, this value is followed by its SI equivalent, MPa.

In addition, three abbreviated Appendixes (B, C, and D) are provided to assist the user in locating specific information. These appendixes use the same five major divisions as presented earlier for Appendix A. Appendix B was alphabetized on the basis of the property cited. Appendix C was arranged so that the material names are listed alphabetically.

Appendix D was alphabetized on the basis of formation name where that information was supplied in the report. Appendix D is the shortest appendix because formation names are often omitted. This information may be available in the original references.

If an interesting item is located in Appendix B, C, or D, the user can either access Appendix A (to review the more complete summary for that entry) or go directly to the source. Potential users are encouraged to take time to become familiar with the formats used.

Finally, the computer program employed here did not permit the use of subscripts or superscripts. Many of the experimental values are given to powers of 10. These values are shown parenthetically on the line, following the numeral 10; for example, 10(6) = 10^6 and 10(-12) = 10^{-12}. Nor did the program permit the use of a centered period; hence, units such as W/m•K are shown with a dash (e.g., W/m-K) in the Appendixes.

13.1 Appendix A. DATABASES

13.1.1 Appendix A.1. CHEMICAL PROPERTIES

Property class: Diffusivity
Material: Bentonite
Formation: -
Location: -
Condition 1: 10% bentonite + sand
Condition 2: Sr(+2) ion
Condition 3: -
Property/units: Diffusivity (m(2)/s)
ranges from: 1.3 x 10(-10)
to: -
as: -
ranges from: - to: -
Reference: Neretnieks (1977)
Source: ONWI-312 (1981), p. 14

Property class: Ion exchange
Material: Allophane
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 70
to: -
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Ion exchange
Material: Bentonite
Formation: -
Location: -
Condition 1: pH = 7 and 9
Condition 2: NaCl = 10(-2) and 10(-3) molar
Condition 3: Ion used: Cs
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 0.1
to: 100
as: Concentration Cs (mol/dm(3))
ranges from: ca. 10(-6) to: ca. 100
Reference: -
Source: NUREG/CP-0052 (1983), p. 181

Property class: Ion exchange
Material: Bentonite (Na) (a)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: 2.5% organic content
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 68.6
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Ion exchange
Material: Bentonite (Na) (b)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: 50% sand mixture
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 34.3
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Ion exchange
Material: Chlorite (a)
Formation: -
Location: -
Condition 1: pH 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 10-40
to: -
as: -
ranges from: - to: -
Reference: Grim (1968)
Source: ONWI-486 (1983), p. 67

Property class: Ion exchange
Material: Chlorite (b)
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 10
to: 40
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Ion exchange
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: Vermiculite 30%, illite 25%, smectite 20%
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: ca. 20
to: -
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 88

Property class: Ion exchange
Material: Glauconite
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 11
to: 20
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Ion exchange
Material: Halloysite
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 5
to: 10
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Ion exchange
Material: Illite (a)
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 10
to: 40
as: -
ranges from: - to: -
Reference: Grim (1968)
Source: ONWI-486 (1983), p. 67

Property class: Ion exchange
Material: Illite (b)
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 16
to: 50
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Ion exchange
Material: Kaolinite (a)
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 3
to: 15
as: -
ranges from: - to: -
Reference: Grim (1968)
Source: ONWI-486 (1983), p. 67

Property class: Ion exchange
Material: Kaolinite (b)
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 2
to: 15
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Ion exchange
Material: Palygorskite
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 20
to: 30
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Ion exchange
Material: Smectite
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 80
to: 150
as: -
ranges from: - to: -
Reference: Grim (1968)
Source: ONWI-486 (1983), p. 67

Property class: Ion exchange
Material: Smectite (Ca)
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 80
to: 150
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Ion exchange
Material: Smectite (Ca)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/g) (?)
ranges from: 93
to: 12
as: Temperature (C)
ranges from: 105 to: 390
Reference: Grim (1968)
Source: ONWI-312 (1981), p. 24

Property class: Ion exchange
Material: Smectite (Li)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/g) (?)
ranges from: 56
to: 20
as: Temperature (C)
ranges from: 105 to: 200
Reference: Grim (1968)
Source: ONWI-312 (1981), p. 24

Property class: Ion exchange
Material: Smectite (Na)
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 100
to: 150
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Ion exchange
Material: Smectite (Na)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/g) (?)
ranges from: 95
to: 68
as: Temperature (C)
ranges from: 105 to: 390
Reference: Grim (1968)
Source: ONWI-312 (1981), p. 24

Property class: Ion exchange
Material: Vermiculite (a)
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 100
to: 150
as: -
ranges from: - to: -
Reference: Grim (1968)
Source: ONWI-486 (1983), p. 67

Property class: Ion exchange
Material: Vermiculite (b)
Formation: -
Location: -
Condition 1: pH = 7
Condition 2: -
Condition 3: -
Property/units: Ion exchange capacity (meq/100 g)
ranges from: 100
to: 150+
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 152

Property class: Sorption
Material: Argillite
Formation: Eleana Argillite
Location: -
Condition 1: Ions used: Am, Ba, Ce, Cm, Cs, Eu, Pm, Ra, Sr, Tc, U
Condition 2: Sources of variability: method, source, fluid comp, R-N conc, temp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 1 x 10(5)
as: -
ranges from: - to: -
Reference: Three refs
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Attapulgite
Formation: -
Location: -
Condition 1: Ions used: Am, Cm, I, Rb, Sr
Condition 2: Sources of variability: Na conc, time, pH, fluid comp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 1 x 10(-2)
to: 2 x 10(4)
as: -
ranges from: - to: -
Reference: Beall et al (1979)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Bentonite
Formation: -
Location: -
Condition 1: pH = 10
Condition 2: Ions used = I, Tc, Cs, Sr, Np, Pu, Am, Zr, Sm
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g?)
ranges from: 1
to: 2 x 10(5)
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 304

Property class: Sorption
Material: Bentonite (Ca)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: Cs ions
Condition 3: pH 9.85 (initial), pH 8.6 (final)
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 2.5 x 10(4)
to: 1.1 x 10(5)
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Ca)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: I ions
Condition 3: pH 9.85 (initial), pH 8.6 (final)
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 2.5
to: 3.2
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Ca)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: Sr ions
Condition 3: pH 9.85 (initial), pH 8.6 (final)
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 1.2 x 10(3)
to: 865
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Na)
Formation: -
Location: -
Condition 1: Grand Ronde ground water
Condition 2: pH 9.85 (initial), pH 8.6 (final)
Condition 3: Sr ions
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 5.0 x 10(3)
to: 6.8 x 10(3)
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Na)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: I ions
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0.4
to: 8.6
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Na)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: pH 9.85 (initial), pH 8.6 (final)
Condition 3: Cs ions
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 1.1 x 10(3)
to: 1.0 x 10(3)
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Na)
Formation: -
Location: -
Condition 1: Ions used: Am, Cs, Eu, Ra, Sr, Tc
Condition 2: Sources of variability: pH, temp, fluid comp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 4 x 10(4)
as: -
ranges from: - to: -
Reference: Nowak (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Bentonite (Na) (Accofloc-350)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: pH 9.85 (initial), pH 8.6 (final)
Condition 3: Cs ions
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 1.3 x 10(3)
to: 1.1 x 10(3)
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Na) (Accofloc-350)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: pH 9.85 (initial), pH 8.6 (final)
Condition 3: I ions
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 1.2
to: 0.1
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Na) (Accofloc-350)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: pH 9.85 (initial), pH 8.6 (final)
Condition 3: Sr ions
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 1.5 x 10(3)
to: 1.5 x 10(3)
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Na) (Saline Seal-100)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: pH 9.85 (initial), pH 8.6 (final)
Condition 3: Cs ions
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 2.6 x 10(3)
to: 3.8 x 10(3)
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Na) (Saline Seal-100)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: pH 9.85 (initial), pH 8.6 (final)
Condition 3: I ions
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 2.8
to: 3.6
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite (Na) (Saline Seal-100)
Formation: -
Location: -
Condition 1: Grande Ronde ground water
Condition 2: pH 9.85 (initial), pH 8.6 (final)
Condition 3: Sr ions
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 1.2 x 10(3)
to: 1.5 x 10(3)
as: Time (days)
ranges from: 14 to: 28
Reference: -
Source: ONWI-312 (1981), p. 35

Property class: Sorption
Material: Bentonite and Quartz
Formation: -
Location: -
Condition 1: Ions used: Am, Ce, Cs, Eu, I, Np, Pu, Ra, Sr, Tc, U
Condition 2: Sources of variability: fluid comp, temp, R-N conc
Condition 3: 1:9 mixture
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: <1
to: 1 x 10(4)
as: -
ranges from: - to: -
Reference: Allard et al (1979)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Bentonite and Sand
Formation: -
Location: -
Condition 1: Ions used: Am, Ra
Condition 2: Sources of variability: fluid comp, pH
Condition 3: 1:9 mixture
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 490
to: 9.5 x 10(3)
as: -
ranges from: - to: -
Reference: Nowak (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: Anion used = I
Condition 2: Various concentrations and depths
Condition 3: pH = 3
Property/units: Sorption coefficient (Kd) (ml/g?)
ranges from: 0.87
to: 6.12
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 97

Property class: Sorption
Material: Clay (Na)
Formation: -
Location: Belle Fourch
Condition 1: Ion used: Cs
Condition 2: Sources of variability: pH, fluid comp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 5.6
to: 5.7 x 10(3)
as: -
ranges from: - to: -
Reference: Silva et al (1979)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Hectorite
Formation: -
Location: -
Condition 1: Ions used: Cs, Eu, Sr, Tc
Condition 2: Sources of variability: fluid comp, pH, temp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0.4
to: 7.2 x 10(3)
as: -
ranges from: - to: -
Reference: Nowak (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Hectorite and Sand
Formation: -
Location: -
Condition 1: Ion used: Ra
Condition 2: Sources of variability: fluid comp, pH
Condition 3: 1:9 mixture
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 400
to: 1300
as: -
ranges from: - to: -
Reference: Nowak (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Illite
Formation: -
Location: -
Condition 1: Ion used: Cs
Condition 2: 0.2 mol/L NaCl
Condition 3: -
Property/units: Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.9
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7812 (1983), p. 25

Property class: Sorption
Material: Illite
Formation: -
Location: -
Condition 1: Ions used: Sr
Condition 2: 0.04 to 0.2 mol/L NaCl (and NaOAC)
Condition 3: pH = 5
Property/units: Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.005
to: 0.02
as: -
ranges from: - to: -
Reference: Three refs
Source: AECL-7812 (1983), p. 25

Property class: Sorption
Material: Illite
Formation: -
Location: -
Condition 1: Ions used: U, Co
Condition 2: 0.04 mol/L NaCl
Condition 3: pH = 5
Property/units: Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.045
to: 0.090
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 25

Property class: Sorption
Material: Illite
Formation: -
Location: -
Condition 1: Ions used: Co, Sr, Nb, Ru, Cs, Th, U, Np, Pu, Am
Condition 2: Sources of variability: pH, temp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 3 x 10(5)
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 132-133

Property class: Sorption
Material: Illite
Formation: -
Location: -
Condition 1: pH = 7.5
Condition 2: Ions used: I, Tc, Np, Sr, Cs, Am, Sm, Sr
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g?)
ranges from: 1
to: 3 x 10(6)
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 304

Property class: Sorption
Material: Kaolinite
Formation: -
Location: -
Condition 1: Ion used: Sr
Condition 2: 0.04 to 0.2 Mol/L NaCl (and NaOAC)
Condition 3: pH = 5
Property/units: Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.003
to: 0.006
as: -
ranges from: - to: -
Reference: Three refs
Source: AECL-7812 (1983), p. 25

Property class: Sorption
Material: Kaolinite
Formation: -
Location: -
Condition 1: Ions used: Am, Cm, Sm, U, Co
Condition 2: 0.04 to 0.25 mol/L NaCl
Condition 3: pH = 5
Property/units: Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.002
to: 0.04
as: -
ranges from: - to: -
Reference: Two refs
Source: AECL-7812 (1983), p. 25

Property class: Sorption
Material: Kaolinite
Formation: -
Location: -
Condition 1: Ions used: Cs
Condition 2: 0.2 to 0.5 mol/L NaCl; 0.01 mol/L NaOAC
Condition 3: -
Property/units: Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.02
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7812 (1983), p. 25

Property class: Sorption
Material: Kaolinite
Formation: -
Location: -
Condition 1: Ions used: Am, Cf, Cm, Es, Eu, La, Sm, Tc, Yb
Condition 2: Sources of variability: pH, fluid comp, Na conc, R-N conc
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0.1
to: 1.6 x 10(3)
as: -
ranges from: - to: -
Reference: Three refs
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Kaolinite
Formation: -
Location: -
Condition 1: Ions used: Co, Sr, Nb, Tc, Ru, Cs, Sm, Eu, Th, U, Np, Pu, Am
Condition 2: Sources of variability: pH, temp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 3 x 10(5)
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2/(in preparation) p. 132-133

Property class: Sorption
Material: Kaolinite
Formation: -
Location: -
Condition 1: pH = 6.5
Condition 2: Ions used: I, Np, Tc, Sr, Cs, Zr, Pu, Am, Sm
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g?)
ranges from: 1
to: 2 x 10(4)
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 304

Property class: Sorption
Material: Kaolinite (a)
Formation: -
Location: Georgia
Condition 1: American Clay Institute Source Clay KGa-1
Condition 2: Tested in basalt ground water; ions: Sr, Cs, Am
Condition 3: Tested for 28 days at 25 deg C
Property/units: Batch distribution ratio (Rd) (ml/g?)
ranges from: 1.28 x 10(2)
to: 9.22 x 10(2)
as: -
ranges from: - to: -
Reference: -
Source: PNL-4452 UC-70 (1983), p. 18

Property class: Sorption
Material: Kaolinite (b)
Formation: -
Location: Georgia
Condition 1: American Clay Institute Source Clay KGa-2
Condition 2: Tested in basalt ground water; ions used: Sr, Cs, Am
Condition 3: Tested for 28 days at 25 deg C
Property/units: Batch distribution ratio (Rd) (ml/g?)
ranges from: 1.88 x 10(2)
to: 9.0 x 10(3)
as: -
ranges from: - to: -
Reference: -
Source: PNL-4452 UC-70 (1983), p. 18

Property class: Sorption
Material: Kaolinite (Ca)
Formation: -
Location: -
Condition 1: Ion used: Cs
Condition 2: -
Condition 3: -
Property/units: Sorption coefficient (Kd) (Log) (ml/g?)
ranges from: ca. 2.3
to: ca. 1.5
as: Log C calcium chloride
ranges from: (-3) to: ca. 0.5
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 282

Property class: Sorption
Material: Kaolinite (Ca)
Formation: -
Location: -
Condition 1: Ion used: Sr
Condition 2: -
Condition 3: -
Property/units: Sorption coefficient (Kd) (Log) (ml/g?)
ranges from: ca. 1.3
to: ca. (-1)
as: Log C calcium chloride
ranges from: (-3) to: ca. 0
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 282

Property class: Sorption
Material: Kaolinite (Na)
Formation: -
Location: -
Condition 1: Ion used: Cs
Condition 2: -
Condition 3: -
Property/units: Sorption coefficient (Kd) (Log) (ml/g?)
ranges from: ca. 2.3
to: ca. 1.3
as: Log C NaCl
ranges from: (-2) to: ca. 1
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 282

Property class: Sorption
Material: Kaolinite (Na)
Formation: -
Location: -
Condition 1: Ion used: Sr
Condition 2: -
Condition 3: -
Property/units: Sorption coefficient (Kd) (Log) (ml/g?)
ranges from: >2
to: <0
as: Log C NaCl
ranges from: (-2) to: ca. 0.5
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 282

Property class: Sorption
Material: Nontronite
Formation: -
Location: -
Condition 1: Ions used: Am, Cs, I, Np, Pu, Ra, Se, Sr, Tc, U
Condition 2: Sources of variability: pH, R-N conc, Eh, temp, sol:sorb ratio
Condition 3: Mineralization in basalt fractures and vugs
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 2.25 x 10(5)
as: -
ranges from: - to: -
Reference: Two refs
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Shale
Formation: Conasauga Shale
Location: -
Condition 1: Ions used: Cs, Rb, Sr
Condition 2: Sources of variability: not stated
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 57
to: 100
as: -
ranges from: - to: -
Reference: Komarneni and Roy (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Shale
Formation: Dewey Lake Redbeds
Location: -
Condition 1: Ion used: Eu
Condition 2: Sources of variability: pH, temp, fluid comp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 200
to: 1.4 x 10(4)
as: -
ranges from: - to: -
Reference: Nowak (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Smectite
Formation: -
Location: -
Condition 1: Calculated values
Condition 2: NaCl conc = 10(-2) molar
Condition 3: 25 deg C
Property/units: Sorption coefficient (Kd) (cm(3)/g) (ml/g)
ranges from: ca. 188
to: ca. 200
as: Weight % clay
ranges from: ca. 5 to: ca. 95
Reference: -
Source: NUREG/CP-0052 (1983), p. 186

Property class: Sorption
Material: Smectite
Formation: -
Location: -
Condition 1: Ion used: Cs
Condition 2: 0.2 to 0.5 mol/L NaCl; 0.01 mol/L NaOAC
Condition 3: pH = 5
Property/units: Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.06
to: 0.7
as: -
ranges from: - to: -
Reference: -
Source: AECL-7812 (1983), p. 25

Property class: Sorption
Material: Smectite
Formation: -
Location: -
Condition 1: Ions used: Eu, Am, Cm, Sm, U, Co
Condition 2: 0.04 to 0.25 mol/L NaCl (and NaOAC)
Condition 3: pH = 5
Property/units: Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.034
to: 0.65
as: -
ranges from: - to: -
Reference: Three refs
Source: AECL-7812 (1983), p. 25

Property class: Sorption
Material: Smectite
Formation: -
Location: -
Condition 1: Ions used: Sr
Condition 2: 0.04 to 0.2 mol/L NaCl (and NaOAC)
Condition 3: pH = 5
Property/units: Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.030
to: 0.6
as: -
ranges from: - to: -
Reference: Three refs
Source: AECL-7812 (1983), p. 25

Property class: Sorption
Material: Smectite
Formation: -
Location: -
Condition 1: Ions used: Co, Sr, Nb, Tc, Ru, I, Cs, Sm, Eu, U, Np, Pu, Am
Condition 2: Sources of variability: pH, temp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 4 x 10(5)
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 132-133

Property class: Sorption
Material: Smectite
Formation: -
Location: -
Condition 1: Various pH's, salinities, flow rates, etc.
Condition 2: Several ion species
Condition 3: -
Property/units: Sorption coefficient (ml/g)
ranges from: 200
to: 2,000
as: -
ranges from: - to: -
Reference: Nowak (1979)
Source: ONWI-312 (1981), p. 13

Property class: Sorption
Material: Smectite
Formation: -
Location: Arizona
Condition 1: American Clay Institute Source Clay SAz-1
Condition 2: Tested in basalt ground water; ions used: Sr, Cs, Am
Condition 3: Tested for 28 days at 25 deg C
Property/units: Batch distribution ratio (Rd) (ml/g?)
ranges from: 8.15 x 10(2)
to: 2.7 x 10(3)
as: -
ranges from: - to: -
Reference: -
Source: PNL-4452 UC-70 (1983), p. 18

Property class: Sorption
Material: Smectite
Formation: -
Location: Arizona
Condition 1: Ions used: Cs, Rb, Sr
Condition 2: Sources of variability: not stated
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 260
to: 750
as: -
ranges from: - to: -
Reference: Komarneni and Roy (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Smectite
Formation: -
Location: Texas
Condition 1: American Clay Institute Source Clay STx-1
Condition 2: Tested in basalt ground water; ions used: Sr, Cs, Am
Condition 3: Tested for 28 days at 25 deg C
Property/units: Batch distribution ratio (Rd) (ml/g?)
ranges from: 1.4 x 10(3)
to: 1.9 x 10(3)
as: -
ranges from: - to: -
Reference: -
Source: PNL-4452 UC-70 (1983), p. 18

Property class: Sorption
Material: Smectite
Formation: -
Location: Texas
Condition 1: Saturated NaCl brine
Condition 2: Ion used: Cs
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 310
to: 685
as: Hydrothermal alteration
ranges from: Untreated to: 200 deg C, 30 MPa
Reference: Roy and Burns
Source: Sci Basis for Waste Management - V (1982), p. 638

Property class: Sorption
Material: Smectite
Formation: -
Location: Texas
Condition 1: Saturated NaCl brine
Condition 2: Ion used: Cs
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 410
to: 400
as: Hydrothermal alteration
ranges from: Untreated to: 200 deg C, 30 MPa
Reference: Roy and Burns
Source: Sci Basis for Waste Management - V (1982), p. 638

Property class: Sorption
Material: Smectite
Formation: -
Location: Texas
Condition 1: Saturated NaCl brine
Condition 2: Ion used: Sr
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 310
to: 370
as: Hydrothermal alteration
ranges from: Untreated to: 200 deg C, 30 MPa
Reference: Roy and Burns
Source: Sci Basis for Waste Management - V (1982), p. 638

Property class: Sorption
Material: Smectite
Formation: -
Location: Wyoming
Condition 1: American Clay Institute Source Clay SWy-1
Condition 2: Tested in basalt ground water; ions used: Sr, Cs, Am
Condition 3: Tested for 28 days at 25 deg C
Property/units: Batch distribution ratio (Rd) (ml/g?)
ranges from: 1.0 x 10(3)
to: 2.0 x 10(3)
as: -
ranges from: - to: -
Reference: -
Source: PNL-4452 UC-70 (1983), p. 18

Property class: Sorption
Material: Smectite
Formation: -
Location: Wyoming
Condition 1: Saturated NaCl brine
Condition 2: Ion used: Sr
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 170
to: 200
as: Hydrothermal alteration
ranges from: Untreated to: 200 deg C, 30 MPa
Reference: Roy and Burns
Source: Sci Basis for Waste Management - V (1982), p. 638

Property class: Sorption
Material: Smectite (Ca)
Formation: -
Location: -
Condition 1: Ions used: Ba, Cs, Eu, Sr
Condition 2: Sources of variability: R-N conc, Ca conc
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0.4
to: 1.1 x 10(4)
as: -
ranges from: - to: -
Reference: Shiao et al (1979)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Smectite (Na)
Formation: -
Location: -
Condition 1: Ions used: Am, Ba, Cf, Cm, Cs, Es, Eu, La, Sm, Sr, Yb
Condition 2: Sources of variability: Na conc, R-N conc, pH, temp, fluid comp
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 0.2
to: 1 x 10(5)
as: -
ranges from: - to: -
Reference: Three refs
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Vermiculite
Formation: -
Location: -
Condition 1: Ions used: Ba, Cs, Rb, Se, Sr
Condition 2: Sources of variability: not stated
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 47
to: 1.5 x 10(3)
as: -
ranges from: - to: -
Reference: Two refs
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Vermiculite
Formation: -
Location: -
Condition 1: Varies with pH
Condition 2: -
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g?)
ranges from: ca. 40
to: 4 x 10(4)
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979), p. 315

Property class: Sorption
Material: Vermiculite
Formation: -
Location: -
Condition 1: pH = 8.5
Condition 2: Ions used = I, Tc, Np, Sr, Zr, Cs, Am, Sm, Pu
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g?)
ranges from: 30
to: 4 x 10(6)
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979a), p. 304

Property class: Sorption
Material: Vermiculite
Formation: -
Location: South Carolina
Condition 1: Saturated NaCl brine
Condition 2: Ion used: Cs
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 8.9 x 10(2)
to: 1.01 x 10(4)
as: Hydrothermal alteration
ranges from: Untreated to: 200 deg C, 30 MPa
Reference: Roy and Burns
Source: Sci Basis for Waste Management - V (1982), p. 638

Property class: Sorption
Material: Vermiculite
Formation: -
Location: South Carolina
Condition 1: Saturated NaCl brine
Condition 2: Ion used: Sr
Condition 3: -
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 2 x 10(3)
to: 9.8 x 10(2)
as: Hydrothermal alteration
ranges from: Untreated to: 200 deg C, 30 MPa
Reference: Roy and Burns
Source: Sci Basis for Waste Management - V (1982), p. 638

Property class: Sorption
Material: Vermiculite and Gibbsite
Formation: -
Location: -
Condition 1: Ions used: Ba, Cm, Rb, Sr
Condition 2: Sources of variability: not stated
Condition 3: 1:1 mixture
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 77
to: 1520
as: -
ranges from: - to: -
Reference: Komarneni and Roy (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Vermiculite and Shale
Formation: Conasauga Shale
Location: -
Condition 1: Ions used: Ba, Cm, Rb, Sr
Condition 2: Sources of variability: not stated
Condition 3: 1:1 mixture
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 41
to: 1340
as: -
ranges from: - to: -
Reference: Komarneni and Roy (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Vermiculite and Smectite
Formation: -
Location: -
Condition 1: Ions used: Ba, Cm, Rb, Sr
Condition 2: Sources of variability: not stated
Condition 3: 1:1 mixture
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 192
to: 3800
as: -
ranges from: - to: -
Reference: Komarneni and Roy (1980)
Source: ONWI-486 (1983), p. 73

Property class: Sorption
Material: Vermiculite and Zeolite (various)
Formation: -
Location: -
Condition 1: Ions used: Ba, Cm, Rb, Sr
Condition 2: Sources of variability: zeolite species
Condition 3: 1:1 mixture
Property/units: Sorption coefficient (Kd) (ml/g)
ranges from: 130
to: 5.92 x 10(5)
as: -
ranges from: - to: -
Reference: Komarneni and Roy (1980)
Source: ONWI-486 (1983), p. 73

13.1.2 Appendix A.2. GENERAL PHYSICAL PROPERTIES

Property class: Density
Material: Argillite
Formation: Eleana Argillite
Location: Nevada
Condition 1: Quartz and illite dominant
Condition 2: Lesser kaolinite, chamosite, etc.
Condition 3: -
Property/units: Density (bulk) (g/cm(3))
ranges from: 2.44
to: 2.71
as: -
ranges from: - to: -
Reference: -
Source: ORNL/Sub/84-64794/1 (1985), p. 406

Property class: Density
Material: Bentonite (a)
Formation: -
Location: -
Condition 1: Pressed at 50 to 100 MPa
Condition 2: Water content ca. 10%
Condition 3: -
Property/units: Density (bulk) (t/m(3)) (g/cm(3))
ranges from: ca. 2.1
to: -
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979b), p. 148

Property class: Density
Material: Bentonite (a)
Formation: -
Location: Oregon
Condition 1: 20 - 160 mesh
Condition 2: -
Condition 3: -
Property/units: Specific gravity (g/cm(3))
ranges from: 2.73
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Density
Material: Bentonite (b)
Formation: -
Location: Oregon
Condition 1: Minus 200 mesh
Condition 2: -
Condition 3: -
Property/units: Specific gravity (g/cm(3))
ranges from: 2.85
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Density
Material: Bentonite (c)
Formation: -
Location: Wyoming
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Specific gravity (g/cm(3))
ranges from: 2.77
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Density
Material: Bentonite (Ca)
Formation: Panther Creek Clay
Location: -
Condition 1: Held at compaction pressure for one minute
Condition 2: -
Condition 3: -
Property/units: Density (g/cm(3))
ranges from: <1.7
to: ca. 2.14
as: Compaction pressure (MPa) and water content (%)
ranges from: 55; <5 to: 221; ca. 8
Reference: -
Source: PNL-4452 UC-70 (1983), p. 24

Property class: Density
Material: Bentonite (Na)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: ADOPTED VALUE FOR CALCULATIONS
Condition 3: -
Property/units: Density (specific) (t/m(3)) (g/cm(3))
ranges from: 2.7
to: -
as: -
ranges from: - to: -
Reference: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 3

Property class: Density
Material: Bentonite (Na) (a)
Formation: -
Location: -
Condition 1: Plus 80 to 90% crushed quartzite, quartz sand, etc.
Condition 2: Laboratory compaction
Condition 3: -
Property/units: Density (bulk) (t/m(3)) (g/cm(3))
ranges from: 1.8
to: 2.0
as: -
ranges from: - to: -
Reference: -
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Property class: Density
Material: Bentonite (Na) (a)
Formation: -
Location: -
Condition 1: Density maximum near 6% water
Condition 2: Density varies with compaction pressure
Condition 3: -
Property/units: Density (g/cm(3))
ranges from: <1.8
to: 2.28
as: Compaction pressure (MPa)
ranges from: 55 to: 221
Reference: -
Source: ONWI-312 (1981), p. 32

Property class: Density
Material: Bentonite (Na) (b)
Formation: -
Location: -
Condition 1: Plus 80 to 90% crushed quartzite, sand, etc.
Condition 2: Field compaction test
Condition 3: -
Property/units: Density (bulk) (t/m(3)) (g/cm(3))
ranges from: 1.4
to: 1.7
as: -
ranges from: - to: -
Reference: -
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Property class: Density
Material: Bentonite (Na) (b)
Formation: -
Location: -
Condition 1: CS-50 Na-bentonite
Condition 2: Compaction for one minute
Condition 3: -
Property/units: Density (g/cm(3))
ranges from: <1.8
to: ca. 2.5
as: Compaction pressure (MPa) and water content (%)
ranges from: 55; <2 to: 221; 5
Reference: -
Source: PNL-4452 UC-70 (1983), p. 21

Property class: Density
Material: Bentonite (Na) (c)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (rho x t/m(3)) (g/cm(3))
ranges from: 2.54
to: 1.08
as: Water content (wt. %); void ratio (e)
ranges from: 3.7; 0.1 to: 741; 20.0
Reference: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 4

Property class: Density
Material: Bentonite (Na) and Sand (a)
Formation: -
Location: -
Condition 1: 75% clay
Condition 2: Held at compaction pressure for one minute
Condition 3: -
Property/units: Density (g/cm(3))
ranges from: <1.9
to: ca. 2.8
as: Compaction pressure (MPa) and water content (%)
ranges from: 55; <3 to: 220; ca. 4
Reference: -
Source: PNL-4452 UC-70 (1983), p. 22

Property class: Density
Material: Bentonite (Na) and Sand (b)
Formation: -
Location: -
Condition 1: 50% bentonite
Condition 2: Held at pressure for one minute
Condition 3: -
Property/units: Density (g/cm(3))
ranges from: <1.9
to: ca. 2.7
as: Compaction pressure (MPa) and water content (%)
ranges from: 55; <3 to: 276; ca. 8
Reference: -
Source: PNL-4452 UC-70 (1983), p. 23

Property class: Density
Material: Bentonite and Sand
Formation: -
Location: -
Condition 1: Dry
Condition 2: -
Condition 3: -
Property/units: Density (dry) (Mg/m(3)) (g/cm(3))
ranges from: 1.81
to: 1.4
as: Clay content (%)
ranges from: 22 to: 100
Reference: -
Source: AECL-7812 (1983), p. 31

Property class: Density
Material: Chlorite
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (dry) (presumed g/cm(3))
ranges from: 2.6
to: 2.96
as: -
ranges from: - to: -
Reference: Grim (1968)
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Property class: Density
Material: Clay
Formation: -
Location: Hanford
Condition 1: Ringold clay D
Condition 2: -
Condition 3: - .
Property/units: Specific gravity (g/cm(3))
ranges from: 2.71
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Density
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (kg/m(3))
ranges from: 2100 (2.100 g/cm(3))
to: -
as: -
ranges from: - to: -
Reference: Chapman and Gera
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Property class: Density
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (kg/m(3))
ranges from: 2010 (2.010 g/cm(3))
to: -
as: -
ranges from: - to: -
Reference: Chapman and Gera
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Property class: Density
Material: Clay
Formation: Oxford Clay
Location: England
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (kg/m(3))
ranges from: 2210 (2.210 g/cm(3))
to: -
as: -
ranges from: - to: -
Reference: Chapman and Gera
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Property class: Density
Material: Clay
Formation: Porter's Creek Clay
Location: Louisiana
Condition 1: Smectite, kaolinite, illite, etc.
Condition 2: Quartz 5 to 50 %
Condition 3: -
Property/units: Density (kg/m(3))
ranges from: 1,954 (1.954 g/cm(3))
to: -
as: -
ranges from: - to: -
Reference: Boutwell (1980)
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Property class: Density
Material: Clay and Sand
Formation: -
Location: -
Condition 1: Various bentonite sand mixtures
Condition 2: 10 - 70% clay by weight
Condition 3: -
Property/units: Density (dry) (kg/mg(3)) (?) (g/cm(3)) (?)
ranges from: ca. 1.6
to: ca. 2.2
as: Clay content (%) and moisture content (%)
ranges from: 70; ca. 20 - 27 to: 10; ca. 5 - 15
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Density
Material: Clays and Shales
Formation: -
Location: Eastern US
Condition 1: Twenty-six determinations
Condition 2: -
Condition 3: -
Property/units: Density (grain) (average) (presumed g/cm(3))
ranges from: 2.69
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Property class: Density
Material: Illite
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (presumed g/cm(3))
ranges from: 2.65
to: 2.13
as: Humidity (%)
ranges from: Dry to: 100
Reference: Grim (1968)
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Property class: Density
Material: Illite and Smectite
Formation: -
Location: -
Condition 1: Mixed-layer with smectite
Condition 2: -
Condition 3: -
Property/units: Density (presumed g/cm(3))
ranges from: 2.64
to: 1.48
as: Humidity (%)
ranges from: Dry to: 100
Reference: Grim (1968)
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Property class: Density
Material: Kaolinite
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (dry) (Mg/m(3)) (g/cm(3))
ranges from: ca. 1.2
to: ca. 1.5
as: Moisture content (%)
ranges from: 10 to: 25
Reference: -
Source: AECL-7812 (1983), p. 35

Property class: Density
Material: Kaolinite
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (presumed g/cm(3))
ranges from: 2.60 - 2.68
to: 2.43
as: Humidity (%)
ranges from: Dry to: 100
Reference: Grim (1968)
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Property class: Density
Material: Kaolinite and Sand
Formation: -
Location: -
Condition 1: Dry
Condition 2: -
Condition 3: -
Property/units: Density (dry) (Mg/m(3)) (g/cm(3))
ranges from: 2.05
to: 1.45
as: Clay content (%)
ranges from: 22 to: 100
Reference: -
Source: AECL-7812 (1983), p. 31

Property class: Density
Material: Oil Shales
Formation: Green River Fm
Location: -
Condition 1: Mahogany zone
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (presumed g/cm(3))
ranges from: 1.506
to: 2.37
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 13

Property class: Density
Material: Shale
Formation: -
Location: California
Condition 1: Pliocene
Condition 2: Depth: 5,000 to 6,000 feet
Condition 3: -
Property/units: Density (presumed g/cm(3))
ranges from: 2.5
to: -
as: Water content (%)
ranges from: 6 to: -
Reference: McCulloch (1967)
Source: Y/OWI/SUB-7009/1 (1976), p. 12

Property class: Density
Material: Shale
Formation: Antrim Shale
Location: Michigan
Condition 1: Quartz dominant
Condition 2: Illite, kaolinite
Condition 3: -
Property/units: Density (bulk) (g/cm(3))
ranges from: 2.2
to: 2.8
as: -
ranges from: - to: -
Reference: Young (1978)
Source: ORNL/Sub/84-64794/1 (1985), p. 96

Property class: Density
Material: Shale
Formation: Bearpaw Shale
Location: Montana
Condition 1: Upper Cretaceous
Condition 2: Depth from 180 to 200 feet
Condition 3: -
Property/units: Density (dry) (average) (lbs/ft(3))
ranges from: 118 (1.890 g/cm(3))
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 6-1

Property class: Density
Material: Shale
Formation: Bearpaw Shale
Location: Montana
Condition 1: Upper Cretaceous
Condition 2: Depth from 180 to 200 feet
Condition 3: -
Property/units: Density (wet) (average) (pounds/ft(3))
ranges from: 135 (2.162 g/cm(3))
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 6-1

Property class: Density
Material: Shale
Formation: New Albany Shale
Location: Illinois, Indiana, and Kentucky
Condition 1: Devonian and Mississippian
Condition 2: Five coreholes
Condition 3: Illite:chlorite = 2:1
Property/units: Density (bulk) (average) (g/cm(3))
ranges from: 2.36
to: 2.53
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-5703 (1983), p. 76

Property class: Density
Material: Shale
Formation: Olentangy and Huron Shales
Location: Ohio
Condition 1: Illite dominant
Condition 2: Several samples
Condition 3: -
Property/units: Density (bulk) (g/cm(3))
ranges from: 2.65
to: -
as: -
ranges from: - to: -
Reference: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Property class: Density
Material: Shale
Formation: Pierre Shale
Location: Northern Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (dry) (lb/cu ft)
ranges from: 95 (1.522 g/cm(3))
to: 110 (1.762 g/cm(3))
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Density
Material: Shale (a)
Formation: -
Location: -
Condition 1: Miocene
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (presumed g/cm(3))
ranges from: 2.1
to: 2.5
as: Water content (%); depth (ft)
ranges from: 31; 6,000 to: 4; 16,000
Reference: Kerr and Barrington (1961)
Source: Y/OWI/SUB-7009/1 (1976), p. 12

Property class: Density
Material: Shale (a)
Formation: -
Location: -
Condition 1: Summary
Condition 2: -
Condition 3: -
Property/units: Density (kg/m(3))
ranges from: 2,123 (2.123 g/cm(3))
to: 3,003 (3.003 g/cm(3))
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 40

Property class: Density
Material: Shale (b)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (grain) (average) (presumed g/cm(3))
ranges from: 2.71
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Property class: Density
Material: Shale (b)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (kg/m(3))
ranges from: 2,563 (2.563 g/cm(3))
to: -
as: -
ranges from: - to: -
Reference: Loken, M. (personal communication) (1984)
Source: ORNL-6241/V2 (in preparation) p. 99

Property class: Density
Material: Shale (c)
Formation: -
Location: -
Condition 1: Paleozoic
Condition 2: Deep burial
Condition 3: Expanded
Property/units: Density (presumed g/cm(3))
ranges from: 2.4
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Property class: Density
Material: Shale (d)
Formation: -
Location: -
Condition 1: Paleozoic
Condition 2: Deep burial
Condition 3: Non-expanded
Property/units: Density (presumed g/cm(3))
ranges from: 2.65
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Property class: Density
Material: Shale (e)
Formation: -
Location: -
Condition 1: Paleozoic
Condition 2: Shallow burial
Condition 3: Expanded
Property/units: Density (presumed g/cm(3))
ranges from: 2.2
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Property class: Density
Material: Shale (f)
Formation: -
Location: -
Condition 1: Paleozoic
Condition 2: Shallow burial
Condition 3: Non-expanded
Property/units: Density (presumed g/cm(3))
ranges from: 2.3
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Property class: Density
Material: Shale (g)
Formation: -
Location: -
Condition 1: Tertiary
Condition 2: Deep burial
Condition 3: Expanded
Property/units: Density (presumed g/cm(3))
ranges from: 2.2
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Property class: Density
Material: Shale (h)
Formation: -
Location: -
Condition 1: Tertiary
Condition 2: Deep burial
Condition 3: Non-expanded
Property/units: Density (presumed g/cm(3))
ranges from: 2.5
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Property class: Density
Material: Shale (i)
Formation: -
Location: -
Condition 1: Tertiary
Condition 2: Shallow burial
Condition 3: Expanded
Property/units: Density (presumed g/cm(3))
ranges from: 2.0
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Property class: Density
Material: Shale (j)
Formation: -
Location: Gulf Coast
Condition 1: Oligocene
Condition 2: -
Condition 3: -
Property/units: Density (g/cm(3))
ranges from: 2.1
to: 2.3
as: Porosity (%); Depth (feet)
ranges from: 22; 2,000 to: 12; 10,000
Reference: Two refs
Source: Y/OWI/SUB-7009/1 (1976), p. 121

Property class: Density
Material: Shale (k)
Formation: -
Location: Gulf Coast
Condition 1: Eocene
Condition 2: Depth 8,600 feet
Condition 3: -
Property/units: Density (presumed g/cm(3))
ranges from: 2.58
to: -
as: Water content (%)
ranges from: 1.3 to: -
Reference: Dickinson (1953)
Source: Y/OWI/SUB-7009/1 (1976), p. 12

Property class: Density
Material: Shales
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (dry) (presumed g/cm(3))
ranges from: 1.55
to: 2.55
as: Depth (feet)
ranges from: 0 to: 11,000
Reference: Skeels (year not stated)
Source: Y/OWI/SUB-7009/1 (1976), Fig. 1

Property class: Density
Material: Shales
Formation: -
Location: -
Condition 1: Represents many tests
Condition 2: -
Condition 3: -
Property/units: Density (lbs/ft(3))
ranges from: 117 (1.874 g/cm(3))
to: 188 (3.011 g/cm(3))
as: -
ranges from: - to: -
Reference: Several refs
Source: Y/OWI/TM36/6, p. A-2, 3 & 4

Property class: Density
Material: Shales
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (wet) (presumed g/cm(3))
ranges from: 1.98
to: 2.67
as: Depth (feet)
ranges from: 0 to: 11,000
Reference: Skeels (year not stated)
Source: Y/OWI/SUB-7009/1 (1976), Fig. 1

Property class: Density
Material: Shales
Formation: -
Location: Black Hills
Condition 1: Cretaceous
Condition 2: Nine determinations
Condition 3: -
Property/units: Density (grain) (average) (presumed g/cm(3))
ranges from: 2.66
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Property class: Density
Material: Shales
Formation: -
Location: Eastern Canada
Condition 1: Cretaceous
Condition 2: Illite dominant plus chlorite, quartz, smectite, etc.
Condition 3: -
Property/units: Density (bulk) (presumed g/cm(3))
ranges from: 2.07
to: 2.68
as: Depth (feet)
ranges from: 2,698 to: 9,120
Reference: Kaarsberg (1959)
Source: Y/OWI/SUB-7009/1 (1976), p. 15

Property class: Density
Material: Shales
Formation: -
Location: Kansas
Condition 1: Paleozoic and Mesozoic
Condition 2: Twenty-five determinations
Condition 3: -
Property/units: Density (grain) (average) (presumed g/cm(3))
ranges from: 2.72
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Property class: Density
Material: Shales
Formation: -
Location: New York, Kentucky, Virginia and West Virginia
Condition 1: Devonian
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (average) (g/cm(3))
ranges from: 2.61
to: 2.68
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-5703 (1983), p. 37

Property class: Density
Material: Shales
Formation: -
Location: Oklahoma
Condition 1: Permian and Pennsylvanian
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (presumed g/cm(3))
ranges from: 2.1
to: 2.62
as: Depth (feet)
ranges from: 400 to: 5,000
Reference: Athey (1930)
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Property class: Density
Material: Shales
Formation: -
Location: Venezuela
Condition 1: Tertiary
Condition 2: Forty determinations
Condition 3: -
Property/units: Density (grain) (average) (presumed g/cm(3))
ranges from: 2.69
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Property class: Density
Material: Shales
Formation: Graneros, Greenhorn, Niobara and Pierre Shales
Location: Black Hills
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (presumed g/cm(3))
ranges from: 1.559
to: 2.038
as: -
ranges from: - to: -
Reference: Rubey (1930)
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Property class: Density
Material: Shales
Formation: Ireton Fm
Location: Western Canada
Condition 1: Devonian
Condition 2: Illite plus chlorite
Condition 3: Some calcite and dolomite
Property/units: Density (bulk) (presumed g/cm(3))
ranges from: 2.43
to: 2.71
as: Depth (feet)
ranges from: 2,770 to: 6,565
Reference: Kaarsberg (1959)
Source: Y/OWI/SUB-7009/1 (1976), p. 17

Property class: Density
Material: Shales (a)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (bulk) (g/cm(3))
ranges from: 1.6
to: 2.5
as: Depth (m)
ranges from: 0 to: 6000
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 199

Property class: Density
Material: Shales (b)
Formation: -
Location: -
Condition 1: Pennsylvanian
Condition 2: Three samples
Condition 3: -
Property/units: Density (bulk) (presumed g/cm(3))
ranges from: 2.40
to: 2.43
as: Water content (%)
ranges from: 12 to: 11
Reference: Kaarsberg (1959)
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Property class: Density
Material: Shales (c)
Formation: -
Location: -
Condition 1: Mississippian-Devonian
Condition 2: -
Condition 3: -
Property/units: Density (natural) (presumed g/cm(3))
ranges from: 2.43
to: 2.65
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 18

Property class: Density
Material: Smectite
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Density (presumed g/cm(3))
ranges from: 2.2-2.7
to: 1.77
as: Humidity (%)
ranges from: Dry to: 100
Reference: Grim (1968)
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Property class: Moisture content
Material: Argillite
Formation: Eleana Argillite
Location: Nevada
Condition 1: Quartz and illite dominant
Condition 2: Lesser kaolinite, chamosite, etc.
Condition 3: -
Property/units: Moisture content (%)
ranges from: 2
to: 4
as: -
ranges from: - to: -
Reference: -
Source: ORNL/Sub/84-64794/1 (1985), p. 406

Property class: Moisture content
Material: Bentonite and Sand
Formation: -
Location: -
Condition 1: Moist
Condition 2: -
Condition 3: -
Property/units: Moisture content (%)
ranges from: 13
to: 22
as: Clay content (%)
ranges from: 22 to: 100
Reference: -
Source: AECL-7812 (1983), p. 31

Property class: Moisture content
Material: Kaolinite and Sand
Formation: -
Location: -
Condition 1: Moist
Condition 2: -
Condition 3: -
Property/units: Moisture content (%)
ranges from: 10
to: 30
as: Clay content (%)
ranges from: 22 to: 100
Reference: -
Source: AECL-7812 (1983), p. 31

Property class: Moisture content
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Moisture content (natural) (%)
ranges from: 2
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 5-14

Property class: Moisture content
Material: Shale
Formation: Bearpaw Shale
Location: Montana
Condition 1: Upper Cretaceous
Condition 2: Depth from 180 to 200 feet
Condition 3: -
Property/units: Water content (average) (%)
ranges from: 15
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 6-1

Property class: Moisture content
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Moisture content (natural) (%)
ranges from: 4
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 4-12

Property class: Moisture content
Material: Shale
Formation: Lewis Shale
Location: New Mexico
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Moisture content (%)
ranges from: 3.7
to: 6.2
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 8-5

Property class: Moisture content
Material: Shale
Formation: Mancos Fm
Location: New Mexico
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Moisture content (rock) (%)
ranges from: 3
to: 11
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 8-3

Property class: Moisture content
Material: Shale (a)
Formation: -
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Moisture content (natural) (%)
ranges from: 0
to: 38
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 2-2

Property class: Moisture content
Material: Shale (b)
Formation: -
Location: -
Condition 1: "Typical" illitic
Condition 2: Intact
Condition 3: -
Property/units: Moisture content (natural) (%)
ranges from: 1.5
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 7-8

Property class: Moisture content
Material: Shale (c)
Formation: Pierre Shale
Location: -
Condition 1: Cretaceous
Condition 2: Intact
Condition 3: -
Property/units: Moisture content (natural) (%)
ranges from: 18
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 3-24

Property class: Moisture content
Material: Shale (d)
Formation: Pierre Shale
Location: Northern Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Moisture content (natural) (%)
ranges from: 18
to: 38
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Moisture content
Material: Shale (e)
Formation: Pierre Shale
Location: Western USA
Condition 1: Cretaceous
Condition 2: -
Condition 3: -
Property/units: Moisture content (%)
ranges from: 35
to: 15
as: Depth
ranges from: "Near surface" to: "Deeply buried"
Reference: -
Source: Y/OWI/TM36/6, p. 3-1

Property class: Moisture content
Material: Shales
Formation: Pierre, Bearpaw and Claggett Shales
Location: -
Condition 1: Porosities stabilize at 200 to 300 feet depth
Condition 2: -
Condition 3: -
Property/units: Moisture content (natural) (%)
ranges from: 38
to: 12
as: Porosity (%)
ranges from: 61 to: 26
Reference: Abel and Gentry (1975)
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Property class: Moisture content
Material: Shales (a)
Formation: -
Location: -
Condition 1: Represents many tests
Condition 2: -
Condition 3: -
Property/units: Moisture content (%)
ranges from: 1.3
to: 38
as: -
ranges from: - to: -
Reference: Several refs
Source: Y/OWI/TM36/6, p. A-13, 14 & 15

Property class: Moisture content
Material: Shales (b)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Water content (vol %)
ranges from: 70 to 90
to: 5 to 10
as: Depth (m)
ranges from: 0 to: 1,000
Reference: Burst (1969)
Source: ORNL-6241/V2 (in preparation) p. 218

Property class: Porosity
Material: Argillite
Formation: Eleana Argillite
Location: Nevada
Condition 1: Quartz and illite dominant
Condition 2: Lesser kaolinite, chamosite, etc.
Condition 3: -
Property/units: Porosity (%)
ranges from: 8 to 16
to: 6 to 12
as: Depth (m)
ranges from: <500 to: 500-914
Reference: -
Source: ORNL/Sub/84-64794/1 (1985), p. 406

Property class: Porosity
Material: Bentonite and Sand
Formation: -
Location: -
Condition 1: Various bentonite:sand ratios
Condition 2: -
Condition 3: -
Property/units: Porosity (effective) (units not stated)
ranges from: ca 0.4
to: 0.002
as: Density (dry) (Mg/m(3))
ranges from: 1.2 to: 1.8 to 2.4
Reference: -
Source: AECL-7812 (1983), p. 32

Property class: Porosity
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 25
to: -
as: -
ranges from: - to: -
Reference: Chapman and Gera
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Property class: Porosity
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 38.5
to: -
as: -
ranges from: - to: -
Reference: Chapman and Gera
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Property class: Porosity
Material: Clay
Formation: Oxford Clay
Location: England
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 30
to: -
as: -
ranges from: - to: -
Reference: Chapman and Gera
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Property class: Porosity
Material: Illite
Formation: -
Location: -
Condition 1: Specific surface = 8 hm(2)/kg
Condition 2: -
Condition 3: -
Property/units: Porosity (effective) (units not stated)
ranges from: ca. 0.5
to: ca. 0.002
as: Density (dry) (Mg/m(3))
ranges from: 1.2 to: 2.6
Reference: -
Source: AECL-7812 (1983), p. 32

Property class: Porosity
Material: Kaolinite
Formation: -
Location: -
Condition 1: Specific surface = 2 hm(2)/kg
Condition 2: -
Condition 3: -
Property/units: Porosity (effective) (units not stated)
ranges from: ca. 0.5
to: ca. 0.002
as: Density (dry) (Mg/m(3))
ranges from: 1.2 to: 2.6
Reference: -
Source: AECL-7812 (1983), p. 32

Property class: Porosity
Material: Shale
Formation: -
Location: -
Condition 1: ADOPTED BASE VALUE
Condition 2: -
Condition 3: -
Property/units: Porosity (effective) (units not stated)
ranges from: 0.05
to: 0.005
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 33

Property class: Porosity
Material: Shale
Formation: -
Location: -
Condition 1: "Typical" illitic
Condition 2: Intact
Condition 3: -
Property/units: Porosity (rock mass) (%)
ranges from: 3.0
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 7-8

Property class: Porosity
Material: Shale
Formation: -
Location: -
Condition 1: ADOPTED BASE VALUE
Condition 2: -
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.1
to: 0.01
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 33

Property class: Porosity
Material: Shale
Formation: -
Location: Great Britain
Condition 1: Silurian
Condition 2: Five outcrop samples
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.020
to: 0.101
as: -
ranges from: - to: -
Reference: Manger (1963)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: -
Location: Michigan
Condition 1: Devonian
Condition 2: -
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.03
to: 0.10
as: -
ranges from: - to: -
Reference: Gonzales (1984)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: -
Location: South Carolina
Condition 1: Triassic
Condition 2: Dumbarton Basin
Condition 3: -
Property/units: Porosity (effective) (units not stated)
ranges from: 0.005
to: -
as: -
ranges from: - to: -
Reference: Gonzales (1984)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Porosity (effective) (%)
ranges from: 4
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 5-14

Property class: Porosity
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Porosity (rock mass) (%)
ranges from: 8
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 4-12

Property class: Porosity
Material: Shale
Formation: Chanute Shale
Location: Kansas
Condition 1: Pennsylvanian
Condition 2: Four samples
Condition 3: 230-m depth
Property/units: Porosity (total) (units not stated)
ranges from: 0.073
to: 0.106
as: -
ranges from: - to: -
Reference: Manger (1963)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: Chattanooga Shale
Location: Kentucky
Condition 1: Devonian
Condition 2: Two subsurface samples
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.074
to: 0.076
as: -
ranges from: - to: -
Reference: Manger (1963)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: Conasauga Shale
Location: Tennessee
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 0.5
to: 1.9
as: -
ranges from: - to: -
Reference: DeLaguna (1968)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Porosity
Material: Shale
Formation: Conasauga Shale
Location: Tennessee
Condition 1: Cambrian
Condition 2: Five samples
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.005
to: 0.019
as: -
ranges from: - to: -
Reference: DeLaguna (1968)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: Hamilton Shale
Location: Missouri
Condition 1: Mississippian
Condition 2: One outcrop sample
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.113
to: -
as: -
ranges from: - to: -
Reference: Manger (1963)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: Martinsburg Shale
Location: Pennsylvania
Condition 1: Ordovician
Condition 2: Quarry sample
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.010
to: -
as: -
ranges from: - to: -
Reference: Manger (1963)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: Muddy Shale
Location: Colorado
Condition 1: Depth 4,900 feet
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 4.1
to: 5.1
as: -
ranges from: - to: -
Reference: Handin et al (1963)
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Property class: Porosity
Material: Shale
Formation: New Albany Shale
Location: Illinois, Indiana, Kentucky
Condition 1: Devonian
Condition 2: -
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.009
to: 0.046
as: -
ranges from: - to: -
Reference: Gonzales (1984)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: Olentangy and Huron Shale
Location: Ohio
Condition 1: Devonian and Mississippian
Condition 2: Illite dominant
Condition 3: -
Property/units: Porosity (primary) (%)
ranges from: >3 %
to: -
as: -
ranges from: - to: -
Reference: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Property class: Porosity
Material: Shale
Formation: Ophir Shale
Location: Utah
Condition 1: Cambrian
Condition 2: Two subsurface samples
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.009
to: -
as: -
ranges from: - to: -
Reference: Manger (1963)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale
Formation: Pierre Shale
Location: -
Condition 1: Cretaceous
Condition 2: Intact
Condition 3: -
Property/units: Porosity (%)
ranges from: 33
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 3-24

Property class: Porosity
Material: Shale (a)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 30
to: 5 to 10
as: Depth (m)
ranges from: 500 to: 2,500
Reference: Conybeare (1967)
Source: ORNL-6241/V2 (in preparation) p. 218

Property class: Porosity
Material: Shale (a)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (effective) (units not
ranges from: 0.01
to: -
as: -
ranges from: - to: -
Reference: Loken, M. (personal communication) (1984)
Source: ORNL-6241/V2 (in preparation) p. 99

Property class: Porosity
Material: Shale (a)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.03
to: -
as: -
ranges from: - to: -
Reference: Loken, M. (personal communication) (1984)
Source: ORNL-6241/V2 (in preparation) p. 99

Property class: Porosity
Material: Shale (a)
Formation: Antrim Shale
Location: Michigan
Condition 1: Devonian
Condition 2: Depth from 350 to 450 m
Condition 3: -
Property/units: Porosity (%)
ranges from: 3
to: 10
as: -
ranges from: - to: -
Reference: Two refs
Source: ORNL-5703 (1983), p. 106

Property class: Porosity
Material: Shale (a)
Formation: New Albany Shale
Location: Illinois, Indiana and Kentucky
Condition 1: Devonian and Mississippian
Condition 2: Four coreholes
Condition 3: -
Property/units: Porosity (average) (vol. %)
ranges from: 0.95
to: 4.64
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-5703 (1983), p. 76

Property class: Porosity
Material: Shale (b)
Formation: -
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Porosity (rock mass) (%)
ranges from: 0
to: 45
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6, p. 2-2

Property class: Porosity
Material: Shale (b)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.03
to: -
as: -
ranges from: - to: -
Reference: D'Appalonia (1980)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale (b)
Formation: Antrim Shale
Location: Michigan
Condition 1: Quartz dominant
Condition 2: Illite and kaolinite
Condition 3: -
Property/units: Porosity (%)
ranges from: 3
to: 10
as: -
ranges from: - to: -
Reference: Young (1978)
Source: ORNL/Sub/84-64794/1 (1985), p. 98

Property class: Porosity
Material: Shale (b)
Formation: New Albany Shale
Location: Illinois, Indiana, Kentucky
Condition 1: Black shale
Condition 2: Quartz dominant
Condition 3: Illite:chlorite = 2:1
Property/units: Porosity (%)
ranges from: 0.95
to: 4.64
as: -
ranges from: - to: -
Reference: Kalyoncu et al (1979)
Source: ORNL/Sub/84-64794/1 (1985), p. 85

Property class: Porosity
Material: Shale (c)
Formation: -
Location: -
Condition 1: Two samples
Condition 2: -
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.003
to: 0.056
as: -
ranges from: - to: -
Reference: Panday (1974)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale (d)
Formation: -
Location: Ohio
Condition 1: Devonian
Condition 2: Appalachian Basin Shale
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.03
to: -
as: -
ranges from: - to: -
Reference: Gonzales (1984)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale (e)
Formation: -
Location: Pennsylvania
Condition 1: Devonian
Condition 2: Gas shale
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.0117
to: -
as: -
ranges from: - to: -
Reference: U. S. DOE (1981)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shale (f)
Formation: -
Location: Scotland
Condition 1: Carboniferous
Condition 2: Outcrop sample
Condition 3: -
Property/units: Porosity (total) (units not stated)
ranges from: 0.016
to: -
as: -
ranges from: - to: -
Reference: Manger (1963)
Source: ORNL-6241/V2 (in preparation) p. 52

Property class: Porosity
Material: Shales
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 70
to: 10
as: Depth (m)
ranges from: 0 to: 6,000
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 199

Property class: Porosity
Material: Shales
Formation: -
Location: Appalachian Basin
Condition 1: Devonian
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: ca. 3
to: -
as: -
ranges from: - to: -
Reference: Gonzales and Johnson (1984)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Porosity
Material: Shales
Formation: -
Location: Illinois Basin
Condition 1: Devonian
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 0.9
to: 4.6
as: -
ranges from: - to: -
Reference: Gonzales and Johnson (1984)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Porosity
Material: Shales
Formation: -
Location: Kentucky (a)
Condition 1: Pennsylvanian
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 3.3
to: 10.1
as: Depth (m)
ranges from: ca. 450 to: -
Reference: Gipson (1966)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Porosity
Material: Shales
Formation: -
Location: Kentucky (b)
Condition 1: Pennsylvanian
Condition 2: Porosity decreases with depth
Condition 3: Porosity decreases with preferred orientation
Property/units: Porosity (%)
ranges from: 15
to: 3
as: Depth (feet); Water content (%)
ranges from: 31; 6 to: 1,484; 1
Reference: Gipson (1966)
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Property class: Porosity
Material: Shales
Formation: -
Location: Kentucky, New York, Virginia and West Virginia
Condition 1: Devonian
Condition 2: -
Condition 3: -
Property/units: Porosity (average) (vol. %)
ranges from: 2.86 to 3.87
to: -
as: -
ranges from: - to: -
Reference: Several refs
Source: ORNL-5703 (1983), p. 37

Property class: Porosity
Material: Shales
Formation: -
Location: Michigan Basin
Condition 1: Devonian
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 3
to: 10
as: -
ranges from: - to: -
Reference: Gonzales and Johnson (1984)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Porosity
Material: Shales
Formation: -
Location: Oklahoma
Condition 1: Pennsylvanian and Permian
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 25
to: 2
as: Depth (feet)
ranges from: 400 to: 5,000
Reference: Athey (1930)
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Property class: Porosity
Material: Shales
Formation: -
Location: Pennsylvania
Condition 1: Devonian
Condition 2: -
Condition 3: -
Property/units: Porosity (effective) (%)
ranges from: 1.17
to: -
as: -
ranges from: - to: -
Reference: U. S. DOE (1981)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Porosity
Material: Shales
Formation: -
Location: South Carolina
Condition 1: Triassic
Condition 2: -
Condition 3: -
Property/units: Porosity (effective) (%)
ranges from: ca. 0.5
to: -
as: -
ranges from: - to: -
Reference: U. S. DOE (1981)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Porosity
Material: Shales
Formation: -
Location: USA and Europe
Condition 1: Outcrops, mines and boreholes
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 19
to: 1
as: -
ranges from: - to: -
Reference: Manger (1963)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Porosity
Material: Shales (a)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 3
to: 15
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V2 (in preparation) p. 218

Property class: Porosity
Material: Shales (b)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 15 to 45
to: 3 to 20
as: Depth (m)
ranges from: 600 to: 3,000
Reference: Rieke (1974)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Porosity
Material: Shales (c)
Formation: -
Location: -
Condition 1: Mississippian and Devonian
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 0.4
to: 7.2
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/SUB-7009/1 (1976), p. 18

Property class: Porosity
Material: Shales (d)
Formation: -
Location: -
Condition 1: Represents many samples
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 0.0
to: 44.8
as: -
ranges from: - to: -
Reference: Several refs
Source: Y/OWI/TM36/6, p. A-12

Property class: Porosity
Material: Shales (e)
Formation: -
Location: Germany
Condition 1: Triassic
Condition 2: -
Condition 3: -
Property/units: Porosity (%)
ranges from: 25
to: ca. 0
as: Depth (feet); Water content (%)
ranges from: 400; 11 to: 4,000; ca. 0
Reference: Muller (1967)
Source: Y/OWI/SUB-7009/1 (1976), p. 15

Property class: Specific gravity
Material: Bentonite (a)
Formation: -
Location: -
Condition 1: Avongel
Condition 2: Air dry moisture content = 9.3%
Condition 3: -
Property/units: Specific gravity (dimensionless)
ranges from: 2.21
to: -
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 340

Property class: Specific gravity
Material: Bentonite (b)
Formation: -
Location: Black Hills
Condition 1: Air dry moisture content = 8.3%
Condition 2: -
Condition 3: -
Property/units: Specific gravity (dimensionless)
ranges from: 2.18
to: -
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 340

Property class: Specific gravity
Material: Bentonite (Na)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: -
Condition 3: -
Property/units: Specific gravity (dimensionless)
ranges from: 2.66
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Specific gravity
Material: Bentonite (Na) and Sand
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: 50% sand
Condition 3: -
Property/units: Specific gravity (dimensionless)
ranges from: 2.635
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Specific gravity
Material: Kaolinite
Formation: -
Location: -
Condition 1: Air dry moisture content = 1.1%
Condition 2: -
Condition 3: -
Property/units: Specific gravity (dimensionless)
ranges from: 2.60
to: -
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 340

Property class: Specific surface
Material: Bentonite (Na)
Formation: -
Location: -
Condition 1: Specific gravity = 2.66
Condition 2: Organic content (dry) (%) = 2.5
Condition 3: -
Property/units: Specific surface (m(2)/g)
ranges from: 519
to: 615
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Specific surface
Material: Bentonite (Na) and Sand
Formation: -
Location: -
Condition 1: 50% bentonite
Condition 2: Specific gravity = 2.635
Condition 3: Organic content (%) = 0.1
Property/units: Specific surface (m(2)/g)
ranges from: 284
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Specific surface
Material: Shale
Formation: Antrim Shale
Location: Michigan
Condition 1: Devonian
Condition 2: Typically 50-60% quartz, 20-35% illite
Condition 3: Values may be inaccurate because of method used
Property/units: Specific surface (m(2)/g)
ranges from: 0.05
to: 1.2
as: -
ranges from: - to: -
Reference: -
Source: ORNL-5703 (1983), p. 109

Property class: Specific surface
Material: Smectite
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Specific surface (m(2)/g)
ranges from: 800
to: -
as: -
ranges from: - to: -
Reference: Two refs
Source: NUREG/CP-0052 (1983), p. 182

Property class: Void ratio
Material: Clays
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Void ratio (dimensionless)
ranges from: ca. 1.5 to 3.0
to: ca. 0.5 to 0.6
as: Effective overburden pressure (kg/cm(2))
ranges from: 0.1 (0.01 MPa)
to: 110 (10.8 MPa)
Reference: Skempton (1953)
Source: ONWI-312 (1981), p. 21

Property class: Void ratio
Material: Kaolinite (Ca)
Formation: -
Location: -
Condition 1: Water saturated.
Condition 2: -
Condition 3: -
Property/units: Void ratio (dimensionless)
ranges from: 2.5
to: 1.0
as: Pressure
ranges from: 100 psf (0.05 MPa) to: 100,000 psf (4.7 MPa)
Reference: Olson and Mesri (1970)
Source: ONWI-486 (1983), p. 38

Property class: Void ratio
Material: Kaolinite (Na)
Formation: -
Location: -
Condition 1: Water saturated.
Condition 2: -
Condition 3: -
Property/units: Void ratio (dimensionless)
ranges from: 2.5
to: 1.0
as: Pressure
ranges from: 100 psf (0.05 MPa) to: 100,000 psf (4.7 MPA)
Reference: Olson and Mesri (1970)
Source: ONWI-486 (1983), p. 38

Property class: Void ratio
Material: Smectite (Ca)
Formation: -
Location: -
Condition 1: Water saturated.
Condition 2: -
Condition 3: -
Property/units: Void ratio (dimensionless)
ranges from: 7.0
to: 1.0
as: Pressure
ranges from: 100 psf (0.05 MPa) to: 100,000 psf (4.7 MPa)
Reference: Olson and Mesri (1970)
Source: ONWI-486 (1983), p. 38

Property class: Void ratio
Material: Smectite (Na)
Formation: -
Location: -
Condition 1: Water saturated.
Condition 2: -
Condition 3: -
Property/units: Void ratio (dimensionless)
ranges from: 30.0
to: 1.0
as: Pressure
ranges from: 100 psf (0.05 MPa) to: 100,000 psf (4.7 MPa)
Reference: Olson and Mesri (1970)
Source: ONWI-486 (1983), p. 38

13.1.3 Appendix A.3. HYDROLOGIC PROPERTIES

Property class: Hydraulic conductivity
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (m/s)
ranges from: 10(-11) (1 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference: Two refs
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Hydraulic conductivity
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (m/s)
ranges from: 10(-10) (1 x 10(-8) cm/s)
to: 10(-12) (1 x 10(-10) cm/s)
as:
ranges from: to:
Reference: Two refs
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Hydraulic conductivity
Material: Clay
Formation: Oxford Clay
Location: England
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (m/s)
ranges from: 10(-12) (1 x 10(-10) cm/s)
to:
as:
ranges from: to:
Reference: Two refs
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Hydraulic conductivity
Material: Clay
Formation: Panther Creek Clay
Location:
Condition 1: Confining force <100 lbs
Condition 2: Reference basalt ground water
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 7 x 10(-12)
to: 2 x 10(-12)
as: Density (g/cm(3))
ranges from: ca. 1.7 to: ca. 2.1
Reference:
Source: PNL-4452 UC-70 (1983), p. 14

Property class: Hydraulic conductivity
Material: Clay
Formation: Porters Creek Clay
Location: Louisiana
Condition 1: Smectite dominant; plus illite, kaolinite and chlorite
Condition 2: 5-50% quartz
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-8) (est)
to:
as:
ranges from: to:
Reference:
Source: ORNL/Sub/84-64794/1 (1985), p. 175

Property class: Hydraulic conductivity
Material: Clays and Shales
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 8 x 10(-4) (7.7 x 10(-10) cm/s)
to: 2 x 10(-6) (1.9 x 10(-12) cm/s)
as:
ranges from: to:
Reference: Dickey (1972)
Source: Proc NEA Workshop OECD (1979b), p. 69

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location:
Condition 1: ADOPTED BASE VALUE
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-10) (1 x 10(-8) cm/s)
to: 1 x 10(-12) (1 x 10(-10) cm/s)
as:
ranges from: to:
Reference:
Source: ORNL-6241/V1 (in preparation) p. 33

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location:
Condition 1: ADOPTED BASE VALUE
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (vertical) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to: 1 x 10(-13) (1 x 10(-11) cm/s)
as:
ranges from: to:
Reference:
Source: ORNL-6241/V1 (in preparation) p. 33

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (vertical) (m/s)
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to:
as:
ranges from: to:
Reference: Loken, M. (personal communication) (1984)
Source: ORNL-6241/V2 (in preparation) p. 99

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location:
Condition 1: Intact
Condition 2: Range of properties
Condition 3:
Property/units: Permeability (vertical) (factor of K horizontal)
ranges from: 1/2Kh
to: 1/10Kh
as:
ranges from: to:
Reference:
Source: Y/OWI/TM36/6 (1978), p. 2-2

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location: California
Condition 1: Miocene
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 4 x 10(-4) (3.8 x 10(-10) cm/s)
to:
as:
ranges from: to:
Reference:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location: Gulf Coast
Condition 1: Cenozoic
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 1 x 10(-8) (9.6 x 10(-15) cm/s) (?)
to: 2.5 x 10(-9) (2.4 x 10(-15) cm/s) (?)
as:
ranges from: to:
Reference:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location: Maryland
Condition 1: Triassic
Condition 2: Newark-Gettysburg Basin
Condition 3: Field test
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 0.0(?) (0.0 cm/s) (?)
to: 1 x 10(-9) (1 x 10(-7) cm/s)
as:
ranges from: to:
Reference: Gonzales (1984)
Source: ORNL-6241/V2 (in preparation) p. 43

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location: Michigan
Condition 1: Devonian
Condition 2: Core data
Condition 3: Kv<<Kh
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 X 10(-11) (1 x 10(-9) cm/s)
to: 2 x 10(-8) (2 x 10(-6) cm/s)
as:
ranges from: to:
Reference: Gonzales (1984)
Source: ORNL-6241/V2 (in preparation) p. 42

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location: Pennsylvania
Condition 1: Devonian
Condition 2: Core data
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 3 x 10(-11) (3 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference: U. S. DOE (1981)
Source: ORNL-6241/V2 (in preparation) p. 42

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location: Pennsylvania
Condition 1: Devonian
Condition 2: Field test
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference: U.S. DOE (1981)
Source: ORNL-6241/V2 (in preparation) p. 43

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location: South Carolina
Condition 1: Triassic
Condition 2: Dumbarton Basin
Condition 3: Core data
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-13) (1 x 10(-11) cm/s)
to: 1 x 10(-10) (1 x 10(-8) cm/s)
as:
ranges from: to:
Reference: Gonzales (1984)
Source: ORNL-6241/V2 (in preparation) p. 42

Property class: Hydraulic conductivity
Material: Shale
Formation:
Location: South Carolina
Condition 1: Triassic
Condition 2: Dumbarton Basin
Condition 3: Field test
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to:
as:
ranges from: to:
Reference: Gonzales (1984)
Source: ORNL-6241/V2 (in preparation) p. 43

Property class: Hydraulic conductivity
Material: Shale
Formation: Antrim Shale
Location: Michigan
Condition 1: Devonian
Condition 2: Horizontal permeability higher than vertical
Condition 3:
Property/units: Permeability (md)
ranges from: 0.001 (1 x 10(-9) cm/s)
to: 2.0 (1.9 x 10(-6) cm/s)
as:
ranges from: to:
Reference:
Source: ORNL-5703 (1983), p. 109

Property class: Hydraulic conductivity
Material: Shale
Formation: Antrim Shale
Location: Michigan
Condition 1: 50% quartz
Condition 2: 20-35% illite and 5-15% kaolinite
Condition 3: Bulk density = 2.2-2.8 g/cm(3)
Property/units: Permeability (md)
ranges from: 0.001 (1 x 10(-9) cm/s)
to: 2.0 (1.9 x 10(-6) cm/s)
as:
ranges from: to:
Reference: Young (1978)
Source: ORNL/Sub/84-64794/1 (1985), p. 98

Property class: Hydraulic conductivity
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3:
Property/units: Permeability (ft/yr) (hydraulic conductivity)
ranges from: 10(-3) (9.7 x 10(-10) cm/s)
to: 10(-4) (9.7 x 10(-11) cm/s)
as:
ranges from: to:
Reference:
Source: Y/OWI/TM36/6 (1978), p. 5-14

Property class: Hydraulic conductivity
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3:
Property/units: Permeability (horizontal) (ft/yr) (hydraulic conductivity)
ranges from: 0.1 (9.7 x 10(-8) cm/s)
to:
as:
ranges from: to:
Reference:
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Hydraulic conductivity
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3:
Property/units: Permeability (vertical) (ft/yr) (hydraulic conductivity)
ranges from: 0.05 (5 x 10(-8) cm/s)
to:
as:
ranges from: to:
Reference:
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Hydraulic conductivity
Material: Shale
Formation: Conasauga Shale
Location: Tennessee
Condition 1: Cambrian
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 6 x 10(-10)
to: 3 x 10(-11)
as: Depth (m)
ranges from: 50 to: 850
Reference: DeLaguna (1968)
Source: ORNL-6241/V2 (in preparation) p. 220

Property class: Hydraulic conductivity
Material: Shale
Formation: Conasauga Shale
Location: Tennessee
Condition 1: Cambrian
Condition 2: Core data
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 3 x 10(-13) (3 x 10(-11) cm/s)
to: 2 x 10(-12) (2 x 10(-10) cm/s)
as:
ranges from: to:
Reference: DeLaguna (1968)
Source: ORNL-6241/V2 (in preparation) p. 42

Property class: Hydraulic conductivity
Material: Shale
Formation: Maquoketa Shale
Location: Illinois
Condition 1: Ordovician
Condition 2: Field test
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 2 x 10(-11) (2 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference: Gonzales (1984)
Source: ORNL-6241/V2 (in preparation) p. 42

Property class: Hydraulic conductivity
Material: Shale
Formation: Maquoketa Shale
Location: Illinois Basin
Condition 1: Ordovician
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-9)
to:
as:
ranges from: to:
Reference: Gonzales and Johnson (1984)
Source: ORNL-6241/V2 (in preparation) p. 220

Property class: Hydraulic conductivity
Material: Shale
Formation: Muddy Shale (a)
Location:
Condition 1: Cretaceous
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 5 x 10(-2) (4.8 x 10(-8) cm/s)
to:
as:
ranges from: to:
Reference: Two refs
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shale
Formation: Muddy Shale (b)
Location: Colorado
Condition 1: Depth: 4,900 ft
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: <0.05 (<4.8 x 10(-8) cm/s)
to:
as:
ranges from: to:
Reference: Handin et al (1963)
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Property class: Hydraulic conductivity
Material: Shale
Formation: Pierre Shale
Location:
Condition 1: Intact
Condition 2:
Condition 3:
Property/units: Permeability (horizontal) (ft/yr) (hydraulic conductivity)
ranges from: 0.01 (9.7 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference:
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Hydraulic conductivity
Material: Shale
Formation: Pierre Shale
Location:
Condition 1: Intact
Condition 2:
Condition 3:
Property/units: Permeability (vertical) (ft/yr) (hydraulic conductivity)
ranges from: 0.005 (5 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference:
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Hydraulic conductivity
Material: Shale
Formation: Pierre Shale
Location: South Dakota
Condition 1: Field test
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
as:
ranges from: to:
Reference: Brace (1980)
Source: ORNL-6241/V2 (in preparation) p. 43

Property class: Hydraulic conductivity
Material: Shale (a)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference: Loken, M. (personal communication) (1984)
Source: ORNL-6241/V2 (in preparation) p. 99

Property class: Hydraulic conductivity
Material: Shale (a)
Formation:
Location:
Condition 1: "Typical" illitic shale
Condition 2: Intact
Condition 3:
Property/units: Permeability (ft/yr) (hydraulic conductivity)
ranges from: 0.1 (9.7 x 10(-8) cm/s)
to: 0.05 (4.8 x 10(-8) cm/s)
as:
ranges from: to:
Reference:
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Hydraulic conductivity
Material: Shale (a)
Formation: Pierre Shale
Location:
Condition 1: Cretaceous
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 1.1 x 10(-4) (1.1 x 10(-10) cm/s)
to:
as:
ranges from: to:
Reference: Two refs
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shale (b)
Formation:
Location:
Condition 1: Core data
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-16) (1 x 10(-14) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
as:
ranges from: to:
Reference: Brace (1980)
Source: ORNL-6241/V2 (in preparation) p. 42

Property class: Hydraulic conductivity
Material: Shale (b)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Permeability (microdarcies)
ranges from: 100 (1 x 10(-7) cm/s)
to: 0.01 (1 x 10(-9) cm/s)
as: Depth (m)
ranges from: 0 to: 6,000
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 199

Property class: Hydraulic conductivity
Material: Shale (b)
Formation: Pierre Shale
Location: Great Plains
Condition 1: Mixed-layer illite-smectite dominant
Condition 2: Plus smectite, illite, kaolinite and chlorite
Condition 3: Up to 25% quartz
Property/units: Permeability (cm/s) (hydraulic conductivity)
ranges from: 1 x 10(-6)
to: 1 x 10(-10)
as:
ranges from: to:
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Hydraulic conductivity
Material: Shale (c)
Formation:
Location:
Condition 1: Core data
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to: 7 x 10(-9) (7 x 10(-7) cm/s)
as:
ranges from: to:
Reference: Pandey (1974)
Source: ORNL-6241/V2 (in preparation) p. 42

Property class: Hydraulic conductivity
Material: Shale (d)
Formation:
Location:
Condition 1: Generic properties
Condition 2: Note: K(vertical) = 1/2 to 1/10 K(horizontal)
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to: 1 x 10(-6) (1 x 10(-4) cm/s)
as:
ranges from: to:
Reference: D'Appolonia (1980)
Source: ORNL-6241/V2 (in preparation) p. 43

Property class: Hydraulic conductivity
Material: Shale (e)
Formation:
Location:
Condition 1: Intact
Condition 2: Range of properties
Condition 3:
Property/units: Permeability (horizontal) (ft/yr) (hydraulic conductivity)
ranges from: 1 x 10(-4) (9.7 x 10(-11) cm/s)
to: 1 x 10(3) (9.7 x 10(-4) cm/s)
as:
ranges from: to:
Reference:
Source: Y/OWI/TM36/6 (1978), p. 2-2

Property class: Hydraulic conductivity
Material: Shales
Formation:
Location:
Condition 1: Paleozoic
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 8 x 10(-4) (7.7 x 10(-10) cm/s)
to: 2 x 10(-6) (1.9 x 10(-12) cm/s)
as:
ranges from: to:
Reference:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shales
Formation:
Location: East Coast
Condition 1: Triassic basins
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-7)
to: 10(-11)
as:
ranges from: to:
Reference: Gonzales and Johnson (1984)
Source: ORNL-6241/V2 (in preparation) p. 220

Property class: Hydraulic conductivity
Material: Shales
Formation:
Location: Illinois
Condition 1: Paleozoic
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 2 x 10(-6) (1.9 x 10(-12) cm/s)
to:
as:
ranges from: to:
Reference: Two refs
Source: Y/OW!/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shales
Formation:
Location: Michigan and Appalachian Basins
Condition 1: Devonian
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-6)
to: 10(-9)
as:
ranges from: to:
Reference: Gonzales and Johnson (1984)
Source: ORNL-6241/V2 (in preparation) p. 220

Property class: Hydraulic conductivity
Material: Shales
Formation:
Location: Montana
Condition 1: Paleozoic
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 6 x 10(-4) (5.8 x 10(-10) cm/s)
to:
as:
ranges from: to:
Reference: Two refs
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shales
Formation:
Location: New Mexico
Condition 1: Paleozoic
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 2 x 10(-6) (1.9 x 10(-12) cm/s)
to:
as:
ranges from: to:
Reference: Two refs
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shales
Formation:
Location: Oklahoma
Condition 1: Paleozoic
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 8 x 10(-4) (7.7 x 10(-10) cm/s)
to:
as:
ranges from: to:
Reference: Two refs
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shales
Formation:
Location: Texas
Condition 1: Paleozoic
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 3 x 10(-4) (2.9 x 10(-10) cm/s)
to: 7 x 10(-6) (6.7 x 10(-12) cm/s)
as:
ranges from: to:
Reference: Two refs
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shales
Formation:
Location: Utah
Condition 1: Paleozoic
Condition 2:
Condition 3:
Property/units: Permeability (md)
ranges from: 7 x 10(-6) (6.7 x 10(-12) cm/s)
to:
as:
ranges from: to:
Reference: Two refs
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Property class: Hydraulic conductivity
Material: Shales
Formation: Pierre, Bearpaw and Claggett Shales
Location: Northern Great Plains
Condition 1: Cretaceous
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-6)
to: 10(-10)
as:
ranges from: to:
Reference: Abel and Gentry (1975)
Source: ORNL-6241/V2 (in preparation) p. 220

Property class: Hydraulic conductivity
Material: Shales (c)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-8)
to: 10(-11)
as:
ranges from: to:
Reference:
Source: ORNL-6241/V2 (in preparation) p. 218

Property class: Hydraulic conductivity
Material: Shales (d)
Formation:
Location:
Condition 1: In situ
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-9)
to: 10(-11)
as:
ranges from: to:
Reference: Brace (1980)
Source: ORNL-6241/V2 (in preparation) p. 219

Property class: Hydraulic conductivity
Material: Shales (e)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Permeability (m(2))
ranges from: 10(-17) (9.7 x 10(-9) cm/s)
to: 10(-21) (9.7 x 10(-13) cm/s)
as: Depth (m)
ranges from: 0 to: 6,000
Reference: Several refs
Source: ORNL-6241/V2 (in preparation) p. 199

Property class: Hydraulic conductivity
Material: Shales (f)
Formation:
Location: Various
Condition 1: Various formations, depths, etc.
Condition 2: Represents many tests
Condition 3:
Property/units: Permeability (ft/yr) (hydraulic conductivity)
ranges from: 1.0 x 10(-4) (9.7 x 10(-11) cm/s)
to: 1.1 x 10(3) (1.1 x 10(-4) cm/s)
as:
ranges from: to:
Reference: Three refs
Source: Y/OWI/TM36/6 (1978), p. A-16

Property class: Hydraulic conductivity
Material: Siltstone/Mudstone
Formation:
Location: South Carolina
Condition 1: Triassic
Condition 2: Field test
Condition 3:
Property/units: Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-13) (1 x 10(-11) cm/s)
to: 5 x 10(-10) (5 x 10(-8) cm/s)
as:
ranges from: to:
Reference: Brace (1980)
Source: ORNL-6241/V2 (in preparation) p. 43

Property class: Hydraulic conductivity
(minerals)
Material: Bentonite (Ca)
Formation:
Location:
Condition 1: Density 2.09 and 2.11 g/cm(3)
Condition 2: Head 20.7 and 15.4 MPa
Condition 3: Hydraulic gradient 2.13 x 10(5) and 1.59 x 10(5)
Property/units: Hydraulic conductivity (cm/s)
ranges from: 1.3 x 10(-12) and 1.6 x 10(-12)
to:
as:
ranges from: to:
Reference:
Source: ONWI-312 (1981), p. 33

Property class: Hydraulic conductivity
(minerals)
Material: Bentonite (Ca)
Formation:
Location:
Condition 1: 80-90% quartz powder
Condition 2: Water content 5-15%
Condition 3: Field compacted
Property/units: Permeability (m/s) (hydraulic conductivity)
ranges from: 1 x 10(-9) (1 x 10(-7) cm/s)
to:
as:
ranges from: to:
Reference: Jacobsson and Pusch (1977)
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Property class: Hydraulic conductivity
(minerals)
Material: Bentonite (Ca) and (Na)
Formation:
Location:
Condition 1: Density (dry) (bulk) (g/cm(3)) =
Condition 2: Load (MPa) = 0.1
Condition 3:
Property/units: Permeability (m(2))
ranges from: 1 x 10(-16) (9.7 x 10(-8) cm/s)
to:
as:
ranges from: to:
Reference: Grim (1962)
Source: NUREG/CP-0052 (1983), p. 209

Property class: Hydraulic conductivity
(minerals)
Material: Bentonite (Na)
Formation:
Location:
Condition 1: 75% sand
Condition 2: Density (initial) 2.1 g/cm(3)
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 2.7 x 10(-9)
to: 0.7 x 10(-9)
as: Time (hrs)
ranges from: 10 to: 900
Reference:
Source: ONWI-312 (1981), p. 34

Property class: Hydraulic conductivity
(minerals)
Material: Bentonite (Na)
Formation:
Location: Wyoming
Condition 1: MX-80
Condition 2: Compacted at 50 MPa; density = 2.0-2.3 t/m(3)
Condition 3: 10% water by weight
Property/units: Hydraulic conductivity (cm/s)
ranges from: Not stated
to: 10(-9)
as: Density (t/m(3))
ranges from: 2.0 - 2.3 to: 1.0
Reference: Several refs
Source: ONWI-486 (1983), p. 61

Property class: Hydraulic conductivity
(minerals)
Material: Bentonite (Na) (a)
Formation:
Location:
Condition 1: Three tests
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s x 10(12))
ranges from: <1 (<1 x 10(-12) cm/s)
to: ca. 8 (ca. 8 x 10(-12) cm/s)
as: Hydraulic pressure gradient (psi/ft x 10(-8))
ranges from: 1.5 to: 7
Reference: Kharaka and Smalley (1976)
Source: ONWI-312 (1981), p. 11

Property class: Hydraulic conductivity
(minerals)
Material: Bentonite (Na) (b)
Formation:
Location:
Condition 1: Highly compacted
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: ca. 1 x 10(-13)
to:
as:
ranges from: to:
Reference: Kharaka and Smalley (1976)
Source: ONWI-312 (1981), p. 10

Property class: Hydraulic conductivity
(minerals)
Material: Bentonite (Na) (c)
Formation:
Location:
Condition 1: 50% sand; density 2.12 and 2.09 g/cm(3)
Condition 2: Head 15.5 and 16.7 MPa
Condition 3: Hydraulic gradient 1.62 x 10(5) and 1.73 x 10(5)
Property/units: Hydraulic conductivity (cm/s)
ranges from: 4.6 x 10(-12) and 6.4 x 10(-12)
to:
as:
ranges from: to:
Reference:
Source: ONWI-312 (1981), p. 33

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (d)
Formation:
Location:
Condition 1: 75% sand; density 2.10 g/cm(3)
Condition 2: Head 3.4 MPa
Condition 3: Hydraulic gradient 1.19 x 10(4)
Property/units: Hydraulic conductivity (cm/s)
ranges from: 6.6 x 10(-10)
to:
as:
ranges from: to:
Reference:
Source: ONWI-312 (1981), p. 33

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (e)
Formation:
Location:
Condition 1: Density 2.13 g/cm(3)
Condition 2: Head 14.6 MPa
Condition 3: Hydraulic gradient 1.56 x 10(5)
Property/units: Hydraulic conductivity (cm/s)
ranges from: 5.6 x 10(-13)
to:
as:
ranges from: to:
Reference:
Source: ONWI-312 (1981), p. 33

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (f)
Formation:
Location:
Condition 1: CS-50
Condition 2: Confining force <100 lbs
Condition 3: Reference basalt ground water
Property/units: Hydraulic conductivity (cm/s)
ranges from: 6 x 10(-12)
to: 6 x 10(-13)
as: Density (g/cm(3))
ranges from: ca. 1.7 to: ca. 2.2
Reference:
Source: PNL-4452 UC-70 (1983), p. 13

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (g)
Formation:
Location:
Condition 1: Various radiation treatments
Condition 2: Various heat treatments (to 300 deg C)
Condition 3: Density (g/cm(3)) from 2.07-2.22
Property/units: Hydraulic conductivity (cm/s)
ranges from: 1.2 x 10(-12)
to: 8.3 x 10(-13)
as:
ranges from: to:
Reference:
Source: PNL-4452 UC-70 (1983), p. 27

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (h)
Formation:
Location:
Condition 1: Plus quartz
Condition 2: Hydraulic gradient ca. 100
Condition 3:
Property/units: Permeability (cm/s) (hydraulic conductivity)
ranges from: 1 x 10(-11)
to:
as: Bentonite content (%)
ranges from: 20 to:
Reference: Pusch (1979)
Source: ONWI-312 (1981), p. 10

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (i)
Formation:
Location:
Condition 1: Plus quartz
Condition 2: Hydraulic gradient ca. 100
Condition 3:
Property/units: Permeability (cm/s) (hydraulic conductivity)
ranges from: 3 x 10(-8)
to: 1.5 x 10(-9)
as: Bentonite content (%)
ranges from: 4 to: 8
Reference: Pusch (1979)
Source: ONWI-312 (1981), p. 10

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (j)
Formation:
Location:
Condition 1: MX-80
Condition 2:
Condition 3:
Property/units: Permeability (m/s) (hydraulic conductivity)
ranges from: 5 x 10(-15) (5 x 10(-13) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
as: Density (t/m(3))
ranges from: ca. 2.5 to: ca. 1.2
Reference:
Source: KBS TEKNISK RAPPORT 74 (1978), p. 8

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (k)
Formation:
Location:
Condition 1: 67% quartz powder
Condition 2:
Condition 3:
Property/units: Permeability (m/s) (hydraulic conductivity)
ranges from: ca. 1 x 10(-11) (ca. 1 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference: Jacobsson and Pusch (1977)
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (l)
Formation:
Location:
Condition 1: 80-90% quartz powder
Condition 2: Water content 5-15%
Condition 3: Field compacted
Property/units: Permeability (m/s) (hydraulic conductivity)
ranges from: ca. 3 x 10(-11) (ca. 3 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference: Jacobsson and Pusch (1977)
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) (m)
Formation:
Location:
Condition 1: Bentonite >10%
Condition 2: Bulk density >1.6 t/m(3)
Condition 3:
Property/units: Permeability (m/s) (hydraulic conductivity)
ranges from: 1 x 10(-10) (1 x 10(-8) cm/s) (maximum)
to:
as:
ranges from: to:
Reference:
Source: KBS TEKNISK RAPPORT 9 (1977), p. 5

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) and (Ca)
Formation:
Location: Various
Condition 1: Sand/silt/gravel mixtures
Condition 2: Density = 1.8 to 2.2 g/cm(3)
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-4)
to: 10(-12)
as: % Bentonite
ranges from: <10 to: 100
Reference: Several refs
Source: ONWI-486 (1983), p. 36

Property class: Hydraulic conductivity (minerals)
Material: Bentonite (Na) and Sand
Formation:
Location:
Condition 1: Density (g/cm(3)) = 2.0 - 2.2
Condition 2: Temperature = 25 deg C
Condition 3: Reference basalt ground water
Property/units: Hydraulic conductivity (cm/s)
ranges from: ca. 10(-9)
to: ca. 10(-12)
as: Bentonite content (%)
ranges from: 25 to: 75
Reference:
Source: PNL-4452 UC-70 (1983), p. 16

Property class: Hydraulic conductivity (minerals)
Material: Bentonite and Sand
Formation:
Location:
Condition 1: Various mixtures of bentonite and sand
Condition 2: Initial density (dry) = 2.1 Mg/m(3)
Condition 3:
Property/units: Hydraulic conductivity (m/s)
ranges from: ca. 10(-6) (ca. 1 x 10(-4) cm/s)
to: ca. 10(-14) (ca. 1 x 10(-12) cm/s)
as: Percent bentonite (%)
ranges from: ca. 5 to: 100
Reference:
Source: AECL-7812 (1983), p. 29

Property class: Hydraulic conductivity (minerals)
Material: Bentonite and Sand (a)
Formation:
Location: Oregon
Condition 1: 10% bentonite
Condition 2: Saturation time (days) = 37
Condition 3: Hydraulic gradient = 4
Property/units: Permeability (cm/s) (hydraulic conductivity)
ranges from: 9.5 x 10(-8)
to:
as:
ranges from: to:
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 7

Property class: Hydraulic conductivity (minerals)
Material: Bentonite and Sand (b)
Formation:
Location: Oregon
Condition 1: 50% bentonite
Condition 2: Saturation time (days) = 62 (still saturating)
Condition 3: Hydraulic gradient = 4
Property/units: Permeability (cm/s) (hydraulic conductivity)
ranges from: <9.5 x 10(-8)
to:
as:
ranges from: to:
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 7

Property class: Hydraulic conductivity (minerals)
Material: Bentonite and Sand (c)
Formation:
Location: Wyoming
Condition 1: 10% bentonite
Condition 2: Saturation time (days) = 42 (still saturating)
Condition 3: Hydraulic gradient = 4
Property/units: Permeability (cm/s) (hydraulic conductivity)
ranges from: <9.5 x 10(-8)
to:
as:
ranges from: to:
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 7

Property class: Hydraulic conductivity (minerals)
Material: Bentonite and Sand (d)
Formation:
Location: Wyoming
Condition 1: 50% bentonite
Condition 2: Saturation time (days) = 53 (still saturating)
Condition 3: Hydraulic gradient = 4
Property/units: Permeability (cm/s) (hydraulic conductivity)
ranges from: <9.5 x 10(-8)
to:
as:
ranges from: to:
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 7

Property class: Hydraulic conductivity (minerals)
Material: Bentonite and Sand (e)
Formation:
Location: Wyoming
Condition 1: 75% sand
Condition 2: 20 - 80 mesh sand
Condition 3: Density (dry) (bulk) (g/cm(3)) = 1.72
Property/units: Permeability (m(2))
ranges from: 3 x 10(-18) (2.9 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference: Grim (1962)
Source: NUREG/CP-0052 (1983), p. 220

Property class: Hydraulic conductivity (minerals)
Material: Bentonite and Sand (f)
Formation:
Location: Wyoming
Condition 1: 75% sand
Condition 2: 80 - 140 mesh sand
Condition 3: Density (dry) (bulk) (g/cm(3)) = 1.59
Property/units: Permeability (m(2))
ranges from: 8 x 10(-18) (7.8 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference:
Source: NUREG/CP-0052 (1983), p. 220

Property class: Hydraulic conductivity (minerals)
Material: Clay and Sand
Formation:
Location: Hanford
Condition 1: 50% Ringold clay
Condition 2: Saturation time (days) = 38 (still saturating)
Condition 3: Hydraulic gradient = 4
Property/units: Permeability (cm/s) (hydraulic conductivity)
ranges from: <9.5 x 10(-8)
to:
as:
ranges from: to:
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 7

Property class: Hydraulic conductivity (minerals)
Material: Illite (Ca)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-10)
to: 10(-6)
as: Void ratio
ranges from: 0.7 to: 6
Reference: Mesri and Olson (1971)
Source: ONWI-486 (1983), p. 35

Property class: Hydraulic conductivity (minerals)
Material: Illite (Na)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-10)
to: 10(-7)
as: Void ratio
ranges from: 0.7 to: 7
Reference: Mesri and Olson (1971)
Source: ONWI-486 (1983), p. 35

Property class: Hydraulic conductivity (minerals)
Material: Kaolinite (a)
Formation:
Location:
Condition 1: Density (dry) (bulk) (g/cm(3)) =
Condition 2: Load (MPa) = 0.1
Condition 3:
Property/units: Permeability (m(2))
ranges from: 1 x 10(-16) (9.7 x 10(-8) cm/s)
to:
as:
ranges from: to:
Reference: Grim (1962)
Source: NUREG/CP-0052 (1983), p. 209

Property class: Hydraulic conductivity (minerals)
Material: Kaolinite (b)
Formation:
Location:
Condition 1: Density (dry) (bulk) (g/cm(3)) =
Condition 2: Load (MPa) = 6.4
Condition 3:
Property/units: Permeability (m(2))
ranges from: 5 x 10(-17) (4.9 x 10(-8) cm/s)
to:
as:
ranges from: to:
Reference: Grim (1962)
Source: NUREG/CP-0052 (1983), p. 209

Property class: Hydraulic conductivity (minerals)
Material: Kaolinite (Ca)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-8)
to: 10(-5)
as: Void ratio
ranges from: 0.7 to: 2
Reference: Mesri and Olson (1971)
Source: ONWI-486 (1983), p. 35

Property class: Hydraulic conductivity (minerals)
Material: Kaolinite (Na)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-8)
to: 10(-5)
as: Void ratio
ranges from: 0.7 to: 2
Reference: Mesri and Olson (1971)
Source: ONWI-486 (1983), p. 35

Property class: Hydraulic conductivity (minerals)
Material: Kaolinite and Sand
Formation:
Location:
Condition 1: Density (dry) (bulk) (g/cm(3)) (not stated)
Condition 2: Load (MPa) = 6.4
Condition 3: 30% kaolinite
Property/units: Permeability (m(2))
ranges from: 2 x 10(-16) (1.9 x 10(-7) cm/s)
to:
as:
ranges from: to:
Reference: Grim (1962)
Source: NUREG/CP-0052 (1983), p. 209

Property class: Hydraulic conductivity (minerals)
Material: Silty Clay
Formation:
Location:
Condition 1: Kneading compaction
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 5 x 10(-6)
to: ca. 2 x 10(-8)
as: Molding water content (wt. %)
ranges from: 13 to: 25
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 39

Property class: Hydraulic conductivity (minerals)
Material: Silty Clay
Formation:
Location:
Condition 1: Static compaction
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 5 x 10(-6)
to: 10(-7)
as: Molding water content (wt. %)
ranges from: 13 to: 23
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 39

Property class: Hydraulic conductivity (minerals)
Material: Smectite (Ca) (a)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-11)
to: 10(-6)
as: Void ratio
ranges from: 1 to: 6
Reference: Mesri and Olson (1971)
Source: ONWI-486 (1983), p. 35

Property class: Hydraulic conductivity (minerals)
Material: Smectite (Ca) (b)
Formation:
Location:
Condition 1: Density (dry) (bulk) (g/cm(3)) (not stated)
Condition 2: Load (MPa) = 6.4
Condition 3:
Property/units: Permeability (m(2))
ranges from: 3 x 10(-18) (2.9 x 10(-9) cm/s)
to:
as:
ranges from: to:
Reference: Grim (1962)
Source: NUREG/CP-0052 (1983), p. 209

Property class: Hydraulic conductivity (minerals)
Material: Smectite (Ca) and Sand
Formation:
Location:
Condition 1: Density (dry) (bulk) (g/cm(3)) (not stated)
Condition 2: Load (MPa) = 6.4
Condition 3: 30% smectite
Property/units: Permeability (m(2))
ranges from: 4 x 10(-17) (3.9 x 10(-8) cm/s)
to:
as:
ranges from: to:
Reference: Grim (1962)
Source: NUREG/CP-0052 (1983), p. 209

Property class: Hydraulic conductivity (minerals)
Material: Smectite (Na) (a)
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Hydraulic conductivity (cm/s)
ranges from: 10(-11)
to: 10(-7)
as: Void ratio
ranges from: 1 to: 30
Reference: Mesri and Olson (1971)
Source: ONWI-486 (1983), p. 35

Property class: Hydraulic conductivity (minerals)
Material: Smectite (Na) and Sand
Formation:
Location:
Condition 1: Density (dry) (bulk) (g/cm(3)) (not stated)
Condition 2: Load (MPa) = 6.4
Condition 3: 30% smectite
Property/units: Permeability (m(2))
ranges from: 5 x 10(-19) (4.9 x 10(-10) cm/s)
to:
as:
ranges from: to:
Reference: Grim (1962)
Source: NUREG/CP-0052 (1983), p. 209

Property class: Hydraulic conductivity (minerals)
Material: Volclay saline seal and Sand
Formation:
Location:
Condition 1: 50% sand
Condition 2: Density 2.22 g/cm(3)
Condition 3: Various heads and hydraulic gradients
Property/units: Hydraulic conductivity (cm/s)
ranges from: 2.9 x 10(-12)
to: 4.1 x 10(-12)
as:
ranges from: to:
Reference:
Source: ONWI-312 (1981), p. 33

Property class: Miscellaneous
Material: Shale
Formation:
Location:
Condition 1: Pre-emplacement travel
Condition 2: 100,000 years
Condition 3:
Property/units: Groundwater travel distance (m)
ranges from: 0.3
to: 40
as:
ranges from: to:
Reference:
Source: ORNL-6241/V1 (in preparation) p. 36

Property class: Miscellaneous
Material: Shale
Formation:
Location:
Condition 1: Preclosure mined openings
Condition 2:
Condition 3:
Property/units: Inflow (ml/min per m)
ranges from: 10
to: 5 x 10(-1)
as: Time (days)
ranges from: 0.1 to: 5,000
Reference:
Source: ORNL-6241/V1 (in preparation) p. 38

Property class: Miscellaneous
Material: Shale
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Inflow (ml/min per m)
ranges from: 10
to: <1
as: Time (days)
ranges from: 0.1 to: 5,000
Reference:
Source: ORNL-6241/V2 (in preparation) p. 106

Property class: Miscellaneous
Material: Shale
Formation:
Location:
Condition 1:
Condition 2:
Condition 3:
Property/units: Specific storage (l/m)
ranges from: 1 x 10(-6)
to:
as:
ranges from: to:
Reference: Loken, M. (personal communication) (1984)
Source: ORNL-6241/V2 (in preparation) p. 99

Property class: Miscellaneous
Material: Shale
Formation:
Location:
Condition 1: Computed value
Condition 2:
Condition 3:
Property/units: Specific storage (l/m)
ranges from: 4.3 x 10(-7)
to: 2.8 x 10(-6)
as:
ranges from: to:
Reference:
Source: ORNL-6241/V2 (in preparation) p. 57

Property class: Miscellaneous
Material: Shale
Formation:
Location:
Condition 1: ADOPTED BASE VALUE
Condition 2:
Condition 3:
Property/units: Specific storage (m(-1)) (?)
ranges from: 5 x 10(-6)
to: 5 x 10(-7)
as:
ranges from: to:
Reference:
Source: ORNL-6241/V1 (in preparation) p. 33

Property class: Miscellaneous
Material: Shale
Formation:
Location:
Condition 1: Pre-emplacement travel
Condition 2: 10 km distance
Condition 3:
Property/units: Travel time (years)
ranges from: >100,000
to: >100,000
as:
ranges from: to:
Reference:
Source: ORNL-6241/V1 (in preparation) p. 36

13.1.4 Appendix A.4. MECHANICAL PROPERTIES

Property class: Bulk modulus
Material: Argillite
Formation: Eleana Argillite
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Bulk modulus (confined) (GPa)
ranges from: 14.0 (1.4 x 10(4) MPa)
to: -
as: -
ranges from: - to: -
Reference: Y/OWI/TM-36/6 (1978)
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Bulk modulus
Material: Shale
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Bulk modulus (psi)
ranges from: 7.6 x 10(5) (5.2 x 10(3) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Bulk modulus
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Bulk modulus (psi)
ranges from: 6.3 x 10(5) (4.3 x 10(3) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Property class: Bulk modulus
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Bulk modulus (psi)
ranges from: 1.1 x 10(5) (7.6 x 10(2) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Bulk modulus
Material: Shale
Formation: Pierre Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Bulk modulus (psi)
ranges from: 77.8 x 10(3) (5.4 x 10(2) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Bulk modulus
Material: Shales
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Bulk modulus (Pa x 10(10))
ranges from: ca. 50 (ca. 5 x 10(5) MPa)
to: ca. 200 (ca. 2 x 10(6) MPa)
as: Depth (m)
ranges from: 0 to: 6,000
Reference: Three refs
Source: ORNL-6241/V2 (in preparation) p. 199

Property class: Cohesion
Material: Argillite
Formation: Eleana Argillite
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Cohesion (unconfined) (MPa)
ranges from: 8 x 10(-1)
to: -
as: -
ranges from: - to: -
Reference: Y/OWI/TM-36/6 (1978)
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Cohesion
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Cohesion (MPa)
ranges from: 1 x 10(-1)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Cohesion
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Cohesion (MPa)
ranges from: 1 x 10(-1)
to: 1
as: -
ranges from: - to: -
Reference: -
Source: *Rad Waste Management and Nuclear Fuel Cycle* v.6 (1985), p. 54

Property class: Cohesion
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Cohesion (psi)
ranges from: 5,900 (4.1 x 10(1) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Property class: Cohesion
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Cohesion (psi)
ranges from: 14 (1 x 10(-1) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Cohesion
Material: Shale (a)
Formation: -
Location: -
Condition 1: Intact
Condition 2: Range of properties
Condition 3: -
Property/units: Cohesion (psi)
ranges from: 0 (0 MPa)
to: 4,250 (3 x 10(1) MPa)
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 2-2

Property class: Cohesion
Material: Shale (b)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Cohesion (psi)
ranges from: 6 x 10(3) (4.1 x 10(1) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Cohesion
Material: Shale (c)
Formation: Pierre Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Cohesion (psi)
ranges from: 206 (1.4 MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Cohesion
Material: Shale (d)
Formation: Pierre Shale
Location: Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Cohesion (psi)
ranges from: 2 (1.4 x 10(-2) MPa)
to: 30 (2.1 x 10(-1) MPa)
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Compressive strength
Material: Argillite
Formation: Eleana Argillite
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Compressive strength (unconfined) (MPa)
ranges from: 4.75
to: -
as: -
ranges from: - to: -
Reference: Y/OWI/TM-36/6 (1978)
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Compressive strength
Material: Bentonite (Na) (a)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Compressive strength (unconfined) (psi)
ranges from: 55.5 (3.8 x 10(-1) MPa)
to: -
as: -
ranges from: - to: -
Reference: Mielenz and King (1955)
Source: ONWI-312 (1981), p. 22

Property class: Compressive strength
Material: Bentonite (Na) (b)
Formation: -
Location: -
Condition 1: Air dry (water ca. 10%)
Condition 2: Density (bulk) = 2 t/m(3)
Condition 3: -
Property/units: Compressive strength (uniaxial) (MPa)
ranges from: 8.9
to: -
as: -
ranges from: - to: -
Reference: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 14

Property class: Compressive strength
Material: Bentonite and Sand (a)
Formation: -
Location: Oregon
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Compressive strength (unconfined) (MPa)
ranges from: ca. 0
to: ca. 1.8
as: Clay content (wt. %)
ranges from: ca. 0 to: 50-70
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), Fig. 4

Property class: Compressive strength
Material: Bentonite and Sand (b)
Formation: -
Location: Wyoming
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Compressive strength (unconfined) (MPa)
ranges from: ca. 0
to: ca. 3
as: Clay content (wt. %)
ranges from: ca. 0 to: 50-60
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), Fig. 4

Property class: Compressive strength
Material: Kaolinite
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Compressive strength (unconfined) (psi)
ranges from: 100.3 (6.9 x 10(-1) MPa)
to: -
as: -
ranges from: - to: -
Reference: Mielenz and King (1955)
Source: ONWI-312 (1981), p. 22

Property class: Compressive strength
Material: Oil Shales
Formation: -
Location: -
Condition 1: High grade
Condition 2: -
Condition 3: -
Property/units: Compressive strength (MPa)
ranges from: 35
to: 138
as: -
ranges from: - to: -
Reference: Netherland et al (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Property class: Compressive strength
Material: Oil Shales
Formation: -
Location: -
Condition 1: Low grade
Condition 2: -
Condition 3: -
Property/units: Compressive strength (MPa)
ranges from: 138
to: 172
as: -
ranges from: - to: -
Reference: Netherland et al (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Property class: Compressive strength
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Compressive strength (uniaxial) (psi)
ranges from: 1 x 10(4) (6.9 x 10(1) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Property class: Compressive strength
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian-Mississippian
Condition 2: Intact
Condition 3: Depth = 30 m
Property/units: Compressive strength (uniaxial) (MPa)
ranges from: 13.8
to: -
as: -
ranges from: - to: -
Reference: Dames and Moore (1978)
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Property class: Compressive strength
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Compressive strength (uniaxial) (psi)
ranges from: 2 x 10(3) (1.4 x 10(1) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Compressive strength
Material: Shale
Formation: Hucknall Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Compressive strength (psi)
ranges from: 8.5 x 10(3) (5.9 x 10(1) MPa)
to: -
as: -
ranges from: - to: -
Reference: Hobbs (1970)
Source: Y/OWI/TM36/6 (1978), p. 6-3

Property class: Compressive strength
Material: Shale
Formation: Lewis Shale
Location: New Mexico
Condition 1: Moisture content 3.7 to 6.2%
Condition 2: -
Condition 3: -
Property/units: Compressive strength (psi)
ranges from: 1,000 (6.9 MPa)
to: 6,000 (4.1 x 10(1) MPa)
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 8-5

Property class: Compressive strength
Material: Shale
Formation: Mancos Fm
Location: New Mexico
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Compressive strength (psi)
ranges from: 1,000 (6.9 MPa)
to: 8,000 (5.5 x 10(1) MPa)
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 8-2

Property class: Compressive strength
Material: Shale
Formation: Maquoketa Group
Location: Indiana
Condition 1: Illite dominant
Condition 2: -
Condition 3: -
Property/units: Compressive strength (MPa)
ranges from: 11
to: 115
as: -
ranges from: - to: -
Reference: Cobb Engineering (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 60

Property class: Compressive strength
Material: Shale (a)
Formation: -
Location: -
Condition 1: Intact
Condition 2: Range of properties
Condition 3: -
Property/units: Compressive strength (uniaxial) (psi)
ranges from: 70 (4.8 x 10(-1) MPa)
to: 3.7 x 10(4) (2.5 x 10(2) MPa)
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 2-2

Property class: Compressive strength
Material: Shale (a)
Formation: Bearpaw Shale
Location: Montana
Condition 1: Upper Cretaceous
Condition 2: -
Condition 3: -
Property/units: Compressive strength (kg/cm(2))
ranges from: 122 (1.2 x 10(1) MPa)
to: 25 (2.5 MPa)
as: Angle between sample axis and horizontal (deg)
ranges from: 0 to: 40 +/- 10
Reference: Wright (1969)
Source: Y/OWI/TM36/6 (1978), p. 6-13

Property class: Compressive strength
Material: Shale (a)
Formation: Pierre Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Compressive strength (uniaxial) (psi)
ranges from: 2.1 x 10(3) (1.4 x 10(1) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Compressive strength
Material: Shale (b)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Compressive strength (uniaxial) (psi)
ranges from: 1 x 10(4) (6.9 x 10(1) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Compressive strength
Material: Shale (b)
Formation: Bearpaw Shale
Location: Montana
Condition 1: Upper Cretaceous
Condition 2: -
Condition 3: -
Property/units: Compressive strength (kg/cm(2))
ranges from: 25 (2.5 MPa)
to: 55 (5.4 MPa)
as: Angle between sample axis and horizontal (deg)
ranges from: 40 +/- 10 to: 90
Reference: Wright (1969)
Source: Y/OWI/TM36/6 (1978), p. 6-13

Property class: Compressive strength
Material: Shale (b)
Formation: Pierre Shale
Location: Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Compressive strength (psi)
ranges from: 70 (4.8 x 10(-1) MPa)
to: 2,530 (1.7 x 10(1) MPa)
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Compressive strength
Material: Shales
Formation: -
Location: Western Ohio
Condition 1: Mean composition: illite (47%), quartz (24%)
Condition 2: Plus other clays, carbonates, etc.
Condition 3: -
Property/units: Compressive strength (MPa)
ranges from: 20
to: 32
as: -
ranges from: - to: -
Reference: Cobb Engineering (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 71

Property class: Compressive strength
Material: Shales (a)
Formation: -
Location: -
Condition 1: Tested at room temperature
Condition 2: "Dry" specimens
Condition 3: Forty-nine data points
Property/units: Compressive strength (unconfined) (MPa)
ranges from: 25.2
to: 113.6
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V3 (in preparation) p. 110

Property class: Compressive strength
Material: Shales (b)
Formation: -
Location: Various
Condition 1: Various depths, compositions, etc.
Condition 2: Represents many tests
Condition 3: -
Property/units: Compressive strength (unconfined) (psi)
ranges from: <100 (<6.9 x 10(-1) MPa)
to: 3.7 x 10(4) (2.5 x 10(2) MPa)
as: -
ranges from: - to: -
Reference: Thirteen refs
Source: Y/OWI/TM36/6 (1978), p. A-4,5,6

Property class: Compressive strength
Material: Smectite (Na), Kaolinite, Sand Mixtures (a)
Formation: -
Location: Osage, NY
Condition 1: Kaolinite from Bath, SC
Condition 2: Air dried
Condition 3: -
Property/units: Compressive strength (psi)
ranges from: 76.5 (5.3 x 10(-1) MPa)
to: 541.0 (3.7 MPa)
as: -
ranges from: - to: -
Reference: Mielenz and King (1955)
Source: ONWI-312 (1981), p. 24

Property class: Compressive strength
Material: Smectite (Na), Kaolinite, Sand Mixtures (b)
Formation: -
Location: Osage, NY
Condition 1: Kaolinite from Bath, SC
Condition 2: Optimum moisture content
Condition 3: -
Property/units: Compressive strength (psi)
ranges from: 9.1 (6.3 x 10(-2) MPa)
to: 85.5 (5.9 x 10(-1) MPa)
as: -
ranges from: - to: -
Reference: Mielenz and King (1955)
Source: ONWI-312 (1981), p. 24

Property class: Friction angle
Material: Argillite
Formation: Eleana Argillite
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Friction angle (internal) (deg)
ranges from: 35
to: -
as: -
ranges from: - to: -
Reference: Y/OWI/TM-36/6 (1978)
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Friction angle
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Friction angle (angle of shear resistance) (deg)
ranges from: 25
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Friction angle
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Friction angle (angle of shear resistance) (deg)
ranges from: 19
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Friction angle
Material: Illite (Na) (a)
Formation: -
Location: -
Condition 1: 0 g NaCl/liter
Condition 2: -
Condition 3: -
Property/units: Friction angle (residual) (tan)
ranges from: 0.3
to: 0.7
as: Quartz content (% dry wt.)
ranges from: 0 to: 100
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 47

Property class: Friction angle
Material: Illite (Na) (b)
Formation: -
Location: -
Condition 1: 30 g NaCl/liter
Condition 2: -
Condition 3: -
Property/units: Friction angle (residual) (tan)
ranges from: 0.47
to: 0.7
as: Quartz content (% dry wt.)
ranges from: 0 to: 100
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 47

Property class: Friction angle
Material: Kaolinite
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Friction angle (residual) (tan)
ranges from: 0.27
to: 0.7
as: Quartz content (% dry wt.)
ranges from: 0 to: 100
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 47

Property class: Friction angle
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Friction angle (deg)
ranges from: 23.4
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Property class: Friction angle
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Friction angle (deg)
ranges from: 22
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Friction angle
Material: Shale (a)
Formation: -
Location: -
Condition 1: Intact
Condition 2: Range of properties
Condition 3: -
Property/units: Friction angle (deg)
ranges from: 4.2
to: 56
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 2-2

Property class: Friction angle
Material: Shale (a)
Formation: Pierre Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Friction angle (deg)
ranges from: 5.3
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Friction angle
Material: Shale (b)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Friction angle (deg)
ranges from: 26
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Friction angle
Material: Shale (b)
Formation: Pierre Shale
Location: Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Friction angle (internal) (deg)
ranges from: 8
to: 25
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Friction angle
Material: Shale (c)
Formation: -
Location: -
Condition 1: Intact
Condition 2: Range of properties
Condition 3: -
Property/units: Friction angle (dilation angle) (deg)
ranges from: +5
to: -5
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 2-2

Property class: Friction angle
Material: Shale (d)
Formation: -
Location: -
Condition 1: Summary
Condition 2: 7 data points
Condition 3: "dry"; tested at room temperature
Property/units: Friction angle (internal) (deg)
ranges from: 14.2
to: 51.0
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 47

Property class: Friction angle
Material: Smectite (Na) (a)
Formation: -
Location: -
Condition 1: 0 g NaCl/liter
Condition 2: -
Condition 3: -
Property/units: Friction angle (residual) (tan)
ranges from: 0.09
to: 0.7
as: Quartz content (% dry wt.)
ranges from: 0 to: 100
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 47

Property class: Friction angle
Material: Smectite (Na) (b)
Formation: -
Location: -
Condition 1: 30 g NaCl/liter
Condition 2: -
Condition 3: -
Property/units: Friction angle (residual) (tan)
ranges from: 0.18
to: 0.7
as: Quartz content (% dry wt.)
ranges from: 0 to: 100
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 47

Property class: Miscellaneous
Material: Bentonite
Formation: -
Location: -
Condition 1: Wet
Condition 2: 0.5-mm spaces
Condition 3: -
Property/units: Swelling distance (mm)
ranges from: 1
to: 11
as: Time (hr)
ranges from: 1 to: 100
Reference: LeBell (1978)
Source: ONWI-312 (1981), p. 16

Property class: Miscellaneous
Material: Shale
Formation: -
Location: -
Condition 1: Constructibility indices
Condition 2: -
Condition 3: -
Property/units: Ratio of strength to overburden stress
ranges from: 1.3
to: 6.0
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 53

Property class: Plasticity (LI)
Material: Shale
Formation: Bearpaw Shale
Location: Montana
Condition 1: Upper Cretaceous
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquidity index)
ranges from: -0.11
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 6-1

Property class: Plasticity (LL)
Material: Bentonite
Formation: -
Location: Wyoming
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 553.1
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (LL)
Material: Bentonite (a)
Formation: -
Location: Oregon
Condition 1: 20 - 160 mesh
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 209.6
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (LL)
Material: Bentonite (b)
Formation: -
Location: Oregon
Condition 1: Minus 200 mesh
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 212.69
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (LL)
Material: Bentonite (Na)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 260
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Plasticity (LL)
Material: Bentonite (Na) (a)
Formation: -
Location: -
Condition 1: MX-80
Condition 2: 50% sand
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 98
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Plasticity (LL)
Material: Clay
Formation: -
Location: Hanford
Condition 1: Ringold clay C
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 44.6
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (LL)
Material: Clay
Formation: -
Location: Hanford
Condition 1: Ringold clay D
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 63.9
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (LL)
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 50
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Plasticity (LL)
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 77.5
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Plasticity (LL)
Material: Clay
Formation: Oxford Clay
Location: England
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 55
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Plasticity (LL)
Material: Illite (Ca)
Formation: -
Location: Jackson County, OH
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 69
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (LL)
Material: Illite (Ca) (a)
Formation: -
Location: Fithian, IL
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 90
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (LL)
Material: Illite (Ca) (b)
Formation: -
Location: Grundy County, IL
Condition 1: 5 % smectite layers.
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 100
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (LL)
Material: Kaolinite (Ca)
Formation: -
Location: Anna, IL
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 73
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (LL)
Material: Kaolinite (Ca)
Formation: -
Location: Dry Branch, GA
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 34
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (LL)
Material: Shale (a)
Formation: Pierre Shale
Location: Great Plains
Condition 1: Mixed-layer illite-smectite dominant
Condition 2: 60-80% clays
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 36
to: 113
as: -
ranges from: - to: -
Reference: Tourtelot (1962)
Source: ORNL/Sub/84-64794/1 (1985), p. 291

Property class: Plasticity (LL)
Material: Shale (b)
Formation: Pierre Shale
Location: Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 55
to: 202
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Plasticity (LL)
Material: Shales, Mudstones, Siltstones
Formation: -
Location: Various
Condition 1: Many different formations, depths, etc.
Condition 2: Represents over 125 tests
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 17.8
to: 224
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 6-20 to 6-26

Property class: Plasticity (LL)
Material: Smectite (Ca)
Formation: -
Location: Belle Fourche, SD
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 177
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (LL)
Material: Smectite (Ca)
Formation: -
Location: Cheto, AZ
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 155
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (LL)
Material: Smectite (Ca)
Formation: -
Location: Omsted, IL
Condition 1: 25% illite layers.
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 123
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (LL)
Material: Smectite (Ca)
Formation: -
Location: Pontotoc, MS
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (liquid limit) (%)
ranges from: 166
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (PI)
Material: Bentonite
Formation: -
Location: Wyoming
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic index) (%)
ranges from: 519.5
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PI)
Material: Bentonite (a)
Formation: -
Location: Oregon
Condition 1: 20 - 160 mesh
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic index) (%)
ranges from: 168.58
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PI)
Material: Bentonite (b)
Formation: -
Location: Oregon
Condition 1: Minus 200 mesh
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic index) (%)
ranges from: 174.6
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PI)
Material: Bentonite (Na) (a)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: -
Condition 3: -
Property/units: Plasticity (plasticity index) (%)
ranges from: 210
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Plasticity (PI)
Material: Bentonite (Na) (b)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: 50% sand
Condition 3: -
Property/units: Plasticity (plasticity index) (%)
ranges from: 79
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Plasticity (PI)
Material: Clay
Formation: -
Location: Hanford
Condition 1: Ringold clay C
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic index) (%)
ranges from: 18.8
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PI)
Material: Clay
Formation: -
Location: Hanford
Condition 1: Ringold clay D
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic index) (%)
ranges from: 40.8
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PI)
Material: Clay
Formation: Porters Creek Clay
Location: Louisiana
Condition 1: Smectite, kaolinite, illite, etc.
Condition 2: Quartz 5 to 50%
Condition 3: -
Property/units: Plasticity (plasticity index) (%)
ranges from: 40
to: -
as: -
ranges from: - to: -
Reference: Boutwell (personal communication) (1980)
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Property class: Plasticity (PI)
Material: Illite
Formation: -
Location: -
Condition 1: Non-clay fraction, quartz sand
Condition 2: -
Condition 3: -
Property/units: Plasticity (plasticity index) (%)
ranges from: 0
to: 90
as: Clay fraction (%)
ranges from: 0 to: 100
Reference: Lambe and Whitman (1969)
Source: ONWI-486 (1983), p. 45

Property class: Plasticity (PI)
Material: Kaolinite
Formation: -
Location: -
Condition 1: Non-clay fraction, quartz sand
Condition 2: -
Condition 3: -
Property/units: Plasticity (plasticity index) (%)
ranges from: 0
to: 35
as: Clay fraction (%)
ranges from: 0 to: 100
Reference: Lambe and Whitman (1969)
Source: ONWI-486 (1983), p. 45

Property class: Plasticity (PI)
Material: Shale
Formation: Pierre Shale
Location: Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plasticity index) (%)
ranges from: 30
to: 110
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Plasticity (PI)
Material: Shales, Mudstones, Siltstones
Formation: -
Location: Various
Condition 1: Many different formations, depths, etc.
Condition 2: Represents over 125 tests
Condition 3: -
Property/units: Plasticity (plasticity index) (%)
ranges from: 1.8
to: 192
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 6-20 to 6-26

Property class: Plasticity (PI)
Material: Smectite (Na)
Formation: -
Location: -
Condition 1: Non-clay fraction, quartz sand
Condition 2: -
Condition 3: -
Property/units: Plasticity (plasticity index) (%)
ranges from: 0
to: 500
as: Clay fraction (%)
ranges from: 0 to: 70
Reference: Lambe and Whitman (1969)
Source: ONWI-486 (1983), p. 45

Property class: Plasticity (PL)
Material: Bentonite
Formation: -
Location: Wyoming
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 33.6
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PL)
Material: Bentonite (a)
Formation: -
Location: Oregon
Condition 1: 20 - 160 mesh
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 41.0
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PL)
Material: Bentonite (b)
Formation: -
Location: Oregon
Condition 1: Minus 200 mesh
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 38.1
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PL)
Material: Bentonite (Na) (a)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 50
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Plasticity (PL)
Material: Bentonite (Na) (b)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: 50% sand
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 19
to: -
as: -
ranges from: - to: -
Reference: -
Source: AECL-7825 (1984), p. 12

Property class: Plasticity (PL)
Material: Clay
Formation: -
Location: Hanford
Condition 1: Ringold clay C
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 25.8
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PL)
Material: Clay
Formation: -
Location: Hanford
Condition 1: Ringold clay D
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 23.1
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (PL)
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 25
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Plasticity (PL)
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 26.5
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Plasticity (PL)
Material: Clay
Formation: Oxford Clay
Location: England
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 26
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Plasticity (PL)
Material: Illite (Ca)
Formation: -
Location: Jackson County, OH
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 36
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (PL)
Material: Illite (Ca) (a)
Formation: -
Location: Fithian, IL
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 40
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (PL)
Material: Illite (Ca) (b)
Formation: -
Location: Grundy County, IL
Condition 1: 5% smectite layers.
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 42
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (PL)
Material: Kaolinite (Ca)
Formation: -
Location: Anna, IL
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 36
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (PL)
Material: Kaolinite (Ca)
Formation: -
Location: Dry Branch, GA
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 26
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (PL)
Material: Shale (a)
Formation: Pierre Shale
Location: Great Plains
Condition 1: 60-80% clay minerals
Condition 2: Mixed layer illite-smectite dominant
Condition 3: Plus smectite and illite; minor kaolinite and chlorite
Property/units: Plasticity (plastic limit) (%)
ranges from: 20
to: 62
as: -
ranges from: - to: -
Reference: Tourtelot (1962)
Source: ORNL/Sub/84-64794/1 (1985), p. 291

Property class: Plasticity (PL)
Material: Shale (b)
Formation: Pierre Shale
Location: Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 22
to: 39
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Plasticity (PL)
Material: Shales, Mudstones, Siltstones
Formation: -
Location: Various
Condition 1: Many different formations, depths, etc.
Condition 2: Represents over 125 tests
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 16.0
to: 45.5
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 6-20 to 6-26

Property class: Plasticity (PL)
Material: Smectite (Ca)
Formation: -
Location: Belle Fourche, SD
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 63
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (PL)
Material: Smectite (Ca)
Formation: -
Location: Cheto, AZ
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 65
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (PL)
Material: Smectite (Ca)
Formation: -
Location: Omsted, IL
Condition 1: 25% illite layers.
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 79
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (PL)
Material: Smectite (Ca)
Formation: -
Location: Pontotoc, MS
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Plasticity (plastic limit) (%)
ranges from: 65
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 43

Property class: Plasticity (SL)
Material: Bentonite (a)
Formation: -
Location: Oregon
Condition 1: 20 - 160 mesh
Condition 2: -
Condition 3: -
Property/units: Plasticity (shrinkage limit) (%)
ranges from: 8.47
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (SL)
Material: Bentonite (b)
Formation: -
Location: Oregon
Condition 1: Minus 200 mesh
Condition 2: -
Condition 3: -
Property/units: Plasticity (shrinkage limit) (%)
ranges from: 8.96
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Plasticity (SL)
Material: Clay
Formation: -
Location: Hanford
Condition 1: Ringold clay D
Condition 2: -
Condition 3: -
Property/units: Plasticity (shrinkage limit) (%)
ranges from: 19.75
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Poisson's ratio
Material: Argillite
Formation: Eleana Argillite
Location: -
Condition 1: -
Condition 2: -
Condition 3: - .
Property/units: Poisson's ratio
ranges from: 0.30
to: -
as: -
ranges from: - to: -
Reference: Y/OWI/TM-36/6 (1978)
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Poisson's ratio
Material: Bentonite
Formation: -
Location: Wyoming
Condition 1: Density = 2 t/m(3)
Condition 2: 10% water
Condition 3: -
Property/units: Poisson's ratio
ranges from: 0.15
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 63

Property class: Poisson's ratio
Material: Oil Shales
Formation: -
Location: -
Condition 1: High grade
Condition 2: -
Condition 3: -
Property/units: Poisson's ratio
ranges from: 0.2
to: 0.3
as: -
ranges from: - to: -
Reference: Netherland et al (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Property class: Poisson's ratio
Material: Oil Shales
Formation: -
Location: -
Condition 1: Low grade
Condition 2: -
Condition 3: -
Property/units: Poisson's ratio
ranges from: 0.15
to: 0.20
as: -
ranges from: - to: -
Reference: Netherland et al (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Property class: Poisson's ratio
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Poisson's ratio
ranges from: 0.1
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Property class: Poisson's ratio
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Poisson's ratio
ranges from: 0.25
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Poisson's ratio
Material: Shale
Formation: Pierre Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Poisson's ratio
ranges from: 0.2
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Poisson's ratio
Material: Shale (a)
Formation: -
Location: -
Condition 1: Intact
Condition 2: Range of properties
Condition 3: -
Property/units: Poisson's ratio
ranges from: 0.03
to: 0.50
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 2-2

Property class: Poisson's ratio
Material: Shale (b)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Poisson's ratio
ranges from: 0.15
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Poisson's ratio
Material: Shales (a)
Formation: -
Location: -
Condition 1: Tested at room temperature
Condition 2: "Dry" specimens
Condition 3: Thirty-four data points
Property/units: Poisson's ratio
ranges from: 0.11
to: 0.31
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V3 (in preparation) p. 110

Property class: Poisson's ratio
Material: Shales (b)
Formation: -
Location: Various
Condition 1: Various formations, depths, etc.
Condition 2: Represents many tests
Condition 3: -
Property/units: Poisson's ratio
ranges from: 0.03
to: 0.77
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. A-11

Property class: Shear
Material: Bentonite (Na) (a)
Formation: -
Location: -
Condition 1: Water content ca. 10 %
Condition 2: Calculated values
Condition 3: -
Property/units: Shear strength (kPa)
ranges from: 1,600 (1.6 MPa)
to: <15 (<1.5 x 10(-2) MPa)
as: Density (bulk) (t/m(3))
ranges from: 2.2 to: 1.05
Reference: -
Source: KBS TEKNISK RAPPORT 74 (1978), p.16

Property class: Shear
Material: Bentonite (Na) (b)
Formation: -
Location: -
Condition 1: Air dry (water ca. 10%)
Condition 2: Density (bulk) = 2 t/m(3)
Condition 3: -
Property/units: Shear strength (MPa)
ranges from: 4.5
to: -
as: -
ranges from: - to: -
Reference: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 14

Property class: Shear
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Shear strength (undrained) (MPa)
ranges from: 1.5
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Shear
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Shear strength (undrained) (MPa)
ranges from: 0.6
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Shear
Material: Clay
Formation: Oxford Clay
Location: England
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Shear strength (undrained) (MPa)
ranges from: 1.2
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Shear
Material: Shale
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Shear modulus (psi)
ranges from: 6.2 x 10(5) (4.3 x 10(3) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Shear
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Shear modulus (psi)
ranges from: 6.8 x 10(5) (4.7 x 10(3) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Property class: Shear
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Shear modulus (psi)
ranges from: 6.8 x 10(4) (4.7 x 10(2) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Shear
Material: Shale
Formation: Pierre Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Shear modulus (psi)
ranges from: 58.3 x 10(3) (4 x 10(2) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Shear
Material: Shales (a)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Shear modulus (Pa x 10(10))
ranges from: 0.1 (1 x 10(3) MPa)
to: 100 (1 x 10(6) MPa)
as: Depth (m)
ranges from: 0 to: 6,000
Reference: Three refs
Source: ORNL-6241/V2 (in preparation) p. 199

Property class: Shear
Material: Shales (b)
Formation: -
Location: Various
Condition 1: Various formations, depths, etc.
Condition 2: Represents several tests
Condition 3: -
Property/units: Shear modulus (psi)
ranges from: 1.7 x 10(6) (1.2 x 10(4) MPa)
to: 3.6 x 10(6) (2.5 x 10(4) MPa)
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. A-10

Property class: Shear (?)
Material: Clay
Formation: Porters Creek Clay
Location: Louisiana
Condition 1: Smectite, kaolinite, illite, etc.
Condition 2: Quartz 5 to 50%
Condition 3: -
Property/units: Strength (MPa)
ranges from: 0.19
to: -
as: -
ranges from: - to: -
Reference: Boutwell (personal communication) (1980)
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Property class: Swelling
Material: Bentonite (a)
Formation: -
Location: -
Condition 1: Plus natural silt
Condition 2: Air dry (ca. 5% water)
Condition 3: Laterally confined; axial load, 10 kPa
Property/units: Swelling (%)
ranges from: 5
to: 20
as: Bentonite content (%)
ranges from: 10 to: 20
Reference: -
Source: KBS TEKNISK RAPPORT 9 (1977), p. 5

Property class: Swelling
Material: Bentonite (b)
Formation: -
Location: -
Condition 1: Plus quartz
Condition 2: 10 to 15% water content
Condition 3: Allowed to swell freely
Property/units: Swelling (%)
ranges from: 15
to: 30
as: -
ranges from: - to: -
Reference: VBB company report
Source: KBS TEKNISK RAPPORT 9 (1977), p. 6

Property class: Swelling
Material: Bentonite (c)
Formation: -
Location: -
Condition 1: 1-psi surcharge
Condition 2: Optimum water content, maximum density
Condition 3: -
Property/units: Swelling (%)
ranges from: 1
to: 50
as: % clay size
ranges from: 5 to: 18
Reference: Two refs
Source: ONWI-486 (1983), p. 49

Property class: Swelling
Material: Illite
Formation: -
Location: -
Condition 1: 1-psi surcharge
Condition 2: -
Condition 3: -
Property/units: Swelling (%)
ranges from: <2
to: 20
as: % clay size
ranges from: <20 to: 45
Reference: Two refs
Source: ONWI-486 (1983), p. 49

Property class: Swelling
Material: Illite and Bentonite (a)
Formation: -
Location: -
Condition 1: 1:1 illite:bentonite ratio
Condition 2: 1-psi surcharge
Condition 3: Optimum water content, maximum density
Property/units: Swelling (%)
ranges from: 1
to: 54
as: % clay size
ranges from: 5 to: 27
Reference: Two refs
Source: ONWI-486 (1983), p. 49

Property class: Swelling
Material: Illite and Bentonite (b)
Formation: -
Location: -
Condition 1: 3:1 illite:bentonite ratio
Condition 2: 1-psi surcharge
Condition 3: Optimum water content, maximum density
Property/units: Swelling (%)
ranges from: <2
to: 30
as: % clay size
ranges from: <20 to: 40
Reference: Two refs
Source: ONWI-486 (1983), p. 49

Property class: Swelling
Material: Illite and Kaolinite
Formation: -
Location: -
Condition 1: 1:1 illite:kaolinite ratio
Condition 2: 1-psi surcharge
Condition 3: Optimum water content, maximum density
Property/units: Swelling (%)
ranges from: <2
to: <10
as: % clay size
ranges from: <20 to: 55
Reference: Two refs
Source: ONWI-486 (1983), p. 49

Property class: Swelling
Material: Kaolinite
Formation: -
Location: -
Condition 1: 1-psi surcharge
Condition 2: Optimum water content, maximum density
Condition 3: -
Property/units: Swelling (%)
ranges from: <2
to: 4
as: % clay size
ranges from: <20 to: 60
Reference: Two refs
Source: ONWI-486 (1983), p. 49

Property class: Swelling
Material: Kaolinite and Bentonite
Formation: -
Location: -
Condition 1: 6:1 kaolinite:bentonite ratio
Condition 2: 1-psi surcharge
Condition 3: Optimum water content, maximum density
Property/units: Swelling (%)
ranges from: 2
to: 35
as: % clay size
ranges from: 10 to: 30
Reference: Two refs
Source: ONWI-486 (1983), p. 49

Property class: Swelling
Material: Shale
Formation: Pierre Shale
Location: Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Swelling (potential) (%)
ranges from: 3
to: 5
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Swelling
Material: Shale
Formation: Pierre Shale (equivalent)
Location: Canada
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Swelling (potential) (%)
ranges from: 2
to: 20
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Swelling pressure
Material: Bentonite
Formation: -
Location: Oregon
Condition 1: Mixed with sand
Condition 2: -
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: ca. 0
to: ca. 1.8
as: Bentonite content (%)
ranges from: ca. 10 to: ca. 69
Reference: Smith et al (1980)
Source: AECL-7812 (1983), p. 34

Property class: Swelling pressure
Material: Bentonite
Formation: -
Location: Wyoming
Condition 1: Mixed with sand
Condition 2: -
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: ca. 0
to: ca. 2.2
as: Bentonite content (%)
ranges from: ca. 10 to: ca. 70
Reference: Smith et al (1980)
Source: AECL-7812 (1983), p. 34

Property class: Swelling pressure
Material: Bentonite (a)
Formation: -
Location: -
Condition 1: Plus natural silt
Condition 2: Air dry (5% water, initially)
Condition 3: Laterally confined; axial load, 10 kPa
Property/units: Swelling pressure (kPa)
ranges from: 30 (0.03 MPa) (?)
to: 110 (0.11 MPa) (?)
as: Bentonite content (%)
ranges from: 10 to: 20
Reference: -
Source: KBS TEKNISK RAPPORT 9 (1977), p. 6

Property class: Swelling pressure
Material: Bentonite (b)
Formation: -
Location: -
Condition 1: Plus quartz
Condition 2: 10 to 15% water content
Condition 3: At constant volume
Property/units: Swelling pressure (kPa)
ranges from: 30 (0.03 MPa) (?)
to: 200 (0.20 MPa) (?)
as: -
ranges from: - to: -
Reference: VBB company report
Source: KBS TEKNISK RAPPORT 9 (1977), p. 6

Property class: Swelling pressure
Material: Bentonite (c)
Formation: -
Location: -
Condition 1: Measured at 20 deg C
Condition 2: Used distilled water
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: 0.7
to: ca. 70
as: Density (dry) (Mg/m(3))
ranges from: 1.75 to: 2.2
Reference: Pusch (1980)
Source: AECL-7812 (1983), p. 33

Property class: Swelling pressure
Material: Bentonite (Ca)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: 31.4
to: -
as: Density (g/cm) (?)
ranges from: 2.11 to: -
Reference: -
Source: ONWI-312 (1981), p. 31

Property class: Swelling pressure
Material: Bentonite (Na) (a)
Formation: -
Location: -
Condition 1: Confined
Condition 2: Density at water saturation
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: >10
to: -
as: -
ranges from: - to: -
Reference: Pusch (1979)
Source: ONWI-312 (1981), p. 15

Property class: Swelling pressure
Material: Bentonite (Na) (b)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: 57.7
to: -
as: Density (initial) (presumed g/cm)(3))
ranges from: 2.13 to: -
Reference: -
Source: ONWI-312'(1981), p. 31

Property class: Swelling pressure
Material: Bentonite (Na) (c)
Formation: -
Location: -
Condition 1: 50% sand
Condition 2: -
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: 21.7
to: -
as: Density (initial) (presumed g/cm)(3))
ranges from: 2.09 to: -
Reference: -
Source: ONWI-312 (1981), p. 31

Property class: Swelling pressure
Material: Bentonite (Na) (d)
Formation: -
Location: -
Condition 1: Density (g/cm(3)) ca. 2.2
Condition 2: Time 373 days
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: ca. 72
to: -
as: -
ranges from: - to: -
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), p. 6

Property class: Swelling pressure
Material: Bentonite (Na) (e)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: 50% sand
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: ca. 3
to: ca. 8
as: Density (Mg/m(3))
ranges from: 1.856 to: 2.055
Reference: -
Source: AECL-7825 (1984), p. 16

Property class: Swelling pressure
Material: Bentonite (Na) (f)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: Time dependent
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: ca. 2
to: ca. 20
as: Density (dry) (Mg/m(3))
ranges from: 1.556 to: 1.774
Reference: -
Source: AECL-7825 (1984), p. 16

Property class: Swelling pressure
Material: Bentonite (Na) (g)
Formation: -
Location: Wyoming
Condition 1: MX-80
Condition 2: Compacted air-dry (water ca. 10%)
Condition 3: Curve D
Property/units: Swelling pressure (MPa)
ranges from: 1
to: 8
as: Density (bulk) (t/m(3))
ranges from: ca. 1.8 to: ca. 2.3
Reference: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 6

Property class: Swelling pressure
Material: Bentonite (Na) (h)
Formation: -
Location: Wyoming
Condition 1: Calculated based on dry density
Condition 2: -
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: 2
to: 23
as: Density (dry) (t/m(3))
ranges from: 1.1 to: 1.7
Reference: Pusch (1978)
Source: ONWI-486 (1983), p. 51

Property class: Swelling pressure
Material: Bentonite (Na) (i)
Formation: -
Location: Wyoming
Condition 1: Calculated, water saturated
Condition 2: -
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: 3
to: 26
as: Density (bulk) (t/m(3))
ranges from: 1.7 to: 2.1
Reference: Pusch (1978)
Source: ONWI-486 (1983), p. 51

Property class: Swelling pressure
Material: Bentonite (Na) (j)
Formation: -
Location: Wyoming
Condition 1: Exposed to external water at constant volume
Condition 2: Measured
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: 3
to: 27
as: Density (t/m(3))
ranges from: 1.9 to: 2.3
Reference: Pusch (1978)
Source: ONWI-486 (1983), p. 51

Property class: Swelling pressure
Material: Bentonite and Sand (a)
Formation: -
Location: Oregon
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: ca. 0
to: ca. 1.8
as: Clay content (wt. %)
ranges from: ca. 10 to: ca. 70
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), Fig. 3

Property class: Swelling pressure
Material: Bentonite and Sand (b)
Formation: -
Location: Wyoming
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: ca. 0
to: ca. 2.2
as: Clay content (wt. %)
ranges from: ca. 10 to: ca. 70
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), Fig. 3

Property class: Swelling pressure
Material: Shale
Formation: -
Location: -
Condition 1: MX-80
Condition 2: Water content ca. 10%
Condition 3: -
Property/units: Swelling pressure (MPa)
ranges from: 10
to: 0.5
as: Density (bulk) (t/m(3))
ranges from: 2.2 to: 1.2
Reference: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 7

Property class: Tensile strength
Material: Argillite
Formation: Eleana Argillite
Location: -
Condition 1: Calculated value
Condition 2: -
Condition 3: -
Property/units: Tensile strength (MPa)
ranges from: 3.5
to: -
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979b), p. 81

Property class: Tensile strength
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Tensile strength (psi)
ranges from: 200 (1.4 MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Property class: Tensile strength
Material: Shale (a)
Formation: -
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Tensile strength (psi)
ranges from: 0 (0 MPa) (?)
to: 1,540 (1.1 x 10(1) MPa)
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 2-2

Property class: Tensile strength
Material: Shale (b)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Tensile strength (psi)
ranges from: 200 (1.4 MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Tensile strength
Material: Shale (c)
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian-Mississippian
Condition 2: Intact
Condition 3: Depth = 30 m
Property/units: Tensile strength (MPa)
ranges from: 0.34
to: -
as: -
ranges from: - to: -
Reference: Dames and Moore (1978)
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Property class: Tensile strength
Material: Shale (d)
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Tensile strength (psi)
ranges from: 50 (3.4 x 10(-1) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Tensile strength
Material: Shale (e)
Formation: Pierre Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Tensile strength (psi)
ranges from: 50 (3.4 x 10(-1) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Tensile strength
Material: Shales
Formation: -
Location: Various
Condition 1: Various formations, depths, etc.
Condition 2: Represents many samples
Condition 3: -
Property/units: Tensile strength (psi)
ranges from: <100 (<6.9 x 10(-1) MPa)
to: 1,538 (1.1 x 10(1) MPa)
as: -
ranges from: - to: -
Reference: Several refs
Source: Y/OWI/TM36/6 (1978), p. A-7

Property class: Young's modulus
Material: Argillite (a)
Formation: Eleana Argillite
Location: -
Condition 1: Lab measurement
Condition 2: -
Condition 3: -
Property/units: Young's modulus (GPa)
ranges from: 3.7 (3.7 x 10(3) MPa)
to: 16 (MPa)
as: Confining pressure (MPa)
ranges from: Unconfined to: 20
Reference: -
Source: Proc NEA Workshop OECD (1979b), p. 83

Property class: Young's modulus
Material: Argillite (b)
Formation: Eleana Argillite
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Young's modulus (unconfined) (GPa)
ranges from: 3.74 (3.7 x 10(3) MPa)
to: -
as: -
ranges from: - to: -
Reference: Y/OWI/TM-36/6 (1978)
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Young's modulus
Material: Bentonite
Formation: -
Location: -
Condition 1: Density = 2 t/m(3)
Condition 2: 10% water
Condition 3: -
Property/units: Young's modulus (MPa)
ranges from: 300
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 63

Property class: Young's modulus
Material: Bentonite and Sand (a)
Formation: -
Location: Oregon
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Young's modulus (MPa)
ranges from: ca. 55
to: ca. 80
as: Clay content (wt. %)
ranges from: ca. 10 to: ca. 50
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), Fig. 5

Property class: Young's modulus
Material: Bentonite and Sand (b)
Formation: -
Location: Wyoming
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Young's modulus (MPa)
ranges from: ca. 45
to: 60
as: Clay content (wt. %)
ranges from: 10 to: 50
Reference: Taylor et al (1980)
Source: RHO-BWI-SA-80 (1981), Fig. 5

Property class: Young's modulus
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Young's modulus (elastic modulus) (MPa)
ranges from: 300
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Young's modulus
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Young's modulus (elastic modulus) (MPa)
ranges from: 170
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Property class: Young's modulus
Material: Oil Shales
Formation: -
Location: -
Condition 1: High grade
Condition 2: -
Condition 3: -
Property/units: Young's modulus (MPa)
ranges from: 7,000 (7 x 10(3))
to: 17,500 (1.75 x 10(4))
as: -
ranges from: - to: -
Reference: Netherland et al (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Property class: Young's modulus
Material: Oil Shales
Formation: -
Location: -
Condition 1: Low grade
Condition 2: -
Condition 3: -
Property/units: Young's modulus (MPa)
ranges from: >21,000 (>2.1 x 10(4))
to: -
as: -
ranges from: - to: -
Reference: Netherland et al (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Property class: Young's modulus
Material: Shale
Formation: Arnheim and Waynesville Fms
Location: Ohio
Condition 1: Ordovician
Condition 2: Intact
Condition 3: -
Property/units: Young's modulus (psi)
ranges from: 1.5 x 10(6) (1 x 10(4) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Property class: Young's modulus
Material: Shale
Formation: Chagrin Shale
Location: Ohio
Condition 1: Devonian
Condition 2: Intact
Condition 3: -
Property/units: Young's modulus (psi)
ranges from: 1.7 x 10(5) (1.2 x 10(3) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Property class: Young's modulus
Material: Shale
Formation: Hucknall Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Young's modulus (elastic modulus) (psi x 10(6))
ranges from: 1.48 (1 x 10(4) MPa)
to: -
as: -
ranges from: - to: -
Reference: Hobbs (1970)
Source: Y/OWI/TM36/6 (1978), p. 6-3

Property class: Young's modulus
Material: Shale
Formation: Pierre Shale
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Young's modulus (psi)
ranges from: 1.4 x 10(5) (9.7 x 10(2) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Property class: Young's modulus
Material: Shale
Formation: Pierre Shale
Location: Great Plains
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Young's modulus (elastic modulus) (psi x 10(6))
ranges from: 0.02 (1.4 x 10(2) MPa)
to: 0.014 (9.6 x 10(1) MPa)
as: -
ranges from: - to: -
Reference: Abel and Gentry (1975)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Property class: Young's modulus
Material: Shale (a)
Formation: -
Location: -
Condition 1: Room temperature
Condition 2: Confining pressure = 0-20 MPa
Condition 3: Brittle-to-ductile transition pressure
Property/units: Young's modulus (MPa)
ranges from: 10
to: 32
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 47

Property class: Young's modulus
Material: Shale (b)
Formation: -
Location: -
Condition 1: Room temperature
Condition 2: Confining pressure = <100 MPa
Condition 3: Brittle-to-ductile transition pressure
Property/units: Young's modulus (MPa)
ranges from: 10
to: 32
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 47

Property class: Young's modulus
Material: Shale (c)
Formation: -
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Young's modulus (psi)
ranges from: 2 x 10(3) (1.4 x 10(1) MPa)
to: 6.4 x 10(6) (4.4 x 10(4) MPa)
as: -
ranges from: - to: -
Reference: -
Source: Y/OWIU/TM36/6 (1978), p. 2-2

Property class: Young's modulus
Material: Shale (d)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Young's modulus (psi)
ranges from: 1.6 x 10(6) (1.1 x 10(4) MPa)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Young's modulus
Material: Shales (a)
Formation: -
Location: -
Condition 1: Tested at room temperature
Condition 2: "Dry" specimens
Condition 3: Fifty data points
Property/units: Young's modulus (GPa)
ranges from: 9.9 (9.9 x 10(3) MPa)
to: 31.7 (3.17 x 10(4) MPa)
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V3 (in preparation) p. 110

Property class: Young's modulus
Material: Shales (b)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Young's modulus (Pa x 10(10))
ranges from: 1 (1 x 10(4) MPa)
to: 500 (5 x 10(6) MPa)
as: Depth (m)
ranges from: 0 to: 6,000
Reference: Three refs
Source: ORNL-6241/V2 (in preparation) p. 199

Property class: Young's modulus
Material: Shales (c)
Formation: -
Location: Various
Condition 1: Various formations, depths, etc.
Condition 2: Represents many tests
Condition 3: -
Property/units: Young's modulus (psi)
ranges from: 0.0020 x 10(6) (1.4 x 10(1) MPa)
to: 15.0 x 10(6) (1 x 10(5) MPa)
as: -
ranges from: - to: -
Reference: Fourteen refs
Source: Y/OWI/TM36/6 (1978), p. A-8,9

13.1.5 Appendix A.5. THERMAL PROPERTIES

Property class: Heat capacity
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Specific heat (J/Kg-K)
(specific heat capacity)
ranges from: 9.21 x 10(2)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Heat capacity
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Specific heat (J/Kg-K)
(specific heat capacity)
ranges from: 9.21 x 10(2)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Heat capacity
Material: Shale
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Heat capacity (BTU/lb-deg F)
ranges from: 0.20 (8.4 x 10(2) J/Kg-K)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Heat capacity
Material: Shale (a)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Heat capacity (J/Kg-K)
ranges from: 5.5 x 10(2)
to: 1.042 x 10(3)
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 40

Property class: Heat capacity
Material: Shale (b)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Heat capacity (J/Kg-K)
ranges from: 7.12 x 10(2)
to: 1.170 x 10(3)
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V3 (in preparation) p. 345

Property class: Heat capacity
Material: Shale (c)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Specific heat (J/Kg-deg C)
(specific heat capacity)
(J/Kg-K)
ranges from: 7.96 x 10(2)
to: -
as: -
ranges from: - to: -
Reference: Loken, M. (personal communication) (1984)
Source: ORNL-6241/V2 (in preparation) p. 99

Property class: Heat capacity
Material: Shales (a)
Formation: -
Location: -
Condition 1: Two tests
Condition 2: -
Condition 3: -
Property/units: Heat capacity (BTU/lb-deg F)
ranges from: 0.16 (6.7 x 10(2) J/Kg-K)
to: 0.20 (8.4 x 10(2) J/Kg-K)
as: -
ranges from: - to: -
Reference: Two refs
Source: Y/OWI/TM36/6 (1978), p. A-19

Property class: Heat capacity
Material: Shales (b)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Specific heat (J/Kg-K)
(specific heat capacity)
ranges from: 5.50 x 10(2)
to: 1.042 x 10(3)
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V3 (in preparation) p. 115

Property class: Linear expansion
Material: Argillite
Formation: Eleana Argillite
Location: -
Condition 1: Natural state
Condition 2: Contracts up to ca. 100 deg C
Condition 3: Expands from 100 to 500 deg C
Property/units: Coefficient of linear expansion (deg C(-1)) (K(-1))
ranges from: 8 x 10(-6)
to: 15 x 10(-6)
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979b), p. 77

Property class: Linear expansion
Material: Shale (a)
Formation: -
Location: -
Condition 1: Intact
Condition 2: -
Condition 3: -
Property/units: Coefficient of linear thermal expansion (deg F(-1))
ranges from: 4 x 10(-6) (2.2 x 10(-6) K(-1))
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 2-2

Property class: Linear expansion
Material: Shale (b)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Coefficient of linear thermal expansion (horizontal) (deg F(-1))
ranges from: 4.5 x 10(-6) (2.5 x 10(-6) K(-1))
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Linear expansion
Material: Shale (c)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Coefficient of linear thermal expansion (vertical) (deg F(-1))
ranges from: 9 x 10(-6) (5 x 10(-6) K(-1))
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Linear expansion
Material: Shales (a)
Formation: -
Location: -
Condition 1: Eight samples
Condition 2: -
Condition 3: -
Property/units: Coefficient of linear thermal expansion (K(-1))
ranges from: 2.5 x 10(-6)
to: 15.8 x 10(-6)
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V3 (in preparation) p. 345

Property class: Linear expansion
Material: Shales (b)
Formation: -
Location: -
Condition 1: Eight data points
Condition 2: -
Condition 3: -
Property/units: Coefficient of thermal expansion (K(-1))
ranges from: 2.9 x 10(-6)
to: 12.9 x 10(-6)
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 47

Property class: Thermal conductivity
Material: Argillite (a)
Formation: Eleana
Location: -
Condition 1: At or above 100 deg C
Condition 2: Parallel to layering
Condition 3: -
Property/units: Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
ranges from: ca. 1.80
to: -
as: -
ranges from: - to: -
Reference: Clark (1966)
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Thermal conductivity
Material: Argillite (b)
Formation: Eleana
Location: -
Condition 1: At or above 100 deg C
Condition 2: Perpendicular to layering
Condition 3: -
Property/units: Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
ranges from: ca. 1.48
to: -
as: -
ranges from: - to: -
Reference: McVey et al (1979)
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Thermal conductivity
Material: Argillite (c)
Formation: Eleana Argillite
Location: Nevada
Condition 1: Temperature from 25 to 400 deg C
Condition 2: Many tests
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.28
to: 2.7
as: -
ranges from: - to: -
Reference: Two refs
Source: ORNL-6241/V3 (in preparation) p. 341, 342

Property class: Thermal conductivity
Material: Bentonite (a)
Formation: -
Location: -
Condition 1: 90% quartz
Condition 2: -
Condition 3: -
Property/units: Heat conductivity (W/m-deg C) (thermal conductivity) (W/m-K)
ranges from: 0.5
to: 2.0
as: Water content (%)
ranges from: 4 to: 20-30
Reference: -
Source: KBS TEKNISK RAPPORT 9 (1977), p. 8

Property class: Thermal conductivity
Material: Bentonite (b)
Formation: -
Location: -
Condition 1: Pressed at 50 to 100 MPa
Condition 2: Water content ca. 10%
Condition 3: Density (bulk) = 2.1 t/m(3)
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: ca. 0.75
to: -
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979b), p. 148

Property class: Thermal conductivity
Material: Bentonite (c)
Formation: -
Location: -
Condition 1: Avongel or Wyoming
Condition 2: Mixed with varying amounts of sand, crushed granite, etc.
Condition 3: Ten tests under moist conditions
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.7
to: 3.0
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 342

Property class: Thermal conductivity
Material: Bentonite (Ca)
Formation: -
Location: -
Condition 1: Various pressing forces (21-138 MPa)
Condition 2: Air saturated
Condition 3: Temperature ca. 25 deg C
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.71
to: 1.10
as: Density (g/cm(3))
ranges from: 1.60 to: 2.13
Reference: -
Source: PNL-4452 UC-70 (1983), p. 20

Property class: Thermal conductivity
Material: Bentonite (d)
Formation: -
Location: -
Condition 1: Avongel or Wyoming
Condition 2: Mixed with varying amounts of sand, crushed granite, etc.
Condition 3: Ten tests under dry conditions
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.5
to: 1.0
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 342

Property class: Thermal conductivity
Material: Bentonite (e)
Formation: -
Location: -
Condition 1: 100% water saturated
Condition 2: "Compacted"
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.9
to: 1.3
as: Temperature (deg C)
ranges from: "slightly >73" to: -
Reference: Knutsson (1977)
Source: ONWI-486 (1983), p. 63

Property class: Thermal conductivity
Material: Bentonite (f)
Formation: -
Location: -
Condition 1: Density = 1.6-2.0 t/m(3)
Condition 2: Water content 5-16 %
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 1
to: 3.5
as: -
ranges from: - to: -
Reference: Roy (1982)
Source: ONWI-486 (1983), p. 63

Property class: Thermal conductivity
Material: Bentonite (g)
Formation: -
Location: Wyoming
Condition 1: Constant density
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: ca. 0.0
to: ca. 1.2
as: Moisture content (%)
ranges from: ca. 0 to: ca. 20
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 334

Property class: Thermal conductivity
Material: Bentonite (h)
Formation: -
Location: Wyoming
Condition 1: Density = 2.0 t/m(3)
Condition 2: 66% water saturation
Condition 3: At 73 deg C
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.78
to: -
as: -
ranges from: - to: -
Reference: -
Source: ONWI-486 (1983), p. 61

Property class: Thermal conductivity
Material: Bentonite (Na)
Formation: -
Location: -
Condition 1: Various pressing forces (21-90 MPa)
Condition 2: Air saturated
Condition 3: Temperature ca. 25 deg C
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.52
to: 0.96
as: Density (g/cm(3))
ranges from: 1.70 to: 2.25
Reference: -
Source: PNL-4452 UC-70 (1983), p. 20

Property class: Thermal conductivity
Material: Bentonite and Crushed Granite (a)
Formation: -
Location: Wyoming
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 2.7
to: 0.8
as: Clay content (%)
ranges from: ca. 20 to: 100
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 334

Property class: Thermal conductivity
Material: Bentonite and Crushed Granite (b)
Formation: -
Location: Wyoming
Condition 1: 50% bentonite
Condition 2: Constant density
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: ca. 0.6
to: ca. 1.5
as: Moisture content (%)
ranges from: ca. 0 to: ca. 16
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 334

Property class: Thermal conductivity
Material: Bentonite and Salt (a)
Formation: -
Location: -
Condition 1: 30:70 bentonite:salt
Condition 2: 10 MPa axial stress
Condition 3: Density (dry) = 1.67-1.71 t/m(3)
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.12
to: 0.99
as: Temperature (deg C)
ranges from: 89 to: 250
Reference: Molecke (1982)
Source: ONWI-486 (1983), p. 53

Property class: Thermal conductivity
Material: Bentonite and Salt (b)
Formation: -
Location: -
Condition 1: 30:70 bentonite:salt
Condition 2: 10 MPa axial stress
Condition 3: Density (dry) = 1.67-1.71 t/m(3)
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.01
to: 1.12
as: Temperature (deg C)
ranges from: 21 to: 89
Reference: Molecke (1982)
Source: ONWI-486 (1983), p. 53

Property class: Thermal conductivity
Material: Bentonite and Sand (a)
Formation: -
Location: -
Condition 1: Bentonite:sand from 10:90 to 20:80
Condition 2: Water content 5-30%
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.5
to: 2.0
as: -
ranges from: - to: -
Reference: Fagerstrom and Lundahle (1977)
Source: ONWI-486 (1983), p. 63

Property class: Thermal conductivity
Material: Bentonite and Sand (b)
Formation: -
Location: -
Condition 1: Dry mixtures with sand
Condition 2: Density (dry) = 1.98-2.12 t/m(3)
Condition 3: Temperature range 25 to 300 deg C
Property/units: Thermal conductivity (W/m-K)
ranges from: 0.58-0.80
to: 1.06-1.17
as: Wt % sand
ranges from: 0 to: 50
Reference: Molecke (1982)
Source: ONWI-486 (1983), p. 53

Property class: Thermal conductivity
Material: Clay
Formation: -
Location: S. Paolo mine
Condition 1: Cubic block, 80-cm edge
Condition 2: Plio-Pleistocene
Condition 3: Dominantly illite plus lesser smectite, kaolinite and chlorite
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.014 (1.4 W/m-K)
to: 0.016 (1.6 W/m-K)
as: -
ranges from: - to: -
Reference: -
Source: ORNL-tr-5110 (1981), p. 12

Property class: Thermal conductivity
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.5
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Thermal conductivity
Material: Clay
Formation: Oxford Clay
Location: England
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.56
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Thermal conductivity
Material: Clay (a)
Formation: Boom Clay
Location: Belgium
Condition 1: At or above 100 deg C
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
ranges from: ca. 0.3
to: -
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Thermal conductivity
Material: Clay (b)
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.5
to: -
as: -
ranges from: - to: -
Reference: Two refs
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Thermal conductivity
Material: Clayey Sandstones
Formation: -
Location: -
Condition 1: 40 to 57 % clay by volume
Condition 2: 15 to 20% porosity
Condition 3: -
Property/units: Heat conductivity (millical/cm-s-deg C) (thermal conductivity)
ranges from: 2.5 (1.05 W/m-K)
to: -
as: -
ranges from: - to: -
Reference: Zierfuss (1969)
Source: Y/OWI/SUB-7009/1 (1976), p. 23

Property class: Thermal conductivity
Material: Hectorite
Formation: -
Location: -
Condition 1: 90% quartz
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.5
to: 2 to 3
as: Water content
ranges from: Dry to: Fully saturated
Reference: -
Source: ONWI-312 (1981), p. 18

Property class: Thermal conductivity
Material: Illite (a)
Formation: -
Location: -
Condition 1: Sealbond
Condition 2: Constant density
Condition 3: -
Property/units: Thermal conductivity
(W/m-deg C) (W/m-K)
ranges from: ca. 0.6
to: ca. 1.6
as: Moisture content (%)
ranges from: ca. 0 to: ca. 10
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 336

Property class: Thermal conductivity
Material: Illite (b)
Formation: -
Location: -
Condition 1: Sealbond
Condition 2: Mixed with varying amounts of sand, crushed granite, etc.
Condition 3: Four tests under moist conditions
Property/units: Thermal conductivity
(W/m-deg C) (W/m-K)
ranges from: 1.4
to: 4.0
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 342

Property class: Thermal conductivity
Material: Illite (c)
Formation: -
Location: -
Condition 1: Sealbond
Condition 2: Mixed with varying amounts of sand, crushed granite, etc.
Condition 3: Four tests under dry conditions
Property/units: Thermal conductivity
(W/m-deg C) (W/m-K)
ranges from: 0.8
to: 1.8
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 342

Property class: Thermal conductivity
Material: Illite and Crushed Granite
Formation: -
Location: -
Condition 1: Sealbond
Condition 2: 50% Illite
Condition 3: Constant density
Property/units: Thermal conductivity
(W/m-deg C) (W/m-K)
ranges from: ca. 0.9
to: ca. 1.9
as: Moisture content (%)
ranges from: ca. 0 to: ca. 10
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 336

Property class: Thermal conductivity
Material: Kaolinite (a)
Formation: -
Location: -
Condition 1: Mixed with varying amounts of sand, crushed granite, etc.
Condition 2: Four tests under moist conditions
Condition 3: -
Property/units: Thermal conductivity
(W/m-deg C) (W/m-K)
ranges from: 1.7
to: 3.5
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 342

Property class: Thermal conductivity
Material: Kaolinite (b)
Formation: -
Location: -
Condition 1: Mixed with varying amounts of sand, crushed granite, etc.
Condition 2: Four tests under dry conditions
Condition 3: -
Property/units: Thermal conductivity
(W/m-deg C) (W/m-K)
ranges from: 0.9
to: 2.0
as: -
ranges from: - to: -
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 342

Property class: Thermal conductivity
Material: Kaolinite and Crushed Granite
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity
(W/m-deg C) (W/m-K)
ranges from: 3.4
to: 2.3
as: Clay content (%)
ranges from: ca. 20 to: ca. 50
Reference: -
Source: Proc NEA Workshop OECD (1981), p. 334

Property class: Thermal conductivity
Material: Shale
Formation: -
Location: Kansas
Condition 1: Core 1 and 2
Condition 2: Temperature 20 deg C
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 0.7
to: 4.3
as: -
ranges from: - to: -
Reference: Zierfuss (1969)
Source: ORNL-6241/V3 (in preparation) p. 343

Property class: Thermal conductivity
Material: Shale
Formation: -
Location: South Africa
Condition 1: Temperature 25 deg C
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 2.76
to: -
as: -
ranges from: - to: -
Reference: Clark (1941)
Source: ORNL-6241/V3 (in preparation) p. 343

Property class: Thermal conductivity
Material: Shale
Formation: Karoo Shale
Location: Orange Free State
Condition 1: Temperature 35 deg C
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.97
to: 2.89
as: -
ranges from: - to: -
Reference: Boch (1971)
Source: ORNL-6241/V3 (in preparation) p. 341

Property class: Thermal conductivity
Material: Shale
Formation: Nonesuch Shale
Location: Michigan
Condition 1: Temperature 30 deg C
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 2.64
to: -
as: -
ranges from: - to: -
Reference: Kreig (1983)
Source: ORNL-6241/V3 (in preparation) p. 341

Property class: Thermal conductivity
Material: Shale
Formation: Pierre Shale
Location: -
Condition 1: Temperature 0 deg C
Condition 2: Two tests
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.42
to: 1.94
as: -
ranges from: - to: -
Reference: Woodside (1961)
Source: ORNL-6241/V3 (in preparation) p. 341

Property class: Thermal conductivity
Material: Shale (a)
Formation: -
Location: England
Condition 1: Triassic
Condition 2: Five tests
Condition 3: -
Property/units: Thermal conductivity (millical/cm-s-deg C)
ranges from: 2.2 (9.2 x 10(-1) W/m-K)
to: 5.3 (2.22 W/m-K)
as: -
ranges from: - to: -
Reference: Bullard and Niblett (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 26

Property class: Thermal conductivity
Material: Shale (b)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Thermal conductivity (horizontal) (BTU/hr-ft-deg F)
ranges from: 1.1 (1.9 W/m-K)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Thermal conductivity
Material: Shale (c)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (horizontal) (J/s m-deg C) (W/m-K)
ranges from: 1.89
to: -
as: -
ranges from: - to: -
Reference: Loken, M. (personal communication) (1984)
Source: ORNL-6241/V2 (in preparation) p. 99

Property class: Thermal conductivity
Material: Shale (d)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (horizontal) (W/m-K)
ranges from: 1.52
to: 2.26
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 40

Property class: Thermal conductivity
Material: Shale (e)
Formation: -
Location: -
Condition 1: Typical illitic shale
Condition 2: Intact
Condition 3: -
Property/units: Thermal conductivity (vertical) (BTU/hr-ft-deg F)
ranges from: 0.8 (1.4 W/m-K)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Property class: Thermal conductivity
Material: Shale (f)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (vertical) (W/m-K)
ranges from: 1.21
to: 1.57
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V1 (in preparation) p. 40

Property class: Thermal conductivity
Material: Shale (g)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity ratio (vertical/horizontal)
ranges from: 0.76
to: -
as: -
ranges from: - to: -
Reference: Loken, M. (personal communication) (1984)
Source: ORNL-6241/V2 (in preparation) p. 99

Property class: Thermal conductivity
Material: Shale (h)
Formation: -
Location: England
Condition 1: Carboniferous
Condition 2: Eleven tests
Condition 3: -
Property/units: Thermal conductivity (millical/cm-s-deg C)
ranges from: 3.0 (1.26 W/m-K)
to: 4.3 (1.80 W/m-K)
as: -
ranges from: - to: -
Reference: Bullard and Niblett (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 26

Property class: Thermal conductivity
Material: Shale (i)
Formation: -
Location: England
Condition 1: Carboniferous
Condition 2: Temperature 20 deg C
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.26
to: 1.80
as: -
ranges from: - to: -
Reference: Boch (1971)
Source: ORNL-6241/V3 (in preparation) p. 341

Property class: Thermal conductivity
Material: Shale (j)
Formation: -
Location: Massachusetts
Condition 1: Temperature 45 deg C
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.62
to: -
as: -
ranges from: - to: -
Reference: Eckert (1959)
Source: ORNL-6241/V3 (in preparation) p. 341

Property class: Thermal conductivity
Material: Shale (k)
Formation: -
Location: Sunderland, MA
Condition 1: Density (bulk) = 2.67
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (millical/cm-s-deg C)
ranges from: 3.87 (1.62 W/m-K)
to: 4.25 (1.78 W/m-K)
as: Wetting and compression
ranges from: Dry, uncompressed to: Wet, compressed
Reference: Clark (1941)
Source: Y/OWI/SUB-7009/1 (1976), p. 28

Property class: Thermal conductivity
Material: Shale (l)
Formation: Conasauga Shale
Location: -
Condition 1: At or above 100 deg C
Condition 2: Calcareous
Condition 3: -
Property/units: Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
ranges from: 0.7 to 2.1
to: -
as: -
ranges from: - to: -
Reference: Two refs
Source: Proc NEA Workshop OECD (1979b), p. 87

Property class: Thermal conductivity
Material: Shale (m)
Formation: Conasauga Shale
Location: -
Condition 1: Temperature from 66 to 326 deg C
Condition 2: Several tests
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 0.715
to: 2.20
as: -
ranges from: - to: -
Reference: Robertson (1979)
Source: ORNL-6241/V3 (In preparation) p. 340

Property class: Thermal conductivity
Material: Shale (n)
Formation: -
Location: -
Condition 1: Typical illite shale
Condition 2: Temperature 25 deg C
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.38
to: 1.9
as: -
ranges from: - to: -
Reference: Zerby (1977)
Source: ORNL-6241/V3 (In preparation) p. 341

Property class: Thermal conductivity
Material: Shales
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (vertical) (W/m-K)
ranges from: 1.21
to: 1.57
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V3 (In preparation) p. 115

Property class: Thermal conductivity
Material: Shales
Formation: -
Location: -
Condition 1: Temperature from 0 to 304 deg C
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 1.47
to: 2.00
as: -
ranges from: - to: -
Reference: Moss (1981)
Source: ORNL-6241/V3 (In preparation) p. 340

Property class: Thermal conductivity
Material: Shales
Formation: -
Location: California
Condition 1: Forty-five tests
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-K)
ranges from: 0.99 +/- 0.3
to: 1.63 +/- 0.3
as: -
ranges from: - to: -
Reference: Thomas (1973)
Source: ORNL-6241/V3 (In preparation) p. 341

Property class: Thermal conductivity
Material: Shales (a)
Formation: -
Location: -
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (horizontal) (W/m-K)
ranges from: ca. 1.60
to: ca. 2.20
as: -
ranges from: - to: -
Reference: -
Source: ORNL-6241/V3 (In preparation) p. 117

Property class: Thermal conductivity
Material: Shales (b)
Formation: -
Location: Various
Condition 1: Various formations, depths, etc.
Condition 2: Represents many tests
Condition 3: -
Property/units: Thermal conductivity (BTU/ft-hr-deg F)
ranges from: 0.34 (5.9 x 10(-1) W/m-K)
to: 1.77 (3.1 W/m-K)
as: -
ranges from: - to: -
Reference: Several refs
Source: Y/OWI/TM36/6 (1978), p. A-18

Property class: Thermal conductivity
Material: Silt/Clay Soil (a)
Formation: -
Location: -
Condition 1: Density (bulk) = 1.74 t/m(3)
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.8
to: 2.0
as: Water content (%)
ranges from: 4 to: 15
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 54

Property class: Thermal conductivity
Material: Silt/Clay Soil (b)
Formation: -
Location: -
Condition 1: Density (bulk) = 1.02 t/m(3)
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.4
to: 0.85
as: Water content (%)
ranges from: 8 to: 35
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 54

Property class: Thermal conductivity
Material: Silt/Clay Soil (c)
Formation: -
Location: -
Condition 1: Density (bulk) = 1.16 t/m(3)
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.5
to: 1.1
as: Water content (%)
ranges from: 7 to: 40
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 54

Property class: Thermal conductivity
Material: Silt/Clay Soil (d)
Formation: -
Location: -
Condition 1: Density (bulk) = 1.31 t/m(3)
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.6
to: 1.3
as: Water content (%)
ranges from: 6 to: 32
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 54

Property class: Thermal conductivity
Material: Silt/Clay Soil (e)
Formation: -
Location: -
Condition 1: Density (bulk) = 1.45 t/m(3)
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.7
to: 1.5
as: Water content
ranges from: 6 to: 25
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 54

Property class: Thermal conductivity
Material: Silt/Clay Soil (f)
Formation: -
Location: -
Condition 1: Density (bulk) = 1.60 t/m(3)
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.75
to: 1.75
as: Water content (%)
ranges from: 5 to: 20
Reference: Mitchell (1976)
Source: ONWI-486 (1983), p. 54

Property class: Thermal conductivity
Material: Soils
Formation: -
Location: -
Condition 1: Dry
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (k x 10(4)) (?)
ranges from: 3
to: 5
as: -
ranges from: - to: -
Reference: Smith and Byers (1938)
Source: Y/OWI/SUB-7009/1 (1976), p. 19

Property class: Thermal conductivity
Material: Soils
Formation: -
Location: -
Condition 1: Wetted
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (k x 10(4)) (?)
ranges from: 3-4
to: 8-12
as: Moisture content
ranges from: "Dry" to: 100% moisture equivalent
Reference: Smith (1939)
Source: Y/OWI/SUB-7009/1 (1976), p. 19

Property class: Thermal conductivity
Material: Soils
Formation: -
Location: Bristol, VA
Condition 1: LL x PL = 2180
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (Btu per hr-sq ft) (deg F per ft) (?)
ranges from: 0.14
to: 0.60
as: Moisture content (%)
ranges from: 0 to: 30
Reference: Carter (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Property class: Thermal conductivity
Material: Soils
Formation: -
Location: Columbus, MS
Condition 1: LL x PL = 0
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (Btu per hr sq ft) (deg F per ft) (?)
ranges from: 0.28
to: 2.28
as: Moisture content (%)
ranges from: 0 to: 30
Reference: Carter (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Property class: Thermal conductivity
Material: Soils (a)
Formation: -
Location: Cleveland, TN
Condition 1: LL x PL = 669
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (Btu per hr sq ft) (deg F per ft) (?)
ranges from: 0.15
to: 0.94
as: Moisture content (%)
ranges from: 0 to: 30
Reference: Carter (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Property class: Thermal conductivity
Material: Soils (b)
Formation: -
Location: Murfreesboro, TN
Condition 1: LL x PL = 1210
Condition 2: -
Condition 3: -
Property/units: Thermal conductivity (Btu per hr sq ft) (deg F per ft) (?)
ranges from: 0.21
to: 0.84
as: Moisture content (%)
ranges from: 0 to: 30
Reference: Carter (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Property class: Thermal diffusivity
Material: Bentonite (Na)
Formation: -
Location: -
Condition 1: Dry, compacted
Condition 2: Density (g/cm(3)) = 2.1
Condition 3: Average value between 25 and 600 deg C
Property/units: Thermal diffusivity (cm(2)/s x 10(3))
ranges from: 3.03 (3.03 x 10(-7) m(2)/s)
to: 3.47 (3.47 x 10(-7) m(2)/s)
as: -
ranges from: - to: -
Reference: -
Source: PNL-4452 UC-70 (1983), p. 18, 19

Property class: Thermal diffusivity
Material: Clay
Formation: -
Location: S. Paolo mine
Condition 1: Cubic block, 80 cm edge
Condition 2: Plio-Pleistocene
Condition 3: Dominantly illite plus smectite, kaolinite and chlorite
Property/units: Thermal diffusivity (cm(2)/h)
ranges from: 20 (5.56 x 10(-7) m(2)/s)
to: -
as: -
ranges from: - to: -
Reference: -
Source: ORNL-tr-5110 (1981), p. 12

Property class: Thermal diffusivity
Material: Clay
Formation: Blue Clay
Location: Italy
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal diffusivity (m(2)/s)
ranges from: 7.8 x 10(-7)
to: -
as: -
ranges from: - to: -
Reference: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Thermal diffusivity
Material: Clay
Formation: Boom Clay
Location: Belgium
Condition 1: -
Condition 2: -
Condition 3: -
Property/units: Thermal diffusivity (m(2)/s)
ranges from: 8.1 x 10(-7)
to: -
as: -
ranges from: - to: -
Reference: Two refs
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Property class: Thermal diffusivity
Material: Soils
Formation: -
Location: Bristol, VA
Condition 1: LL x PL = 2180
Condition 2: -
Condition 3: -
Property/units: Thermal diffusivity (ft(2) per hr)
ranges from: 0.0090 (2.3 x 10(-7) m(2)/s)
to: 0.016 (4.13 x 10(-7) m(2)/s)
as: Moisture content (%)
ranges from: 0 to: 30
Reference: Carter (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Property class: Thermal diffusivity
Material: Soils
Formation: -
Location: Columbus, MS
Condition 1: LL x PL = 0
Condition 2: -
Condition 3: -
Property/units: Thermal diffusivity (ft(2) per hr)
ranges from: 0.016 (4.13 x 10(-7) m(2)/s)
to: 0.046 (1.19 x 10(-7) m(2)/s)
as: Moisture content (%)
ranges from: 0 to: 30
Reference: Carter (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Property class: Thermal diffusivity
Material: Soils (a)
Formation: -
Location: Cleveland, TN
Condition 1: LL x PL = 669
Condition 2: -
Condition 3: -
Property/units: Thermal diffusivity (ft(2) per hr)
ranges from: 0.0115 (2.97 x 10(-7) m(2)/s)
to: 0.022 (5.68 x 10(-7) m(2)/s)
as: Moisture content (%)
ranges from: 0 to: 30
Reference: Carter (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Property class: Thermal diffusivity
Material: Soils (b)
Formation: -
Location: Murfreesboro, TN
Condition 1: LL x PL = 1210
Condition 2: -
Condition 3: -
Property/units: Thermal diffusivity (ft(2) per hr)
ranges from: 0.0145 (3.74 x 10(-7) m(2)/s)
to: 0.0235 (6.06 x 10(-7) m(2)/s)
as: Moisture content (%)
ranges from: 0 to: 30
Reference: Carter (1951)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

13.2 Appendix B. PROPERTIES

Batch distribution ratio (Rd) (ml/g?)
Kaolinite (a)
Georgia
ranges from: 1.28 x 10(2)
to: 9.22 x 10(2)
Source: PNL-4452 UC-70 (1983), p. 18

Batch distribution ratio (Rd) (ml/g?)
Kaolinite (b)
Georgia
ranges from: 1.88 x 10(2)
to: 9.0 x 10(3)
Source: PNL-4452 UC-70 (1983), p. 18

Batch distribution ratio (Rd) (ml/g?)
Smectite
Arizona
ranges from: 8.15 x 10(2)
to: 2.7 x 10(3)
Source: PNL-4452 UC-70 (1983), p. 18

Batch distribution ratio (Rd) (ml/g?)
Smectite
Texas
ranges from: 1.4 x 10(3)
to: 1.9 x 10(3)
Source: PNL-4452 UC-70 (1983), p. 18

Batch distribution ratio (Rd) (ml/g?)
Smectite
Wyoming
ranges from: 1.0 x 10(3)
to: 2.0 x 10(3)
Source: PNL-4452 UC-70 (1983), p. 18

Diffusivity (m(2)/s)
Bentonite
ranges from: 1.3 x 10(-10)
to: -
Source: ONWI-312 (1981), p. 14

Ion exchange capacity (meq/100 g)
Allophane
ranges from: 70
to: -
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Bentonite (Na) (a)
Wyoming
ranges from: 68.6
to: -
Source: AECL-7825 (1984), p. 12

Ion exchange capacity (meq/100 g)
Bentonite (Na) (b)
Wyoming
ranges from: 34.3
to: -
Source: AECL-7825 (1984), p. 12

Ion exchange capacity (meq/100 g)
Chlorite (a)
ranges from: 10-40
to: -
Source: ONWI-486 (1983), p. 67

Ion exchange capacity (meq/100 g)
Chlorite (b)
to: 40
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Clay
Belgium
ranges from: ca. 20
to: -
Source: Proc NEA Workshop OECD (1979a), p. 88

Ion exchange capacity (meq/100 g)
Glauconite
ranges from: 11
to: 10
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Halloysite
ranges from: 5
to: 10
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Illite (a)
ranges from: 10
to: 40
Source: ONWI-486 (1983), p. 67

Ion exchange capacity (meq/100 g)
Illite (b)
ranges from: 16
to: 50
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Kaolinite (a)
ranges from: 3
to: 15
Source: ONWI-486 (1983), p. 67

Ion exchange capacity (meq/100 g)
Kaolinite (b)
ranges from: 2
to: 15
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Palygorskite
ranges from: 20
to: 30
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Smectite
ranges from: 80
to: 150
Source: ONWI-486 (1983), p. 67

Ion exchange capacity (meq/100 g)
Smectite (Ca)
ranges from: 80
to: 150
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Smectite (Na)
ranges from: 100
to: 150
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Vermiculite (a)
ranges from: 100
to: 150
Source: ONWI-486 (1983), p. 67

Ion exchange capacity (meq/100 g)
Vermiculite (b)
ranges from: 100
to: 150+
Source: ORNL-6241/V2 (in preparation) p. 152

Ion exchange capacity (meq/100 g)
Bentonite
ranges from: 0.1
to: 100
Source: NUREG/CP-0052 (1983), p. 181

Ion exchange capacity (meq/g) (?)
Smectite (Ca)
ranges from: 93
to: 12
Source: ONWI-312 (1981), p. 24

Ion exchange capacity (meq/g) (?)
Smectite (Li)
ranges from: 56
to: 20
Source: ONWI-312 (1981), p. 24

Ion exchange capacity (meq/g) (?)
Smectite (Na)
ranges from: 95
to: 68
Source: ONWI-312 (1981), p. 24

Sorption coefficient (Kd) (cm(3)/g) (ml/g)
Smectite
ranges from: ca. 188
to: ca. 200
Source: NUREG/CP-0052 (1983), p. 186

Sorption coefficient (Kd) (Log) (ml/g?)
Kaolinite (Ca)
ranges from: ca. 2.3
to: ca. 1.5
Source: Proc NEA Workshop OECD (1979a), p. 282

Sorption coefficient (Kd) (Log) (ml/g?)
Kaolinite (Ca)
ranges from: ca. 1.3
to: ca. (-1)
Source: Proc NEA Workshop OECD (1979a), p. 282

Sorption coefficient (Kd) (Log) (ml/g?)
Kaolinite (Na)
ranges from: ca. 2.3
to: ca. 1.3
Source: Proc NEA Workshop OECD (1979a), p. 282

Sorption coefficient (Kd) (Log) (ml/g?)
Kaolinite (Na)
ranges from: >2
to: <0
Source: Proc NEA Workshop OECD (1979a), p. 282

Sorption coefficient (Kd) (m(3)/kg) (?)
Illite
ranges from: 0.9
to: -
Source: AECL-7812 (1983), p. 25

Sorption coefficient (Kd) (m(3)/kg) (?)
Illite
ranges from: 0.005
to: 0.02
Source: AECL-7812 (1983), p. 25

Sorption coefficient (Kd) (m(3)/kg) (?)
Illite
ranges from: 0.045
to: 0.090
Source: AECL-7825 (1984), p. 25

Sorption coefficient (Kd) (m(3)/kg) (?)
Kaolinite
ranges from: 0.003
to: 0.006
Source: AECL-7812 (1983), p. 25

Sorption coefficient (Kd) (m(3)/kg) (?)
Kaolinite
ranges from: 0.002
to: 0.04
Source: AECL-7812 (1983), p. 25

Sorption coefficient (Kd) (m(3)/kg) (?)
Kaolinite
ranges from: 0.02
to: -
Source: AECL-7812 (1983), p. 25

Sorption coefficient (Kd) (m(3)/kg) (?)
Smectite
ranges from: 0.06
to: 0.7
Source: AECL-7812 (1983), p. 25

Sorption coefficient (Kd) (m(3)/kg) (?)
Smectite
ranges from: 0.034
to: 0.65
Source: AECL-7812 (1983), p. 25

Sorption coefficient (Kd) (m(3)/kg) (?)
Smectite
ranges from: 0.030
to: 0.6
Source: AECL-7812 (1983), p. 25

Sorption coefficient (Kd) (ml/g)
Argillite
ranges from: 0
to: 1 x 10(5)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Attapulgite
ranges from: 1 x 10(-2)
to: 2 x 10(4)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Bentonite (Ca)
ranges from: 2.5 x 10(4)
to: 1.1 x 10(5)
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Ca)
ranges from: 2.5
to: 3.2
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Ca)
ranges from: 1.2 x 10(3)
to: 865
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Na)
ranges from: 5.0 x 10(3)
to: 6.8 x 10(3)
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Na)
ranges from: 0.4
to: 8.6
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Na)
ranges from: 1.1 x 10(3)
to: 1.0 x 10(3)
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Na)
ranges from: 0
to: 4 x 10(4)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Bentonite (Na) (Accofloc-350)
ranges from: 1.3 x 10(3)
to: 1.1 x 10(3)
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Na) (Accofloc-350)
ranges from: 1.2
to: 0.1
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Na) (Accofloc-350)
ranges from: 1.5 x 10(3)
to: 1.5 x 10(3)
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Na) (Saline Seal-100)
ranges from: 2.6 x 10(3)
to: 3.8 x 10(3)
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Na) (Saline Seal-100)
ranges from: 2.8
to: 3.6
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite (Na) (Saline Seal-100)
ranges from: 1.2 x 10(3)
to: 1.5 x 10(3)
Source: ONWI-312 (1981), p. 35

Sorption coefficient (Kd) (ml/g)
Bentonite and Quartz
ranges from: <1
to: 1 x 10(4)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Bentonite and Sand
ranges from: 490
to: 9.5 x 10(3)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Clay (Na)
Belle Fourch
ranges from: 5.6
to: 5.7 x 10(3)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Hectorite
ranges from: 0.4
to: 7.2 x 10(3)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Hectorite and Sand
ranges from: 400
to: 1300
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Illite
ranges from: 0
to: 3 x 10(5)
Source: ORNL-6241/V2 (in preparation) p. 132-133

Sorption coefficient (Kd) (ml/g)
Kaolinite
ranges from: 0.1
to: 1.6 x 10(3)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Kaolinite
ranges from: 0
to: 3 x 10(5)
Source: ORNL-6241/V2 (in preparation) p. 132-133

Sorption coefficient (Kd) (ml/g)
Nontronite
ranges from: 0
to: 2.25 x 10(5)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Shale
ranges from: 57
to: 100
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Shale
ranges from: 200
to: 1.4 x 10(4)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Smectite
ranges from: 0
to: 4 x 10(5)
Source: ORNL-6241/V2 (in preparation) p. 132-133

Sorption coefficient (Kd) (ml/g)
Smectite
Arizona
ranges from: 260
to: 750
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Smectite
Texas
ranges from: 310
to: 685
Source: Sci Basis for Waste Management - V (1982), p. 638

Sorption coefficient (Kd) (ml/g)
Smectite
Texas
ranges from: 410
to: 400
Source: Sci Basis for Waste Management - V (1982), p. 638

Sorption coefficient (Kd) (ml/g)
Smectite
Texas
ranges from: 310
to: 370
Source: Sci Basis for Waste Management - V (1982), p. 638

Sorption coefficient (Kd) (ml/g)
Smectite
Wyoming
ranges from: 170
to: 200
Source: Sci Basis for Waste Management - V (1982), p. 638

Sorption coefficient (Kd) (ml/g)
Smectite (Ca)
ranges from: 0.4
to: 1.1 x 10(4)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Smectite (Na)
ranges from: 0.2
to: 1 x 10(5)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Vermiculite
ranges from: 47
to: 1.5 x 10(3)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Vermiculite
South Carolina
ranges from: 8.9 x 10(2)
to: 1.01 x 10(4)
Source: Sci Basis for Waste Management - V (1982), p. 638

Sorption coefficient (Kd) (ml/g)
Vermiculite
South Carolina
ranges from: 2 x 10(3)
to: 9.8 x 10(2)
Source: Sci Basis for Waste Management - V (1982), p. 638

Sorption coefficient (Kd) (ml/g)
Vermiculite and Gibbsite
ranges from: 77
to: 1520
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Vermiculite and Shale
ranges from: 41
to: 1340
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Vermiculite and Smectite
ranges from: 192
to: 3800
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g)
Vermiculite and Zeolite (various)
ranges from: 130
to: 5.92 x 10(5)
Source: ONWI-486 (1983), p. 73

Sorption coefficient (Kd) (ml/g?)
Bentonite
ranges from: 1
to: 2 x 10(5)
Source: Proc NEA Workshop OECD (1979a), p. 304

Sorption coefficient (Kd) (ml/g?)
Clay
Belgium
ranges from: 0.87
to: 6.12
Source: Proc NEA Workshop OECD (1979a), p. 97

Sorption coefficient (Kd) (ml/g?)
Illite
ranges from: 1
to: 3 x 10(6)
Source: Proc NEA Workshop OECD (1979a), p. 304

Sorption coefficient (Kd) (ml/g?)
Kaolinite
ranges from: 1
to: 2 x 10(4)
Source: Proc NEA Workshop OECD (1979a), p. 304

Sorption coefficient (Kd) (ml/g?)
Vermiculite
ranges from: ca. 40
to: 4 x 10(4)
Source: Proc NEA Workshop OECD (1979), p. 315

Sorption coefficient (Kd) (ml/g?)
Vermiculite
ranges from: 30
to: 4 x 10(6)
Source: Proc NEA Workshop OECD (1979a), p. 304

Sorption coefficient (ml/g)
Smectite
ranges from: 200
to: 2,000
Source: ONWI-312 (1981), p. 13

Density (bulk) (average) (g/cm(3))
Shale
Illinois, Indiana and Kentucky
ranges from: 2.36
to: 2.53
Source: ORNL-5703 (1983), p. 76

Density (bulk) (average) (g/cm(3))
Shales
New York, Kentucky, Virginia and West Virginia
ranges from: 2.61
to: 2.68
Source: ORNL-5703 (1983), p. 37

Density (bulk) (g/cm(3))
Argillite
Nevada
ranges from: 2.44
to: 2.71
Source: ORNL/Sub/84-64794/1 (1985), p. 406

Density (bulk) (g/cm(3))
Shale
Michigan
ranges from: 2.2
to: 2.8
Source: ORNL/Sub/84-64794/1 (1985), p. 96

Density (bulk) (g/cm(3))
Shale
Ohio
ranges from: 2.65
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Density (bulk) (g/cm(3))
Shales (a)
ranges from: 1.6
to: 2.5
Source: ORNL-6241/V2 (In preparation) p. 199

Density (bulk) (kg/m(3))
Clay
Belgium
ranges from: 2010 (2.010 g/cm(3))
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Density (bulk) (kg/m(3))
Clay
England
ranges from: 2210 (2.210 g/cm(3))
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Density (bulk) (kg/m(3))
Clay
Italy
ranges from: 2100 (2.100 g/cm(3))
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Density (bulk) (presumed g/cm(3))
Oil Shales
ranges from: 1.506
to: 2.37
Source: Y/OWI/SUB-7009/1 (1976), p. 13

Density (bulk) (presumed g/cm(3))
Shale (a)
ranges from: 2.1
to: 2.5
Source: Y/OWI/SUB-7009/1 (1976), p. 12

Density (bulk) (presumed g/cm(3))
Shales
Black Hills
ranges from: 1.559
to: 2.038
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Density (bulk) (presumed g/cm(3))
Shales
Eastern Canada
ranges from: 2.07
to: 2.68
Source: Y/OWI/SUB-7009/1 (1976), p. 15

Density (bulk) (presumed g/cm(3))
Shales
Oklahoma
ranges from: 2.1
to: 2.62
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Density (bulk) (presumed g/cm(3))
Shales
Western Canada
ranges from: 2.43
to: 2.71
Source: Y/OWI/SUB-7009/1 (1976), p. 17

Density (bulk) (presumed g/cm(3))
Shales (b)
ranges from: 2.40
to: 2.43
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Density (bulk) (rho x t/m(3)) (g/cm(3))
Bentonite (Na) (c)
Wyoming
ranges from: 2.54
to: 1.08
Source: KBS TEKNISK RAPPORT 74 (1978), p. 4

Density (bulk) (t/m(3)) (g/cm(3))
Bentonite (a)
ranges from: ca. 2.1
to: -
Source: Proc NEA Workshop OECD (1979b), p. 148

Density (bulk) (t/m(3)) (g/cm(3))
Bentonite (Na) (a)
ranges from: 1.8
to: 2.0
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Density (bulk) (t/m(3)) (g/cm(3))
Bentonite (Na) (b)
ranges from: 1.4
to: 1.7
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Density (dry) (average) (lbs/ft(3))
Shale
Montana
ranges from: 118 (1.890 g/cm(3))
to: -
Source: Y/OWI/TM36/6, p. 6-1

Density (dry) (kg/mg(3)) (?) (g/cm(3)) (?)
Clay and Sand
ranges from: ca. 1.6
to: ca. 2.2
Source: RHO-BWI-SA-80 (1981), p. 6

Density (dry) (lb/cu ft)
Shale
Northern Great Plains
ranges from: 95 (1.522 g/cm(3))
to: 110 (1.762 g/cm(3))
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Density (dry) (Mg/m(3)) (g/cm(3))
Bentonite and Sand
ranges from: 1.81
to: 1.4
Source: AECL-7812 (1983), p. 31

Density (dry) (Mg/m(3)) (g/cm(3))
Kaolinite
ranges from: ca. 1.2
to: ca. 1.5
Source: AECL-7812 (1983), p. 35

Density (dry) (Mg/m(3)) (g/cm(3))
Kaolinite and Sand
ranges from: 2.05
to: 1.45
Source: AECL-7812 (1983), p. 31

Density (dry) (presumed g/cm(3))
Chlorite
ranges from: 2.6
to: 2.96
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Density (dry) (presumed g/cm(3))
Shales
ranges from: 1.55
to: 2.55
Source: Y/OWI/SUB-7009/1 (1976), Fig. 1

Density (g/cm(3))
Bentonite (Ca)
ranges from: <1.7
to: ca. 2.14
Source: PNL-4452 UC-70 (1983), p. 24

Density (g/cm(3))
Bentonite (Na) (a)
ranges from: <1.8
to: 2.28
Source: ONWI-312 (1981), p. 32

Density (g/cm(3))
Bentonite (Na) (b)
ranges from: <1.8
to: ca. 2.5
Source: PNL-4452 UC-70 (1983), p. 21

Density (g/cm(3))
Bentonite (Na) and Sand (a)
ranges from: <1.9
to: ca. 2.8
Source: PNL-4452 UC-70 (1983), p. 22

Density (g/cm(3))
Bentonite (Na) and Sand (b)
ranges from: <1.9
to: ca. 2.7
Source: PNL-4452 UC-70 (1983), p. 23

Density (g/cm(3))
Shale (j)
Gulf Coast
ranges from: 2.1
to: 2.3
Source: Y/OWI/SUB-7009/1 (1976), p. 121

Density (grain) (average) (presumed g/cm(3))
Clays and Shales
Eastern US
ranges from: 2.69
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Density (grain) (average) (presumed g/cm(3))
Shale (b)
ranges from: 2.71
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Density (grain) (average) (presumed g/cm(3))
Shales
Black Hills
ranges from: 2.66
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Density (grain) (average) (presumed g/cm(3))
Shales
Kansas
ranges from: 2.72
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Density (grain) (average) (presumed g/cm(3))
Shales
Venezuela
ranges from: 2.69
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Density (kg/m(3))
Clay
Louisiana
ranges from: 1,954 (1.954 g/cm(3))
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Density (kg/m(3))
Shale (a)
ranges from: 2,123 (2.123 g/cm(3))
to: 3,003 (3.003 g/cm(3))
Source: ORNL-6241/V1 (in preparation) p. 40

Density (kg/m(3))
Shale (b)
ranges from: 2,563 (2.563 g/cm(3))
to: -
Source: ORNL-6241/V2 (in preparation) p. 99

Density (lbs/ft(3))
Shales
ranges from: 117 (1.874 g/cm(3))
to: 188 (3.011 g/cm(3))
Source: Y/OWI/TM36/6, p. A-2, 3 & 4

Density (natural) (presumed g/cm(3))
Shales (c)
ranges from: 2.43
to: 2.65
Source: Y/OWI/SUB-7009/1 (1976), p. 18

Density (presumed g/cm(3))
Illite
ranges from: 2.65
to: 2.13
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Density (presumed g/cm(3))
Illite and Smectite
ranges from: 2.64
to: 1.48
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Density (presumed g/cm(3))
Kaolinite
ranges from: 2.60 - 2.68
to: 2.43
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Density (presumed g/cm(3))
Shale
California
ranges from: 2.5
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 12

Density (presumed g/cm(3))
Shale (c)
ranges from: 2.4
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Density (presumed g/cm(3))
Shale (d)
ranges from: 2.65
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Density (presumed g/cm(3))
Shale (e)
ranges from: 2.2
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Density (presumed g/cm(3))
Shale (f)
ranges from: 2.3
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Density (presumed g/cm(3))
Shale (g)
ranges from: 2.2
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Density (presumed g/cm(3))
Shale (h)
ranges from: 2.5
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Density (presumed g/cm(3))
Shale (i)
ranges from: 2.0
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Density (presumed g/cm(3))
Shale (k)
Gulf Coast
ranges from: 2.58
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 12

Density (presumed g/cm(3))
Smectite
ranges from: 2.2-2.7
to: 1.77
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Density (specific) (t/m(3)) (g/cm(3))
Bentonite (Na)
Wyoming
ranges from: 2.7
to: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 3

Density (wet) (average) (pounds/ft(3))
Shale
Montana
ranges from: 135 (2.162 g/cm(3))
to: -
Source: Y/OWI/TM36/6, p. 6-1

Density (wet) (presumed g/cm(3))
Shales
ranges from: 1.98
to: 2.67
Source: Y/OWI/SUB-7009/1 (1976), Fig. 1

Moisture content (%)
Argillite
Nevada
ranges from: 2
to: 4
Source: ORNL/Sub/84-64794/1 (1985), p. 406

Moisture content (%)
Bentonite and Sand
ranges from: 13
to: 22
Source: AECL-7812 (1983), p. 31

Moisture content (%)
Kaolinite and Sand
ranges from: 10
to: 30
Source: AECL-7812 (1983), p. 31

Moisture content (%)
Shale
New Mexico
ranges from: 3.7
to: 6.2
Source: Y/OWI/TM36/6, p. 8-5

Moisture content (%)
Shale (e)
Western USA
ranges from: 35
to: 15
Source: Y/OWI/TM36/6, p. 3-1

Moisture content (%)
Shales (a)
ranges from: 1.3
to: 38
Source: Y/OWI/TM36/6, p. A-13, 14 & 15

Moisture content (natural) (%)
Shale
Ohio
ranges from: 2
to: -
Source: Y/OWI/TM36/6, p. 5-14

Moisture content (natural) (%)
Shale
Ohio
ranges from: 4
to: -
Source: Y/OWI/TM36/6, p. 4-12

Moisture content (natural) (%)
Shale (a)
ranges from: 0
to: 38
Source: Y/OWI/TM36/6, p. 2-2

Moisture content (natural) (%)
Shale (b)
ranges from: 1.5
to: -
Source: Y/OWI/TM36/6, p. 7-8

Moisture content (natural) (%)
Shale (c)
ranges from: 18
to: -
Source: Y/OWI/TM36/6, p. 3-24

Moisture content (natural) (%)
Shale (d)
Northern Great Plains
ranges from: 18
to: 38
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Moisture content (natural) (%)
Shales
ranges from: 38
to: 12
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Moisture content (rock) (%)
Shale
New Mexico
ranges from: 3
to: 11
Source: Y/OWI/TM36/6, p. 8-3

Porosity (%)
Argillite
Nevada
ranges from: 8 to 16
to: 6 to 12
Source: ORNL/Sub/84-64794/1 (1985), p. 406

Porosity (%)
Clay
Belgium
ranges from: 38.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Porosity (%)
Clay
England
ranges from: 30
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Porosity (%)
Clay
Italy
ranges from: 25
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Porosity (%)
Shale
ranges from: 33
to: -
Source: Y/OWI/TM36/6, p. 3-24

Porosity (%)
Shale
Colorado
ranges from: 4.1
to: 5.1
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Porosity (%)
Shale
Tennessee
ranges from: 0.5
to: 1.9
Source: ORNL-6241/V2 (in preparation)
p. 219

Porosity (%)
Shale (a)
ranges from: 30
to: 5 to 10
Source: ORNL-6241/V2 (in preparation)
p. 218

Porosity (%)
Shale (a)
Michigan
ranges from: 3
to: 10
Source: ORNL-5703 (1983), p. 106

Porosity (%)
Shale (b)
Illinois, Indiana, Kentucky
ranges from: 0.95
to: 4.64
Source: ORNL/Sub/84-64794/1 (1985),
p. 85

Porosity (%)
Shale (b)
Michigan
ranges from: 3
to: 10
Source: ORNL/Sub/84-64794/1 (1985),
p. 98

Porosity (%)
Shales
ranges from: 0.7 (70% ?)
to: 0.1 (10% ?)
Source: ORNL-6241/V2 (in preparation)
p. 199

Porosity (%)
Shales
Appalachian Basin
ranges from: ca. 3
to: -
Source: ORNL-6241/V2 (in preparation)
p. 219

Porosity (%)
Shales
Illinois Basin
ranges from: 0.9
to: 4.6
Source: ORNL-6241/V2 (in preparation)
p. 219

Porosity (%)
Shales (a)
Kentucky
ranges from: 3.3
to: 10.1
Source: ORNL-6241/V2 (in preparation)
p. 219

Porosity (%)
Shales (b)
Kentucky
ranges from: 15
to: 3
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Porosity (%)
Shales
Michigan Basin
ranges from: 3
to: 10
Source: ORNL-6241/V2 (in preparation)
p. 219

Porosity (%)
Shales
Oklahoma
ranges from: 25
to: 2
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Porosity (%)
Shales
USA and Europe
ranges from: 19
to: 1
Source: ORNL-6241/V2 (in preparation)
p. 219

Porosity (%)
Shales (a)
ranges from: 3
to: 15
Source: ORNL-6241/V2 (in preparation)
p. 218

Porosity (%)
Shales (b)
ranges from: 15 to 45
to: 3 to 20
Source: ORNL-6241/V2 (in preparation)
p. 219

Porosity (%)
Shales (c)
ranges from: 0.4
to: 7.2
Source: Y/OWI/SUB-7009/1 (1976), p. 18

Porosity (%)
Shales (d)
ranges from: 0.0
to: 44.8
Source: Y/OWI/TM36/6, p. A-12

Porosity (%)
Shales (e)
Germany
ranges from: 25
to: ca. 0
Source: Y/OWI/SUB-7009/1 (1976), p. 15

Porosity (average) (vol. %)
Shale (a)
Illinois, Indiana and Kentucky
ranges from: 0.95
to: 4.64
Source: ORNL-5703 (1983), p. 76

Porosity (average) (vol. %)
Shales
Kentucky, New York, Virginia and West Virginia
ranges from: 2.86 to 3.87
to: -
Source: ORNL-5703 (1983), p. 37

Porosity (effective) (%)
Shale
Ohio
ranges from: 4
to: -
Source: Y/OWI/TM36/6, p. 5-14

Porosity (effective) (%)
Shales
Pennsylvania
ranges from: 1.17
to: -
Source: ORNL-6241/V2 (in preparation) p. 219

Porosity (effective) (%)
Shales
South Carolina
ranges from: ca. 0.5
to: -
Source: ORNL-6241/V2 (in preparation) p. 219

Porosity (effective) (units not stated)
Bentonite and Sand
ranges from: ca 0.4
to: 0.002
Source: AECL-7812 (1983), p. 32

Porosity (effective) (units not stated)
Illite
ranges from: ca. 0.5
to: ca. 0.002
Source: AECL-7812 (1983), p. 32

Porosity (effective) (units not stated)
Kaolinite
ranges from: ca. 0.5
to: ca. 0.002
Source: AECL-7812 (1983), p. 32

Porosity (effective) (units not stated)
Shale
ranges from: 0.05
to: 0.005
Source: ORNL-6241/V1 (in preparation) p. 33

Porosity (effective) (units not stated)
Shale
South Carolina
ranges from: 0.005
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (effective) (units not stated)
Shale (a)
ranges from: 0.01
to: -
Source: ORNL-6241/V2 (in preparation) p. 99

Porosity (primary) (%)
Shale
Ohio
ranges from: >3 %
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Porosity (rock mass) (%)
Shale
ranges from: 3.0
to: -
Source: Y/OWI/TM36/6, p. 7-8

Porosity (rock mass) (%)
Shale
Ohio
ranges from: 8
to: -
Source: Y/OWI/TM36/6, p. 4-12

Porosity (rock mass) (%)
Shale (b)
ranges from: 0
to: 45
Source: Y/OWI/TM36/6, p. 2-2

Porosity (total) (units not stated)
Shale
ranges from: 0.1
to: 0.01
Source: ORNL-6241/V1 (in preparation) p. 33

Porosity (total) (units not stated)
Shale
Great Britain
ranges from: 0.020
to: 0.101
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale
Illinois, Indiana, Kentucky
ranges from: 0.009
to: 0.046
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale
Kansas
ranges from: 0.073
to: 0.106
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale
Kentucky
ranges from: 0.074
to: 0.076
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale
Michigan
ranges from: 0.03
to: 0.10
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale
Missouri
ranges from: 0.113
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale
Pennsylvania
ranges from: 0.010
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale
Tennessee
ranges from: 0.005
to: 0.019
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale
Utah
ranges from: 0.009
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale (a)
ranges from: 0.03
to: -
Source: ORNL-6241/V2 (in preparation) p. 99

Porosity (total) (units not stated)
Shale (b)
ranges from: 0.03
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale (c)
ranges from: 0.003
to: 0.056
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale (d)
Ohio
ranges from: 0.03
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale (e)
Pennsylvania
ranges from: 0.0117
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Porosity (total) (units not stated)
Shale (f)
Scotland
ranges from: 0.016
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Specific gravity (dimensionless)
Bentonite (a)
ranges from: 2.21
to: -
Source: Proc NEA Workshop OECD (1981), p. 340

Specific gravity (dimensionless)
Bentonite (b)
Black Hills
ranges from: 2.18
to: -
Source: Proc NEA Workshop OECD (1981), p. 340

Specific gravity (dimensionless)
Bentonite (Na)
Wyoming
ranges from: 2.66
to: -
Source: AECL-7825 (1984), p. 12

Specific gravity (dimensionless)
Bentonite (Na) and Sand
Wyoming
ranges from: 2.635
to: -
Source: AECL-7825 (1984), p. 12

Specific gravity (dimensionless)
Kaolinite
ranges from: 2.60
to: -
Source: Proc NEA Workshop OECD (1981), p. 340

Specific gravity (g/cm(3))
Bentonite (a)
Oregon
ranges from: 2.73
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Specific gravity (g/cm(3))
Bentonite (b)
Oregon
ranges from: 2.85
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Specific gravity (g/cm(3))
Bentonite (c)
Wyoming
ranges from: 2.77
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Specific gravity (g/cm(3))
Clay
Hanford
ranges from: 2.71
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Specific surface (m(2)/g)
Bentonite (Na)
ranges from: 519
to: 615
Source: AECL-7825 (1984), p. 12

Specific surface (m(2)/g)
Bentonite (Na) and Sand
ranges from: 284
to: -
Source: AECL-7825 (1984), p. 12

Specific surface (m(2)/g)
Shale
Michigan
ranges from: 0.05
to: 1.2
Source: ORNL-5703 (1983), p. 109

Specific surface (m(2)/g)
Smectite
ranges from: 800
to: -
Source: NUREG/CP-0052 (1983), p. 182

Void ratio (dimensionless)
Clays
ranges from: ca. 1.5 to 3.0
to: ca. 0.5 to 0.6
Source: ONWI-312 (1981), p. 21

Void ratio (dimensionless)
Kaolinite (Ca)
ranges from: 2.5
to: 1.0
Source: ONWI-486 (1983), p. 38

Void ratio (dimensionless)
Kaolinite (Na)
ranges from: 2.5
to: 1.0
Source: ONWI-486 (1983), p. 38

Void ratio (dimensionless)
Smectite (Ca)
ranges from: 7.0
to: 1.0
Source: ONWI-486 (1983), p. 38

Void ratio (dimensionless)
Smectite (Na)
ranges from: 30.0
to: 1.0
Source: ONWI-486 (1983), p. 38

Water content (average) (%)
Shale
Montana
ranges from: 15
to: -
Source: Y/OWI/TM36/6, p. 6-1

Water content (vol %)
Shales (b)
ranges from: 70 to 90
to: 5 to 10
Source: ORNL-6241/V2 (in preparation) p. 218

Groundwater travel distance (m)
Shale
ranges from: 6
to: 40
Source: ORNL-6241/V1 (In preparation) p. 36

Hydraulic conductivity (cm/s x 10(12))
Bentonite (Na) (a)
ranges from: <1 (<1 x 10(-12) cm/s)
to: ca. 8 , (ca. 8 x 10(-12) cm/s)
Source: ONWI-312 (1981), p. 11

Hydraulic conductivity (cm/s)
Bentonite (Ca)
ranges from: 1.3 x 10(-12) and 1.6 x 10(-12)
to:
Source: ONWI-312 (1981), p. 33

Hydraulic conductivity (cm/s)
Bentonite (Na)
ranges from: 2.7 x 10(-9)
to: 0.7 x 10(-9)
Source: ONWI-312 (1981), p. 34

Hydraulic conductivity (cm/s)
Bentonite (Na)
Wyoming
ranges from: Not stated
to: 10(-9)
Source: ONWI-486 (1983), p. 61

Hydraulic conductivity (cm/s)
Bentonite (Na) (b)
ranges from: ca. 1 x 10(-13)
to:
Source: ONWI-312 (1981), p. 10

Hydraulic conductivity (cm/s)
Bentonite (Na) (c)
ranges from: 4.6 x 10(-12) and 6.4 x 10(-12)
to:
Source: ONWI-312 (1981), p. 33

Hydraulic conductivity (cm/s)
Bentonite (Na) (d)
ranges from: 6.6 x 10(-10)
to:
Source: ONWI-312 (1981), p. 33

Hydraulic conductivity (cm/s)
Bentonite (Na) (e)
ranges from: 5.6 x 10(-13)
to:
Source: ONWI-312 (1981), p. 33

Hydraulic conductivity (cm/s)
Bentonite (Na) (f)
ranges from: 6 x 10(-12)
to: 6 x 10(-13)
Source: PNL-4452 UC-70 (1983), p. 13

Hydraulic conductivity (cm/s)
Bentonite (Na) (g)
ranges from: 1.2 x 10(-12)
to: 8.3 x 10(-13)
Source: PNL-4452 UC-70 (1983), p. 27

Hydraulic conductivity (cm/s)
Bentonite (Na) and (Ca)
Various
ranges from: 10(-4)
to: 10(-12)
Source: ONWI-486 (1983), p. 36

Hydraulic conductivity (cm/s)
Bentonite (Na) and Sand
ranges from: ca. 10(-9)
to: ca. 10(-12)
Source: PNL-4452 UC-70 (1983), p. 16

Hydraulic conductivity (cm/s)
Clay
ranges from: 7 x 10(-12)
to: 2 x 10(-12)
Source: PNL-4452 UC-70 (1983), p. 14

Hydraulic conductivity (cm/s)
Clay
Louisiana
ranges from: 10(-8) (est)
to:
Source: ORNL/Sub/84-64794/1 (1985), p. 175

Hydraulic conductivity (cm/s)
Illite (Ca)
ranges from: 10(-10)
to: 10(-6)
Source: ONWI-486 (1983), p. 35

Hydraulic conductivity (cm/s)
Illite (Na)
ranges from: 10(-10)
to: 10(-7)
Source: ONWI-486 (1983), p. 35

Hydraulic conductivity (cm/s)
Kaolinite (Ca)
ranges from: 10(-8)
to: 10(-5)
Source: ONWI-486 (1983), p. 35

Hydraulic conductivity (cm/s)
Kaolinite (Na)
ranges from: 10(-8)
to: 10(-5)
Source: ONWI-486 (1983), p. 35

Hydraulic conductivity (cm/s)
Shale
Illinois Basin
ranges from: 10(-9)
to:
Source: ORNL-6241/V2 (In preparation) p. 220

Hydraulic conductivity (cm/s)
Shale
Tennessee
ranges from: 6 x 10(-10)
to: 3 x 10(-11)
Source: ORNL-6241/V2 (In preparation) p. 220

Hydraulic conductivity (cm/s)
Shales
East Coast
ranges from: 10(-7)
to: 10(-11)
Source: ORNL-6241/V2 (in preparation)
p. 220

Hydraulic conductivity (cm/s)
Shales
Michigan and Appalachian Basins
ranges from: 10(-6)
to: 10(-9)
Source: ORNL-6241/V2 (in preparation)
p. 220

Hydraulic conductivity (cm/s)
Shales
Northern Great Plains
ranges from: 10(-6)
to: 10(-10)
Source: ORNL-6241/V2 (in preparation)
p. 220

Hydraulic conductivity (cm/s)
Shales (c)
ranges from: 10(-8)
to: 10(-11)
Source: ORNL-6241/V2 (in preparation)
p. 218

Hydraulic conductivity (cm/s)
Shales (d)
ranges from: 10(-9)
to: 10(-11)
Source: ORNL-6241/V2 (in preparation)
p. 219

Hydraulic conductivity (cm/s)
Silty Clay
ranges from: 5 x 10(-6)
to: ca. 2 x 10(-8)
Source: ONWI-486 (1983), p. 39

Hydraulic conductivity (cm/s)
Silty Clay
ranges from: 5 x 10(-6)
to: 10(-7)
Source: ONWI-486 (1983), p. 39

Hydraulic conductivity (cm/s)
Smectite (Ca) (a)
ranges from: 10(-11)
to: 10(-6)
Source: ONWI-486 (1983), p. 35

Hydraulic conductivity (cm/s)
Smectite (Na) (a)
ranges from: 10(-11)
to: 10(-7)
Source: ONWI-486 (1983), p. 35

Hydraulic conductivity (cm/s)
Volclay saline seal and Sand
ranges from: 2.9 x 10(-12)
to: 4.1 x 10(-12)
Source: ONWI-312 (1981), p. 33

Hydraulic conductivity (horizontal) (m/s)
Shale
ranges from: 1 x 10(-10) (1 x 10(-8) cm/s)
to: 1 x 10(-12) (1 x 10(-10) cm/s)
Source: ORNL-6241/V1 (in preparation)
p. 33

Hydraulic conductivity (horizontal) (m/s)
Shale
Illinois
ranges from: 2 x 10(-11) (2 x 10(-9) cm/s)
to:
Source: ORNL-6241/V2 (in preparation)
p. 42

Hydraulic conductivity (horizontal) (m/s)
Shale
Maryland
ranges from: 0.0(?) (0.0 cm/s) (?)
to: 1 x 10(-9) (1 x 10(-7) cm/s)
Source: ORNL-6241/V2 (in preparation)
p. 43

Hydraulic conductivity (horizontal) (m/s)
Shale
Michigan
ranges from: 1 X 10(-11) (1 x 10(-9) cm/s)
to: 2 x 10(-8) (2 x 10(-6) cm/s)
Source: ORNL-6241/V2 (in preparation)
p. 42

Hydraulic conductivity (horizontal) (m/s)
Shale
Pennsylvania
ranges from: 3 x 10(-11) (3 x 10(-9) cm/s)
to:
Source: ORNL-6241/V2 (in preparation)
p. 42

Hydraulic conductivity (horizontal) (m/s)
Shale
Pennsylvania
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to:
Source: ORNL-6241/V2 (in preparation)
p. 43

Hydraulic conductivity (horizontal) (m/s)
Shale
South Carolina
ranges from: 1 x 10(-13) (1 x 10(-11) cm/s)
to: 1 x 10(-10) (1 x 10(-8) cm/s)
Source: ORNL-6241/V2 (in preparation)
p. 42

Hydraulic conductivity (horizontal) (m/s)
Shale
South Carolina
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to:
Source: ORNL-6241/V2 (in preparation)
p. 43

Hydraulic conductivity (horizontal) (m/s)
Shale
South Dakota
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
Source: ORNL-6241/V2 (in preparation)
p. 43

Hydraulic conductivity (horizontal) (m/s)
Shale
Tennessee
ranges from: 3 x 10(-13) (3 x 10(-11) cm/s)
to: 2 x 10(-12) (2 x 10(-10) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 42

Hydraulic conductivity (horizontal) (m/s)
Shale (a)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to:
Source: ORNL-6241/V2 (in preparation) p. 99

Hydraulic conductivity (horizontal) (m/s)
Shale (b)
ranges from: 1 x 10(-16) (1 x 10(-14) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 42

Hydraulic conductivity (horizontal) (m/s)
Shale (c)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to: 7 x 10(-9) (7 x 10(-7) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 42

Hydraulic conductivity (horizontal) (m/s)
Shale (d)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to: 1 x 10(-6) (1 x 10(-4) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 43

Hydraulic conductivity (horizontal) (m/s)
Siltstone/Mudstone
South Carolina
ranges from: 1 x 10(-13) (1 x 10(-11) cm/s)
to: 5 x 10(-10) (5 x 10(-8) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 43

Hydraulic conductivity (m/s)
Bentonite and Sand
ranges from: ca. 10(-6) (ca. 1 x 10(-4) cm/s)
to: ca. 10(-14) (ca. 1 x 10(-12) cm/s)
Source: AECL-7812 (1983), p. 29

Hydraulic conductivity (m/s)
Clay
Belgium
ranges from: 10(-10) (1 x 10(-8) cm/s)
to: 10(-12) (1 x 10(-10) cm/s)
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Hydraulic conductivity (m/s)
Clay
England
ranges from: 10(-12) (1 x 10(-10) cm/s)
to:
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Hydraulic conductivity (m/s)
Clay
Italy
ranges from: 10(-11) (1 x 10(-9) cm/s)
to:
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Hydraulic conductivity (vertical) (m/s)
Shale
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to: 1 x 10(-13) (1 x 10(-11) cm/s)
Source: ORNL-6241/V1 (in preparation) p. 33

Hydraulic conductivity (vertical) (m/s)
Shale
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to:
Source: ORNL-6241/V2 (in preparation) p. 99

Inflow (ml/min per m)
Shale
ranges from: 1 x 10(-1)
to: 5 x 10(-1)
Source: ORNL-6241/V1 (in preparation) p. 38

Inflow (ml/min per m)
Shale
ranges from: 10
to: <1
Source: ORNL-6241/V2 (in preparation) p. 106

Permeability (cm/s) (hydraulic conductivity)
Bentonite (Na) (h)
ranges from: 1 x 10(-11)
to:
Source: ONWI-312 (1981), p. 10

Permeability (cm/s) (hydraulic conductivity)
Bentonite (Na) (i)
ranges from: 3 x 10(-8)
to: 1.5 x 10(-9)
Source: ONWI-312 (1981), p. 10

Permeability (cm/s) (hydraulic conductivity)
Bentonite and Sand (a)
Oregon
ranges from: 9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Permeability (cm/s) (hydraulic conductivity)
Bentonite and Sand (b)
Oregon
ranges from: <9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Permeability (cm/s) (hydraulic conductivity)
Bentonite and Sand (c)
Wyoming
ranges from: <9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Permeability (cm/s) (hydraulic conductivity)
Bentonite and Sand (d)
Wyoming
ranges from: <9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Permeability (cm/s) (hydraulic conductivity)
Clay and Sand
Hanford
ranges from: <9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Permeability (cm/s) (hydraulic conductivity)
Shale (b)
Great Plains
ranges from: 1 x 10(-6)
to: 1 x 10(-10)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Permeability (ft/yr) (hydraulic conductivity)
Shale
Ohio
ranges from: 10(-3) (9.7 x 10(-10) cm/s)
to: 10(-4) (9.7 x 10(-11) cm/s)
Source: Y/OWI/TM36/6 (1978), p. 5-14

Permeability (ft/yr) (hydraulic conductivity)
Shale (a)
ranges from: 0.1 (9.7 x 10(-8) cm/s)
to: 0.05 (4.8 x 10(-8) cm/s)
Source: Y/OWI/TM36/6 (1978), p. 7-8

Permeability (ft/yr) (hydraulic conductivity)
Shales (f)
Various
ranges from: 1.0 x 10(-4) (9.7 x 10(-11) cm/s)
to: 1.1 x 10(3) (1.1 x 10(-4) cm/s)
Source: Y/OWI/TM36/6 (1978), p. A-16

Permeability (horizontal) (ft/yr) (hydraulic conductivity)
Shale
ranges from: 0.01 (9.7 x 10(-9) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 3-24

Permeability (horizontal) (ft/yr) (hydraulic conductivity)
Shale
Ohio
ranges from: 0.1 (9.7 x 10(-8) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 4-12

Permeability (horizontal) (ft/yr) (hydraulic conductivity)
Shale (e)
ranges from: 1 x 10(-4) (9.7 x 10(-11) cm/s)
to: 1 x 10(3) (9.7 x 10(-4) cm/s)
Source: Y/OWI/TM36/6 (1978), p. 2-2

Permeability (m(2))
Bentonite (Ca) and (Na)
ranges from: 1 x 10(-16) (9.7 x 10(-8) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Permeability (m(2))
Bentonite and Sand (e)
Wyoming
ranges from: 3 x 10(-18) (2.9 x 10(-9) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 220

Permeability (m(2))
Bentonite and Sand (f)
Wyoming
ranges from: 8 x 10(-18) (7.8 x 10(-9) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 220

Permeability (m(2))
Kaolinite (a)
ranges from: 1 x 10(-16) (9.7 x 10(-8) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Permeability (m(2))
Kaolinite (b)
ranges from: 5 x 10(-17) (4.9 x 10(-8) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Permeability (m(2))
Kaolinite and Sand
ranges from: 2 x 10(-16) (1.9 x 10(-7) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Permeability (m(2))
Shales (e)
ranges from: 10(-17) (9.7 x 10(-9) cm/s)
to: 10(-21) (9.7 x 10(-13) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 199

Permeability (m(2))
Smectite (Ca) (b)
ranges from: 3 x 10(-18) (2.9 x 10(-9) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Permeability (m(2))
Smectite (Ca) and Sand
ranges from: 4 x 10(-17) (3.9 x 10(-8) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Permeability (m(2))
Smectite (Na) and Sand
ranges from: 5 x 10(-19) (4.9 x 10(-10) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Permeability (m/s) (hydraulic conductivity)
Bentonite (Ca)
ranges from: 1 x 10(-9) (1 x 10(-7) cm/s)
to:
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Permeability (m/s) (hydraulic conductivity)
Bentonite (Na) (j)
ranges from: 5 x 10(-15) (5 x 10(-13) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
Source: KBS TEKNISK RAPPORT 74 (1978), p. 8

Permeability (m/s) (hydraulic conductivity)
Bentonite (Na) (k)
ranges from: ca. 1 x 10(-11) (ca. 1 x 10(-9) cm/s)
to:
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Permeability (m/s) (hydraulic conductivity)
Bentonite (Na) (l)
ranges from: ca. 3 x 10(-11) (ca. 3 x 10(-9) cm/s)
to:
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Permeability (m/s) (hydraulic conductivity)
Bentonite (Na) (m)
ranges from: 1 x 10(-10) (1 x 10(-8) cm/s) (maximum)
to:
Source: KBS TEKNISK RAPPORT 9 (1977), p. 5

Permeability (md)
Clays and Shales
ranges from: 8 x 10(-4) (7.7 x 10(-10) cm/s)
to: 2 x 10(-6) (1.9 x 10(-12) cm/s)
Source: Proc NEA Workshop OECD (1979b), p. 69

Permeability (md)
Shale
ranges from: 5 x 10(-2) (4.9 x 10(-7)cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (md)
Shale
California
ranges from: 4 x 10(-4) (3.8 x 10(-10) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (md)
Shale
Colorado
ranges from: <0.05 (<4.9 x 10(-7)cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Permeability (md)
Shale
Gulf Coast
ranges from: 1 x 10(-8) (9.6 x 10(-15) cm/s) (?)
to: 2.5 x 10(-9) (2.4 x 10(-15) cm/s) (?)
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (md)
Shale
Michigan
ranges from: 0.001 (1 x 10(-9) cm/s)
to: 2.0 (1.9 x 10(-6) cm/s)
Source: ORNL/5703 (1983), p. 109

Permeability (md)
Shale
Michigan
ranges from: 0.001 (1 x 10(-9) cm/s)
to: 2.0 (1.9 x 10(-6) cm/s)
Source: ORNL/Sub/84-64794/1 (1985), p. 98

Permeability (md)
Shale (a)
ranges from: 1.1 x 10(-4) (1.1 x 10(-10) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (md)
Shales
ranges from: 8 x 10(-4) (7.7 x 10(-10) cm/s)
to: 2 x 10(-6) (1.9 x 10(-12) cm/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (md)
Shales
Illinois
ranges from: 2 x 10(-6) (1.9 x 10(-12) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (md)
Shales
Montana
ranges from: 6 x 10(-4) (5.8 x 10(-10) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Rermeability (md)
Shales
New Mexico
ranges from: 2 x 10(-6) (1.9 x 10(-12) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (md)
Shales
Oklahoma
ranges from: 8 x 10(-4) (7.7 x 10(-10) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (md)
Shales
Texas
ranges from: 3 x 10(-4) (2.9 x 10(-10) cm/s)
to: 7 x 10(-6) (6.7 x 10(-12) cm/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (md)
Shales
Utah
ranges from: 7 x 10(-6) (6.7 x 10(-12) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Permeability (microdarcies)
Shale (b)
ranges from: 100 (1 x 10(-7) cm/s)
to: 0.01 (1 x 10(-9) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 199

Permeability (vertical) (factor of K horizontal)
Shale
ranges from: 1/2Kh
to: 1/10Kh
Source: Y/OWI/TM36/6 (1978), p. 2-2

Permeability (vertical) (ft/yr) (hydraulic conductivity)
Shale
ranges from: 0.005 (5 x 10(-9) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 3-24

Permeability (vertical) (ft/yr) (hydraulic conductivity)
Shale
Ohio
ranges from: 0.05 (5 x 10(-8) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 4-12

Specific storage (l/m)
Shale
ranges from: 1 x 10(-6)
to:
Source: ORNL-6241/V2 (in preparation) p. 99

Specific storage (l/m)
Shale
ranges from: 4.3 x 10(-7)
to: 2.8 x 10(-6)
Source: ORNL-6241/V2 (in preparation) p. 57

Specific storage (m(-1)) (?)
Shale
ranges from: 5 x 10(-6)
to: 5 x 10(-7)
Source: ORNL-6241/V1 (in preparation) p. 33

Travel time (years)
Shale
ranges from: >100,000
to: >100,000
Source: ORNL-6241/V1 (in preparation) p. 36

Bulk modulus (confined) (GPa)
Argillite
ranges from: 14.0 (1.4 x 10(4) MPa)
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Bulk modulus (Pa x 10(10))
Shales
ranges from: ca. 50 (ca. 5 x 10(5) MPa)
to: ca. 200 (ca. 2 x 10(6) MPa)
Source: ORNL-6241/V2 (in preparation) p. 199

Bulk modulus (psi)
Shale
ranges from: 7.6 x 10(5) (5.2 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Bulk modulus (psi)
Shale
ranges from: 77.8 x 10(3) (5.4 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Bulk modulus (psi)
Shale
Ohio
ranges from: 6.3 x 10(5) (4.3 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Bulk modulus (psi)
Shale
Ohio
ranges from: 1.1 x 10(5) (7.6 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Cohesion (MPa)
Clay
Belgium
ranges from: 1 x 10(-1)
to: 1
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Cohesion (MPa)
Clay
Italy
ranges from: 1 x 10(-1)
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Cohesion (psi)
Shale
Ohio
ranges from: 5,900 (4.1 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Cohesion (psi)
Shale
Ohio
ranges from: 14 (1 x 10(-1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Cohesion (psi)
Shale (a)
ranges from: 0 (0 MPa)
to: 4,250 (3 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. 2-2

Cohesion (psi)
Shale (b)
ranges from: 6 x 10(3) (4.1 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Cohesion (psi)
Shale (c)
ranges from: 206 (1.4 MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Cohesion (psi)
Shale (d)
Great Plains
ranges from: 2 (1.4 x 10(-2) MPa)
to: 30 (2.1 x 10(-1) MPa)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Cohesion (unconfined) (MPa)
Argillite
ranges from: 8 x 10(-1)
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Compressive strength (kg/cm(2))
Shale (a)
Montana
ranges from: 122 (1.2 x 10(1) MPa)
to: 25 (2.5 MPa)
Source: Y/OWI/TM36/6 (1978), p. 6-13

Compressive strength (kg/cm(2))
Shale (b)
Montana
ranges from: 25 (2.5 MPa)
to: 55 (5.4 MPa)
Source: Y/OWI/TM36/6 (1978), p. 6-13

Compressive strength (MPa)
Oil Shales
ranges from: 35
to: 138
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Compressive strength (MPa)
Oil Shales
ranges from: 138
to: 172
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Compressive strength (MPa)
Shale
Indiana
ranges from: 11
to: 115
Source: ORNL/Sub/84-64794/1 (1985), p. 60

Compressive strength (MPa)
Shales
Western Ohio
ranges from: 20
to: 32
Source: ORNL/Sub/84-64794/1 (1985), p. 71

Compressive strength (psi)
Shale
ranges from: 8.5 x 10(3) (5.9 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 6-3

Compressive strength (psi)
Shale
New Mexico
ranges from: 1,000 (6.9 MPa)
to: 6,000 (4.1 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. 8-5

Compressive strength (psi)
Shale
New Mexico
ranges from: 1,000 (6.9 MPa)
to: 8,000 (5.5 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. 8-2

Compressive strength (psi)
Shale (b)
Great Plains
ranges from: 70 (4.8 x 10(-1) MPa)
to: 2,530 (1.7 x 10(1) MPa)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Compressive strength (psi)
Smectite (Na), Kaolinite, Sand Mixtures (a)
Osage, NY
ranges from: 76.5 (5.3 x 10(-1) MPa)
to: 541.0 (3.7 MPa)
Source: ONWI-312 (1981), p. 24

Compressive strength (psi)
Smectite (Na), Kaolinite, Sand Mixtures (b)
Osage, NY
ranges from: 9.1 (6.3 x 10(-2) MPa)
to: 85.5 (5.9 x 10(-1) MPa)
Source: ONWI-312 (1981), p. 24

Compressive strength (unconfined) (MPa)
Argillite
ranges from: 4.75
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Compressive strength (unconfined) (MPa)
Bentonite and Sand (a)
Oregon
ranges from: ca. 0
to: ca. 1.8
Source: RHO-BWI-SA-80 (1981), Fig. 4

Compressive strength (unconfined) (MPa)
Bentonite and Sand (b)
Wyoming
ranges from: ca. 0
to: ca. 3
Source: RHO-BWI-SA-80 (1981), Fig. 4

Compressive strength (unconfined) (MPa)
Shales (a)
ranges from: 25.2
to: 113.6
Source: ORNL-6241/V3 (in preparation) p. 110

Compressive strength (unconfined) (psi)
Bentonite (Na) (a)
ranges from: 55.5 (3.8 x 10(-1) MPa)
to: -
Source: ONWI-312 (1981), p. 22

Compressive strength (unconfined) (psi)
Kaolinite
ranges from: 100.3 (6.9 x 10(-1) MPa)
to: -
Source: ONWI-312 (1981), p. 22

Compressive strength (unconfined) (psi)
Shales (b)
Various
ranges from: <100 (<6.9 x 10(-1) MPa)
to: 3.7 x 10(4) (2.5 x 10(2) MPa)
Source: Y/OWI/TM36/6 (1978), p. A-4,5,6

Compressive strength (uniaxial) (MPa)
Bentonite (Na) (b)
ranges from: 8.9
to: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 14

Compressive strength (uniaxial) (MPa)
Shale
Ohio
ranges from: 13.8
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Compressive strength (uniaxial) (psi)
Shale
Ohio
ranges from: 1 x 10(4) (6.9 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Compressive strength (uniaxial) (psi)
Shale
Ohio
ranges from: 2 x 10(3) (1.4 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Compressive strength (uniaxial) (psi)
Shale (a)
ranges from: 70 (4.8 x 10(-1) MPa)
to: 3.7 x 10(4) (2.5 x 10(2) MPa)
Source: Y/OWI/TM36/6 (1978), p. 2-2

Compressive strength (uniaxial) (psi)
Shale (a)
ranges from: 2.1 x 10(3) (1.4 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Compressive strength (uniaxial) (psi)
Shale (b)
ranges from: 1 x 10(4) (6.9 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Friction angle (angle of shear resistance) (deg)
Clay
Belgium
ranges from: 19
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Friction angle (angle of shear resistance) (deg)
Clay
Italy
ranges from: 25
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Friction angle (deg)
Shale
Ohio
ranges from: 23.4
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Friction angle (deg)
Shale
Ohio
ranges from: 22
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Friction angle (deg)
Shale (a)
ranges from: 4.2
to: 56
Source: Y/OWI/TM36/6 (1978), p. 2-2

Friction angle (deg)
Shale (a)
ranges from: 5.3
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Friction angle (deg)
Shale (b)
ranges from: 26
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Friction angle (dilation angle) (deg)
Shale (c)
ranges from: +5
to: -5
Source: Y/OWI/TM36/6 (1978), p. 2-2

Friction angle (internal) (deg)
Argillite
ranges from: 35
to: -
Source: Proc NEA Workshop OECD (1979b) p. 87

Friction angle (internal) (deg)
Shale (b)
Great Plains
ranges from: 8
to: 25
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Friction angle (internal) (deg)
Shale (d)
ranges from: 14.2
to: 51.0
Source: ORNL-6241/V1 (in preparation) p. 47

Friction angle (residual) (tan)
Illite (Na) (a)
ranges from: 0.3
to: 0.7
Source: ONWI-486 (1983), p. 47

Friction angle (residual) (tan)
Illite (Na) (b)
ranges from: 0.47
to: 0.7
Source: ONWI-486 (1983), p. 47

Friction angle (residual) (tan)
Kaolinite
ranges from: 0.27
to: 0.7
Source: ONWI-486 (1983), p. 47

Friction angle (residual) (tan)
Smectite (Na) (a)
ranges from: 0.09
to: 0.7
Source: ONWI-486 (1983), p. 47

Friction angle (residual) (tan)
Smectite (Na) (b)
ranges from: 0.18
to: 0.7
Source: ONWI-486 (1983), p. 47

Plasticity (liquid limit) (%)
Bentonite
Wyoming
ranges from: 553.1
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (liquid limit) (%)
Bentonite (a)
Oregon
ranges from: 209.6
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (liquid limit) (%)
Bentonite (b)
Oregon
ranges from: 212.69
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (liquid limit) (%)
Bentonite (Na)
Wyoming
ranges from: 260
to: -
Source: AECL-7825 (1984), p. 12

Plasticity (liquid limit) (%)
Bentonite (Na) (a)
ranges from: 98
to: -
Source: AECL-7825 (1984), p. 12

Plasticity (liquid limit) (%)
Clay
Belgium
ranges from: 77.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Plasticity (liquid limit) (%)
Clay
England
ranges from: 55
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Plasticity (liquid limit) (%)
Clay
Hanford
ranges from: 44.6
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (liquid limit) (%)
Clay
Hanford
ranges from: 63.9
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (liquid limit) (%)
Clay
Italy
ranges from: 50
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Plasticity (liquid limit) (%)
Illite (Ca)
Jackson County, OH
ranges from: 69
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (liquid limit) (%)
Illite (Ca) (a)
Fithian, IL
ranges from: 90
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (liquid limit) (%)
Illite (Ca) (b)
Grundy County, IL
ranges from: 100
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (liquid limit) (%)
Kaolinite (Ca)
Anna, IL
ranges from: 73
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (liquid limit) (%)
Kaolinite (Ca)
Dry Branch, GA
ranges from: 34
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (liquid limit) (%)
Shale (a)
Great Plains
ranges from: 36
to: 113
Source: ORNL/Sub/84-64794/1 (1985), p. 291

Plasticity (liquid limit) (%)
Shale (b)
Great Plains
ranges from: 55
to: 202
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Plasticity (liquid limit) (%)
Shales, Mudstones, Siltstones
Various
ranges from: 17.8
to: 224
Source: Y/OWI/TM36/6 (1978), p. 6-20 to 6-26

Plasticity (liquid limit) (%)
Smectite (Ca)
Belle Fourche, SD
ranges from: 177
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (liquid limit) (%)
Smectite (Ca)
Cheto, AZ
ranges from: 155
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (liquid limit) (%)
Smectite (Ca)
Omsted, IL
ranges from: 123
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (liquid limit) (%)
Smectite (Ca)
Pontotoc, MS
ranges from: 166
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (liquidity index)
Shale
Montana
ranges from: -0.11
to: -
Source: Y/OWI/TM36/6 (1978), p. 6-1

Plasticity (plastic index) (%)
Bentonite
Wyoming
ranges from: 519.5
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic index) (%)
Bentonite (a)
Oregon
ranges from: 168.58
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic index) (%)
Bentonite (b)
Oregon
ranges from: 174.6
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic index) (%)
Clay
Hanford
ranges from: 18.8
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic index) (%)
Clay
Hanford
ranges from: 40.8
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic limit) (%)
Bentonite
Wyoming
ranges from: 33.6
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic limit) (%)
Bentonite (a)
Oregon
ranges from: 41.0
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic limit) (%)
Bentonite (b)
Oregon
ranges from: 38.1
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic limit) (%)
Bentonite (Na) (a)
Wyoming
ranges from: 50
to: -
Source: AECL-7825 (1984), p. 12

Plasticity (plastic limit) (%)
Bentonite (Na) (b)
Wyoming
ranges from: 19
to: -
Source: AECL-7825 (1984), p. 12

Plasticity (plastic limit) (%)
Clay
Belgium
ranges from: 26.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Plasticity (plastic limit) (%)
Clay
England
ranges from: 26
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Plasticity (plastic limit) (%)
Clay
Hanford
ranges from: 25.8
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic limit) (%)
Clay
Hanford
ranges from: 23.1
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (plastic limit) (%)
Clay
Italy
ranges from: 25
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Plasticity (plastic limit) (%)
Illite (Ca)
Jackson County, OH
ranges from: 36
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (plastic limit) (%)
Illite (Ca) (a)
Fithian, IL
ranges from: 40
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (plastic limit) (%)
Illite (Ca) (b)
Grundy County, IL
ranges from: 42
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (plastic limit) (%)
Kaolinite (Ca)
Anna, IL
ranges from: 36
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (plastic limit) (%)
Kaolinite (Ca)
Dry Branch, GA
ranges from: 26
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (plastic limit) (%)
Shale (a)
Great Plains
ranges from: 20
to: 62
Source: ORNL/Sub/84-64794/1 (1985), p. 291

Plasticity (plastic limit) (%)
Shale (b)
Great Plains
ranges from: 22
to: 39
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Plasticity (plastic limit) (%)
Shales, Mudstones, Siltstones
Various
ranges from: 16.0
to: 45.5
Source: Y/OWI/TM36/6 (1978), p. 6-20 to 6-26

Plasticity (plastic limit) (%)
Smectite (Ca)
Belle Fourche, SD
ranges from: 63
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (plastic limit) (%)
Smectite (Ca)
Cheto, AZ
ranges from: 65
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (plastic limit) (%)
Smectite (Ca)
Omsted, IL
ranges from: 79
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (plastic limit) (%)
Smectite (Ca)
Pontotoc, MS
ranges from: 65
to: -
Source: ONWI-486 (1983), p. 43

Plasticity (plasticity index) (%)
Bentonite (Na) (a)
Wyoming
ranges from: 210
to: -
Source: AECL-7825 (1984), p. 12

Plasticity (plasticity index) (%)
Bentonite (Na) (b)
Wyoming
ranges from: 79
to: -
Source: AECL-7825 (1984), p. 12

Plasticity (plasticity index) (%)
Clay
Louisiana
ranges from: 40
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Plasticity (plasticity index) (%)
Illite
ranges from: 0
to: 90
Source: ONWI-486 (1983), p. 45

Plasticity (plasticity index) (%)
Kaolinite
ranges from: 0
to: 35
Source: ONWI-486 (1983), p. 45

Plasticity (plasticity index) (%)
Shale
Great Plains
ranges from: 30
to: 110
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Plasticity (plasticity index) (%)
Shales, Mudstones, Siltstones
Various
ranges from: 1.8
to: 192
Source: Y/OWI/TM36/6 (1978), p. 6-20 to 6-26

Plasticity (plasticity index) (%)
Smectite (Na)
ranges from: 0
to: 500
Source: ONWI-486 (1983), p. 45

Plasticity (shrinkage limit) (%)
Bentonite (a)
Oregon
ranges from: 8.47
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (shrinkage limit) (%)
Bentonite (b)
Oregon
ranges from: 8.96
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Plasticity (shrinkage limit) (%)
Clay
Hanford
ranges from: 19.75
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Poisson's ratio
Argillite
ranges from: 0.30
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Poisson's ratio
Bentonite
Wyoming
ranges from: 0.15
to: -
Source: ONWI-486 (1983), p. 63

Poisson's ratio
Oil Shales
ranges from: 0.2
to: 0.3
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Poisson's ratio
Oil Shales
ranges from: 0.15
to: 0.20
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Poisson's ratio
Shale
ranges from: 0.2
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Poisson's ratio
Shale
Ohio
ranges from: 0.1
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Poisson's ratio
Shale
Ohio
ranges from: 0.25
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Poisson's ratio
Shale (a)
ranges from: 0.03
to: 0.50
Source: Y/OWI/TM36/6 (1978), p. 2-2

Poisson's ratio
Shale (b)
ranges from: 0.15
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Poisson's ratio
Shales (a)
ranges from: 0.11
to: 0.31
Source: ORNL-6241/V3 (in preparation) p. 110

Poisson's ratio
Shales (b)
Various
ranges from: 0.03
to: 0.77
Source: Y/OWI/TM36/6 (1978), p. A-11

Ratio of strength to overburden stress
Shale
ranges from: 1.3
to: 6.0
Source: ORNL-6241/V1 (in preparation) p. 53

Shear modulus (Pa x 10(10))
Shales (a)
ranges from: 0.1 (1 x 10(3) MPa)
to: 100 (1 x 10(6) MPa)
Source: ORNL-6241/V2 (in preparation) p. 199

Shear modulus (psi)
Shale
ranges from: 6.2 x 10(5) (4.3 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shear modulus (psi)
Shale
ranges from: 58.3 x 10(3) (4 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Shear modulus (psi)
Shale
Ohio
ranges from: 6.8 x 10(5) (4.7 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Shear modulus (psi)
Shale
Ohio
ranges from: 6.8 x 10(4) (4.7 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shear modulus (psi)
Shales (b)
Various
ranges from: 1.7 x 10(6) (1.2 x 10(4) MPa)
to: 3.6 x 10(6) (2.5 x 10(4) MPa)
Source: Y/OWI/TM36/6 (1978), p. A-10

Shear strength (kPa)
Bentonite (Na) (a)
ranges from: 1,600 (1.6 MPa)
to: <15 (<1.5 x 10(-2) MPa)
Source: KBS TEKNISK RAPPORT 74 (1978), p. 16

Shear strength (MPa)
Bentonite (Na) (b)
ranges from: 4.5
to: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 14

Shear strength (undrained) (MPa)
Clay
Belgium
ranges from: 0.6
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Shear strength (undrained) (MPa)
Clay
England
ranges from: 1.2
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Shear strength (undrained) (MPa)
Clay
Italy
ranges from: 1.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Strength (MPa)
Clay
Louisiana
ranges from: 0.19
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Swelling (%)
Bentonite (a)
ranges from: 5
to: 20
Source: KBS TEKNISK RAPPORT 9 (1977), p. 5

Swelling (%)
Bentonite (b)
ranges from: 15
to: 30
Source: KBS TEKNISK RAPPORT 9 (1977), p. 6

Swelling (%)
Bentonite (c)
ranges from: 1
to: 50
Source: ONWI-486 (1983), p. 49

Swelling (%)
Illite
ranges from: <2
to: 20
Source: ONWI-486 (1983), p. 49

Swelling (%)
Illite and Bentonite (a)
ranges from: 1
to: 54
Source: ONWI-486 (1983), p. 49

Swelling (%)
Illite and Bentonite (b)
ranges from: <2
to: 30
Source: ONWI-486 (1983), p. 49

Swelling (%)
Illite and Kaolinite
ranges from: <2
to: <10
Source: ONWI-486 (1983), p. 49

Swelling (%)
Kaolinite
ranges from: <2
to: 4
Source: ONWI-486 (1983), p. 49

Swelling (%)
Kaolinite and Bentonite
ranges from: 2
to: 35
Source: ONWI-486 (1983), p. 49

Swelling (potential) (%)
Shale
Canada
ranges from: 2
to: 20
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Swelling (potential) (%)
Shale
Great Plains
ranges from: 3
to: 5
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Swelling distance (mm)
Bentonite
ranges from: 1
to: 11
Source: ONWI-312 (1981), p. 16

Swelling pressure (kPa)
Bentonite (a)
ranges from: 30 (0.03 MPa) (?)
to: 110 (0.11 MPa) (?)
Source: KBS TEKNISK RAPPORT 9 (1977), p. 6

Swelling pressure (kPa)
Bentonite (b)
ranges from: 30 (0.03 MPa) (?)
to: 200 (0.20 MPa) (?)
Source: KBS TEKNISK RAPPORT 9 (1977), p. 6

Swelling pressure (MPa)
Bentonite
Oregon
ranges from: ca. 0
to: ca. 1.8
Source: AECL-7812 (1983), p. 34

Swelling pressure (MPa)
Bentonite
Wyoming
ranges from: ca. 0
to: ca. 2.2
Source: AECL-7812 (1983), p. 34

Swelling pressure (MPa)
Bentonite (c)
ranges from: 0.7
to: ca. 70
Source: AECL-7812 (1983), p. 33

Swelling pressure (MPa)
Bentonite (Ca)
ranges from: 31.4
to: -
Source: ONWI-312 (1981), p. 31

Swelling pressure (MPa)
Bentonite (Na) (a)
ranges from: >10
to: -
Source: ONWI-312 (1981), p. 15

Swelling pressure (MPa)
Bentonite (Na) (b)
ranges from: 57.7
to: -
Source: ONWI-312 (1981), p. 31

Swelling pressure (MPa)
Bentonite (Na) (c)
ranges from: 21.7
to: -
Source: ONWI-312 (1981), p. 31

Swelling pressure (MPa)
Bentonite (Na) (d)
ranges from: ca. 72
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Swelling pressure (MPa)
Bentonite (Na) (e)
Wyoming
ranges from: ca. 3
to: ca. 8
Source: AECL-7825 (1984), p. 16

Swelling pressure (MPa)
Bentonite (Na) (f)
Wyoming
ranges from: ca. 2
to: ca. 20
Source: AECL-7825 (1984), p. 16

Swelling pressure (MPa)
Bentonite (Na) (g)
Wyoming
ranges from: 1
to: 8
Source: KBS TEKNISK RAPPORT 74 (1978), p. 6

Swelling pressure (MPa)
Bentonite (Na) (h)
Wyoming
ranges from: 2
to: 23
Source: ONWI-486 (1983), p. 51

Swelling pressure (MPa)
Bentonite (Na) (i)
Wyoming
ranges from: 3
to: 26
Source: ONWI-486 (1983), p. 51

Swelling pressure (MPa)
Bentonite (Na) (j)
Wyoming
ranges from: 3
to: 27
Source: ONWI-486 (1983), p. 51

Swelling pressure (MPa)
Bentonite and Sand (a)
Oregon
ranges from: ca. 0
to: ca. 1.8
Source: RHO-BWI-SA-80 (1981), Fig. 3

Swelling pressure (MPa)
Bentonite and Sand (b)
Wyoming
ranges from: ca. 0
to: ca. 2.2
Source: RHO-BWI-SA-80 (1981), Fig. 3

Swelling pressure (MPa)
Shale
ranges from: 10
to: 0.5
Source: KBS TEKNISK RAPPORT 74 (1978), p. 7

Tensile strength (MPa)
Argillite
ranges from: 3.5
to: -
Source: Proc NEA Workshop OECD (1979b), p. 81

Tensile strength (MPa)
Shale (c)
Ohio
ranges from: 0.34
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Tensile strength (psi)
Shale
Ohio
ranges from: 200 (1.4 MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Tensile strength (psi)
Shale (a)
ranges from: 0 (0 MPa) (?)
to: 1,540 (1.1 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. 2-2

Tensile strength (psi)
Shale (b)
ranges from: 200 (1.4 MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Tensile strength (psi)
Shale (d)
Ohio
ranges from: 50 (3.4 x 10(-1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Tensile strength (psi)
Shale (e)
ranges from: 50 (3.4 x 10(-1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Tensile strength (psi)
Shales
Various
ranges from: <100 (<6.9 x 10(-1) MPa)
to: 1,538 (1.1 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. A-7

Young's modulus (elastic modulus) (MPa)
Clay
Belgium
ranges from: 170
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Young's modulus (elastic modulus) (MPa)
Clay
Italy
ranges from: 300
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Young's modulus (elastic modulus) (psi x 10(6))
Shale
ranges from: 1.48 (1 x 10(4) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 6-3

Young's modulus (elastic modulus) (psi x 10(6))
Shale
Great Plains
ranges from: 0.02 (1.4 x 10(2) MPa)
to: 0.014 (9.6 x 10(1) MPa)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Young's modulus (GPa)
Argillite (a)
ranges from: 3.7 (3.7 x 10(3) MPa)
to: 16 (MPa)
Source: Proc NEA Workshop OECD (1979b), p. 83

Young's modulus (GPa)
Shales (a)
ranges from: 9.9 (9.9 x 10(3) MPa)
to: 31.7 (3.17 x 10(4) MPa)
Source: ORNL-6241/V3 (in preparation) p. 110

Young's modulus (MPa)
Bentonite
ranges from: 300
to: -
Source: ONWI-486 (1983), p. 63

Young's modulus (MPa)
Bentonite and Sand (a)
Oregon
ranges from: ca. 55
to: ca. 80
Source: RHO-BWI-SA-80 (1981), Fig. 5

Young's modulus (MPa)
Bentonite and Sand (b)
Wyoming
ranges from: ca. 45
to: 60
Source: RHO-BWI-SA-80 (1981), Fig. 5

Young's modulus (MPa)
Oil Shales
ranges from: 7,000 (7 x 10(3))
to: 17,500 (1.75 x 10(4))
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Young's modulus (MPa)
Oil Shales
ranges from: >21,000 (>2.1 x 10(4))
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Young's modulus (MPa)
Shale (a)
ranges from: 10
to: 32
Source: ORNL-6241/V1 (in preparation) p. 47

Young's modulus (MPa)
Shale (b)
ranges from: 10
to: 32
Source: ORNL-6241/V1 (in preparation) p. 47

Young's modulus (Pa x 10(10))
Shales (b)
ranges from: 1 (1 x 10(4) MPa)
to: 500 (5 x 10(6) MPa)
Source: ORNL-6241/V2 (In preparation)
p. 199

Young's modulus (psi)
Shale
ranges from: 1.4 x 10(5) (9.7 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Young's modulus (psi)
Shale
Ohio
ranges from: 1.5 x 10(6) (1 x 10(4) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Young's modulus (psi)
Shale
Ohio
ranges from: 1.7 x 10(5) (1.2 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Young's modulus (psi)
Shale (c)
ranges from: 2 x 10(3) (1.4 x 10(1) MPa)
to: 6.4 x 10(6) (4.4 x 10(4) MPa)
Source: Y/OWI/TM36/6 (1978), p. 2-2

Young's modulus (psi)
Shale (d)
ranges from: 1.6 x 10(6) (1.1 x 10(4) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Young's modulus (psi)
Shales (c)
Various
ranges from: 0.0020 x 10(6) (1.4 x 10(1) MPa)
to: 15.0 x 10(6) (1 x 10(5) MPa)
Source: Y/OWI/TM36/6 (1978), p. A-8,9

Young's modulus (unconfined) (GPa)
Argillite (b)
ranges from: 3.74 (3.7 x 10(3) MPa)
to: -
Source: Proc NEA Workshop OECD (1979b),
p. 87

Coefficient of linear expansion (deg C(-1)) (K(-1))
Argillite
ranges from: 8 x 10(-6)
to: 15 x 10(-6)
Source: Proc NEA Workshop OECD (1979b), p. 77

Coefficient of linear thermal expansion (deg F(-1))
Shale (a)
ranges from: 4 x 10(-6) (2.2 x 10(-6) K(-1))
to: -
Source: Y/OWI/TM36/6 (1978), p. 2-2

Coefficient of linear thermal expansion (horizontal) (deg F(-1))
Shale (b)
ranges from: 4.5 x 10(-6) (2.5 x 10(-6) K(-1))
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Coefficient of linear thermal expansion (K(-1))
Shales (a)
ranges from: 2.5 x 10(-6)
to: 15.8 x 10(-6)
Source: ORNL-6241/V3 (in preparation) p. 345

Coefficient of linear thermal expansion (vertical) (deg F(-1))
Shale (c)
ranges from: 9 x 10(-6) (5 x 10(-6) K(-1))
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Coefficient of thermal expansion (K(-1))
Shales (b)
ranges from: 2.9 x 10(-6)
to: 12.9 x 10(-6)
Source: ORNL-6241/V1 (in preparation) p. 47

Heat capacity (BTU/lb-deg F)
Shale
ranges from: 0.20 (8.4 x 10(2) J/Kg-K)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Heat capacity (BTU/lb-deg F)
Shales (a)
ranges from: 0.16 (6.7 x 10(2) J/Kg-K)
to: 0.20 (8.4 x 10(2) J/Kg-K)
Source: Y/OWI/TM36/6 (1978), p. A-19

Heat capacity (J/Kg-K)
Shale (a)
ranges from: 5.5 x 10(2)
to: 1.042 x 10(3)
Source: ORNL-6241/V1 (in preparation) p. 40

Heat capacity (J/Kg-K)
Shale (b)
ranges from: 7.12 x 10(2)
to: 1.170 x 10(3)
Source: ORNL-6241/V3 (in preparation) p. 345

Heat conductivity (millical/cm s deg C) (thermal conductivity)
Clayey Sandstones
ranges from: 2.5 (1.05 W/m-K)
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 23

Heat conductivity (W/m-deg C) (thermal conductivity) (W/m-K)
Bentonite (a)
ranges from: 0.5
to: 2.0
Source: KBS TEKNISK RAPPORT 9 (1977), p. 8

Specific heat (J/Kg-deg C) (specific heat capacity) (J/Kg-K)
Shale (c)
ranges from: 7.96 x 10(2)
to: -
Source: ORNL-6241/V2 (in preparation) p. 57

Specific heat (J/Kg-K) (specific heat capacity)
Clay
Belgium
ranges from: 9.21 x 10(2)
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Specific heat (J/Kg-K) (specific heat capacity)
Clay
Italy
ranges from: 9.21 x 10(2)
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Specific heat (J/Kg-K) (specific heat capacity)
Shales (b)
ranges from: 5.50 x 10(2)
to: 1.042 x 10(3)
Source: ORNL-6241/V3 (in preparation) p. 115

Thermal conductivity (Btu per hr sq ft) (deg F per ft) (?)
Soils
Bristol, VA
ranges from: 0.14
to: 0.60
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Thermal conductivity (Btu per hr sq ft) (deg F per ft) (?)
Soils
Columbus, MS
ranges from: 0.28
to: 2.28
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Thermal conductivity (Btu per hr sq ft) (deg F per ft) (?)
Soils (a)
Cleveland, TN
ranges from: 0.15
to: 0.94
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Thermal conductivity (Btu per hr sq ft) (deg F per ft) (?)
Soils (b)
Murfreesboro, TN
ranges from: 0.21
to: 0.84
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Thermal conductivity (BTU/ft-hr deg F)
Shales (b)
Various
ranges from: 0.34 (5.9 x 10(-1) W/m-K)
to: 1.77 (3.1 W/m-K)
Source: Y/OWI/TM36/6 (1978), p. A-18

Thermal conductivity (horizontal) (BTU/hr-ft-deg F)
Shale (b)
ranges from: 1.1 (1.9 W/m-K)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Thermal conductivity (horizontal) (J/s m-deg C) (W/m-K)
Shale (c)
ranges from: 1.89
to: -
Source: ORNL-6241/V2 (in preparation) p. 99

Thermal conductivity (horizontal) (W/m-K)
Shale (d)
ranges from: 1.52
to: 2.26
Source: ORNL-6241/V1 (in preparation) p. 40

Thermal conductivity (horizontal) (W/m-K)
Shales (a)
ranges from: ca. 1.60
to: ca. 2.20
Source: ORNL-6241/V3 (in preparation) p. 117

Thermal conductivity (k x 10(4)) (?)
Soils
ranges from: 3
to: 5
Source: Y/OWI/SUB-7009/1 (1976), p. 19

Thermal conductivity (k x 10(4)) (?)
Soils
ranges from: 3-4
to: 8-12
Source: Y/OWI/SUB-7009/1 (1976), p. 19

Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
Argillite (a)
ranges from: ca. 1.80
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
Argillite (b)
ranges from: ca. 1.48
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
Clay (a)
Belgium
ranges from: ca. 0.3
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
Shale (I)
ranges from: 0.7 to 2.1
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Thermal conductivity (millical/cm s deg C)
Shale (a)
England
ranges from: 2.2 (9.2 x 10(-1) W/m-K)
to: 5.3 (2.22 W/m-K)
Source: Y/OWI/SUB-7009/1 (1976), p. 26

Thermal conductivity (millical/cm s deg C)
Shale (h)
England
ranges from: 3.0 (1.26 W/m-K)
to: 4.3 (1.80 W/m-K)
Source: Y/OWI/SUB-7009/1 (1976), p. 26

Thermal conductivity (millical/cm s deg C)
Shale (k)
Sunderland, MA
ranges from: 3.87 (1.62 W/m-K)
to: 4.25 (1.78 W/m-K)
Source: Y/OWI/SUB-7009/1 (1976), p. 28

Thermal conductivity (vertical) (BTU/hr-ft-deg F)
Shale (e)
ranges from: 0.8 (1.4 W/m-K)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Thermal conductivity (vertical) (W/m-K)
Shale (f)
ranges from: 1.21
to: 1.57
Source: ORNL-6241/V1 (in preparation) p. 40

Thermal conductivity (vertical) (W/m-K)
Shales
ranges from: 1.21
to: 1.57
Source: ORNL-6241/V3 (in preparation) p. 115

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite (b)
ranges from: ca. 0.75
to: -
Source: Proc NEA Workshop OECD (1979b), p. 148

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite (c)
ranges from: 0.7
to: 3.0
Source: Proc NEA Workshop OECD (1981), p. 342

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite (Ca)
ranges from: 0.71
to: 1.10
Source: PNL-4452 UC-70 (1983), p. 20

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite (d)
ranges from: 0.5
to: 1.0
Source: Proc NEA Workshop OECD (1981), p. 342

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite (e)
ranges from: 0.9
to: 1.3
Source: ONWI-486 (1983), p. 63

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite (f)
ranges from: 1
to: 3.5
Source: ONWI-486 (1983), p. 63

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite (g)
Wyoming
ranges from: ca. 0.0
to: ca. 1.2
Source: Proc NEA Workshop OECD (1981), p. 334

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite (h)
Wyoming
ranges from: 0.78
to: -
Source: ONWI-486 (1983), p. 61

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite (Na)
ranges from: 0.52
to: 0.96
Source: PNL-4452 UC-70 (1983), p. 20

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite and Crushed Granite (a)
Wyoming
ranges from: 2.7
to: 0.8
Source: Proc NEA Workshop OECD (1981), p. 334

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite and Crushed Granite (b)
Wyoming
ranges from: ca. 0.6
to: ca. 1.5
Source: Proc NEA Workshop OECD (1981), p. 334

Thermal conductivity (W/m-deg C) (W/m-K)
Bentonite and Sand (a)
ranges from: 0.5
to: 2.0
Source: ONWI-486 (1983), p. 63

Thermal conductivity (W/m-deg C) (W/m-K)
Clay
S. Paolo mine
ranges from: 0.014 (1.4 W/m-K)
to: 0.016 (1.6 W/m-K)
Source: ORNL-tr-5110 (1981), p. 12

Thermal conductivity (W/m-deg C) (W/m-K)
Hectorite
ranges from: 0.5
to: 2 to 3
Source: ONWI-312 (1981), p. 18

Thermal conductivity (W/m-deg C) (W/m-K)
Illite (a)
ranges from: ca. 0.6
to: ca. 1.6
Source: Proc NEA Workshop OECD (1981), p. 336

Thermal conductivity (W/m-deg C) (W/m-K)
Illite (b)
ranges from: 1.4
to: 4.0
Source: Proc NEA Workshop OECD (1981), p. 342

Thermal conductivity (W/m-deg C) (W/m-K)
Illite (c)
ranges from: 0.8
to: 1.8
Source: Proc NEA Workshop OECD (1981), p. 342

Thermal conductivity (W/m-deg C) (W/m-K)
Illite and Crushed Granite
ranges from: ca. 0.9
to: ca. 1.9
Source: Proc NEA Workshop OECD (1981), p. 336

Thermal conductivity (W/m-deg C) (W/m-K)
Kaolinite (a)
ranges from: 1.7
to: 3.5
Source: Proc NEA Workshop OECD (1981), p. 342

Thermal conductivity (W/m-deg C) (W/m-K)
Kaolinite (b)
ranges from: 0.9
to: 2.0
Source: Proc NEA Workshop OECD (1981), p. 342

Thermal conductivity (W/m-deg C) (W/m-K)
Kaolinite and Crushed Granite
ranges from: 3.4
to: 2.3
Source: Proc NEA Workshop OECD (1981), p. 334

Thermal conductivity (W/m-deg C) (W/m-K)
Silt/Clay Soil (a)
ranges from: 0.8
to: 2.0
Source: ONWI-486 (1983), p. 54

Thermal conductivity (W/m-deg C) (W/m-K)
Silt/Clay Soil (b)
ranges from: 0.4
to: 0.85
Source: ONWI-486 (1983), p. 54

Thermal conductivity (W/m-deg C) (W/m-K)
Silt/Clay Soil (c)
ranges from: 0.5
to: 1.1
Source: ONWI-486 (1983), p. 54

Thermal conductivity (W/m-deg C) (W/m-K)
Silt/Clay Soil (d)
ranges from: 0.6
to: 1.3
Source: ONWI-486 (1983), p. 54

Thermal conductivity (W/m-deg C) (W/m-K)
Silt/Clay Soil (e)
ranges from: 0.7
to: 1.5
Source: ONWI-486 (1983), p. 54

Thermal conductivity (W/m-deg C) (W/m-K)
Silt/Clay Soil (f)
ranges from: 0.75
to: 1.75
Source: ONWI-486 (1983), p. 54

Thermal conductivity (W/m-K)
Argillite (c)
Nevada
ranges from: 1.28
to: 2.7
Source: ORNL-6241/V3 (in preparation) p. 341, 342

Thermal conductivity (W/m-K)
Bentonite and Salt (a)
ranges from: 1.12
to: 0.99
Source: ONWI-486 (1983), p. 53

Thermal conductivity (W/m-K)
Bentonite and Salt (b)
ranges from: 1.01
to: 1.12
Source: ONWI-486 (1983), p. 53

Thermal conductivity (W/m-K)
Bentonite and Sand (b)
ranges from: 0.58-0.80
to: 1.06-1.17
Source: ONWI-486 (1983), p. 53

Thermal conductivity (W/m-K)
Clay
England
ranges from: 1.56
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Thermal conductivity (W/m-K)
Clay
Italy
ranges from: 1.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Thermal conductivity (W/m-K)
Clay (b)
Belgium
ranges from: 1.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Thermal conductivity (W/m-K)
Shale
ranges from: 1.42
to: 1.94
Source: ORNL-6241/V3 (in preparation) p. 341

Thermal conductivity (W/m-K)
Shale
Kansas
ranges from: 0.7
to: 4.3
Source: ORNL-6241/V3 (in preparation) p. 343

Thermal conductivity (W/m-K)
Shale
Michigan
ranges from: 2.64
to: -
Source: ORNL-6241/V3 (in preparation) p. 341

Thermal conductivity (W/m-K)
Shale
Orange Free State
ranges from: 1.97
to: 2.89
Source: ORNL-6241/V3 (in preparation)
p. 341

Thermal conductivity (W/m-K)
Shale
South Africa
ranges from: 2.76
to: -
Source: ORNL-6241/V3 (in preparation)
p. 343

Thermal conductivity (W/m-K)
Shale (i)
England
ranges from: 1.26
to: 1.80
Source: ORNL-6241/V3 (in preparation)
p. 341

Thermal conductivity (W/m-K)
Shale (j)
Massachusetts
ranges from: 1.62
to: -
Source: ORNL-6241/V3 (in preparation)
p. 341

Thermal conductivity (W/m-K)
Shale (m)
ranges from: 0.715
to: 2.20
Source: ORNL-6241/V3 (in preparation)
p. 340

Thermal conductivity (W/m-K)
Shale (n)
ranges from: 1.38
to: 1.9
Source: ORNL-6241/V3 (in preparation)
p. 341

Thermal conductivity (W/m-K)
Shales
ranges from: 1.47
to: 2.00
Source: ORNL-6241/V3 (in preparation)
p. 340

Thermal conductivity (W/m-K)
Shales
California
ranges from: 0.99 +/- 0.3
to: 1.63 +/- 0.3
Source: ORNL-6241/V3 (in preparation)
p. 341

Thermal conductivity ratio (vertical/
horizontal)
Shale (g)
ranges from: 0.76
to: -
Source: ORNL-6241/V2 (in preparation)
p. 99

Thermal diffusivity (cm(2)/h)
Clay
S. Paolo mine
ranges from: 20 (5.56 x 10(-7) m(2)/s)
to: -
Source: ORNL-tr-5110 (1981), p. 12

Thermal diffusivity (cm(2)/s x 10(3))
Bentonite (Na)
ranges from: 3.03 (3.03 x 10(-7) m(2)/s)
to: 3.47 (3.47 x 10(-7) m(2)/s)
Source: PNL-4452 UC-70 (1983), p. 18, 19

Thermal diffusivity (ft(2) per hr)
Soils
Bristol, VA
ranges from: 0.0090 (2.3 x 10(-7) m(2)/s)
to: 0.016 (4.13 x 10(-7) m(2)/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Thermal diffusivity (ft(2) per hr)
Soils
Columbus, MS
ranges from: 0.016 (4.13 x 10(-7) m(2)/s)
to: 0.046 (1.19 x 10(-7) m(2)/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Thermal diffusivity (ft(2) per hr)
Soils (a)
Cleveland, TN
ranges from: 0.0115 (2.97 x 10(-7) m(2)/s)
to: 0.022 (5.68 x 10(-7) m(2)/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Thermal diffusivity (ft(2) per hr)
Soils (b)
Murfreesboro, TN
ranges from: 0.0145 (3.74 x 10(-7) m(2)/s)
to: 0.0235 (6.06 x 10(-7) m(2)/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Thermal diffusivity (m(2)/s)
Clay
Belgium
ranges from: 8.1 x 10(-7)
to: -
Source: Rad Waste Management and Nuclear
Fuel Cycle v. 6 (1985), p. 54

Thermal diffusivity (m(2)/s)
Clay
Italy
ranges from: 7.8 x 10(-7)
to: -
Source: Rad Waste Management and Nuclear
Fuel Cycle v. 6 (1985), p. 54

13.3 Appendix C. MATERIALS

Allophane
Ion exchange capacity (meq/100 g)
ranges from: 70
to: -
Source: ORNL-6241/V2 (In preparation) p. 152

Argillite
Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 1 x 10(5)
Source: ONWI-486 (1983), p. 73

Attapulgite
Sorption coefficient (Kd) (ml/g)
ranges from: 1 x 10(-2)
to: 2 x 10(4)
Source: ONWI-486 (1983), p. 73

Bentonite
Diffusivity (m(2)/s)
ranges from: 1.3 x 10(-10)
to: -
Source: ONWI-312 (1981), p. 14

Bentonite
Ion exchange capacity (meq/100 g)
ranges from: 0.1
to: 100
Source: NUREG/CP-0052 (1983), p. 181

Bentonite
Sorption coefficient (Kd) (ml/g?)
ranges from: 1
to: 2 x 10(5)
Source: Proc NEA Workshop OECD (1979a), p. 304

Bentonite (Ca)
Sorption coefficient (Kd) (ml/g)
ranges from: 2.5 x 10(4)
to: 1.1 x 10(5)
Source: ONWI-312 (1981), p. 35

Bentonite (Ca)
Sorption coefficient (Kd) (ml/g)
ranges from: 2.5
to: 3.2
Source: ONWI-312 (1981), p. 35

Bentonite (Ca)
Sorption coefficient (Kd) (ml/g)
ranges from: 1.2 x 10(3)
to: 865
Source: ONWI-312 (1981), p. 35

Bentonite (Na)
Sorption coefficient (Kd) (ml/g)
ranges from: 5.0 x 10(3)
to: 6.8 x 10(3)
Source: ONWI-312 (1981), p. 35

Bentonite (Na)
Sorption coefficient (Kd) (ml/g)
ranges from: 0.4
to: 8.6
Source: ONWI-312 (1981), p. 35

Bentonite (Na)
Sorption coefficient (Kd) (ml/g)
ranges from: 1.1 x 10(3)
to: 1.0 x 10(3)
Source: ONWI-312 (1981), p. 35

Bentonite (Na)
Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 4 x 10(4)
Source: ONWI-486 (1983), p. 73

Bentonite (Na) (a)
Wyoming
Ion exchange capacity (meq/100 g)
ranges from: 68.6
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) (Accofloc-350)
Sorption coefficient (Kd) (ml/g)
ranges from: 1.3 x 10(3)
to: 1.1 x 10(3)
Source: ONWI-312 (1981), p. 35

Bentonite (Na) (Accofloc-350)
Sorption coefficient (Kd) (ml/g)
ranges from: 1.2
to: 0.1
Source: ONWI-312 (1981), p. 35

Bentonite (Na) (Accofloc-350)
Sorption coefficient (Kd) (ml/g)
ranges from: 1.5 x 10(3)
to: 1.5 x 10(3)
Source: ONWI-312 (1981), p. 35

Bentonite (Na) (b)
Wyoming
Ion exchange capacity (meq/100 g)
ranges from: 34.3
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) (Saline Seal-100)
Sorption coefficient (Kd) (ml/g)
ranges from: 2.6 x 10(3)
to: 3.8 x 10(3)
Source: ONWI-312 (1981), p. 35

Bentonite (Na) (Saline Seal-100)
Sorption coefficient (Kd) (ml/g)
ranges from: 2.8
to: 3.6
Source: ONWI-312 (1981), p. 35

Bentonite (Na) (Saline Seal-100)
Sorption coefficient (Kd) (ml/g)
ranges from: 1.2 x 10(3)
to: 1.5 x 10(3)
Source: ONWI-312 (1981), p. 35

Bentonite and Quartz
Sorption coefficient (Kd) (ml/g)
ranges from: <1
to: 1 x 10(4)
Source: ONWI-486 (1983), p. 73

Bentonite and Sand
Sorption coefficient (Kd) (ml/g)
ranges from: 490
to: 9.5 x 10(3)
Source: ONWI-486 (1983), p. 73

Chlorite (a)
Ion exchange capacity (meq/100 g)
ranges from: 10-40
to: -
Source: ONWI-486 (1983), p. 67

Chlorite (b)
Ion exchange capacity (meq/100 g)
ranges from: 10
to: 40
Source: ORNL-6241/V2 (in preparation) p. 152

Clay
Belgium
Ion exchange capacity (meq/100 g)
ranges from: ca. 20
to: -
Source: Proc NEA Workshop OECD (1979a), p. 88

Clay
Belgium
Sorption coefficient (Kd) (ml/g?)
ranges from: 0.87
to: 6.12
Source: Proc NEA Workshop OECD (1979a), p. 97

Clay (Na)
Belle Fourch
Sorption coefficient (Kd) (ml/g)
ranges from: 5.6
to: 5.7 x 10(3)
Source: ONWI-486 (1983), p. 73

Glauconite
Ion exchange capacity (meq/100 g)
ranges from: 11
to: 20
Source: ORNL-6241/V2 (in preparation) p. 152

Halloysite
Ion exchange capacity (meq/100 g)
ranges from: 5
to: 10
Source: ORNL-6241/V2 (in preparation) p. 152

Hectorite
Sorption coefficient (Kd) (ml/g)
ranges from: 0.4
to: 7.2 x 10(3)
Source: ONWI-486 (1983), p. 73

Hectorite and Sand
Sorption coefficient (Kd) (ml/g)
ranges from: 400
to: 1300
Source: ONWI-486 (1983), p. 73

Illite
Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.9
to: -
Source: AECL-7812 (1983), p. 25

Illite
Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.005
to: 0.02
Source: AECL-7812 (1983), p. 25

Illite
Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.045
to: 0.090
Source: AECL-7825 (1984), p. 25

Illite
Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 3 x 10(5)
Source: ORNL-6241/V2 (in preparation) p. 132-133

Illite
Sorption coefficient (Kd) (ml/g?)
ranges from: 1
to: 3 x 10(6)
Source: Proc NEA Workshop OECD (1979a), p. 304

Illite (a)
Ion exchange capacity (meq/100 g)
ranges from: 10
to: 40
Source: ONWI-486 (1983), p. 67

Illite (b)
Ion exchange capacity (meq/100 g)
ranges from: 16
to: 50
Source: ORNL-6241/V2 (in preparation) p. 152

Kaolinite
Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.003
to: 0.006
Source: AECL-7812 (1983), p. 25

Kaolinite
Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.002
to: 0.04
Source: AECL-7812 (1983), p. 25

Kaolinite
Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.02
to: -
Source: AECL-7812 (1983), p. 25

Kaolinite
Sorption coefficient (Kd) (ml/g)
ranges from: 0.1
to: 1.6 x 10(3)
Source: ONWI-486 (1983), p. 73

Kaolinite
Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 3 x 10(5)
Source: ORNL-6241/V2 (in preparation) p. 132-133

Kaolinite
Sorption coefficient (Kd) (ml/g?)
ranges from: 1
to: 2 x 10(4)
Source: Proc NEA Workshop OECD (1979a), p. 304

Kaolinite (a)
Georgia
Batch distribution ratio (Rd) (ml/g?)
ranges from: 1.28 x 10(2)
to: 9.22 x 10(2)
Source: PNL-4452 UC-70 (1983), p. 18

Kaolinite (a)
Ion exchange capacity (meq/100 g)
ranges from: 3
to: 15
Source: ONWI-486 (1983), p. 67

Kaolinite (b)
Georgia
Batch distribution ratio (Rd) (ml/g?)
ranges from: 1.88 x 10(2)
to: 9.0 x 10(3)
Source: PNL-4452 UC-70 (1983), p. 18

Kaolinite (b)
Ion exchange capacity (meq/100 g)
ranges from: 2
to: 15
Source: ORNL-6241/V2 (in preparation) p. 152

Kaolinite (Ca)
Sorption coefficient (Kd) (Log) (ml/g?)
ranges from: ca. 2.3
to: ca. 1.5
Source: Proc NEA Workshop OECD (1979a), p. 282

Kaolinite (Ca)
Sorption coefficient (Kd) (Log) (ml/g?)
ranges from: ca. 1.3
to: ca. (-1)
Source: Proc NEA Workshop OECD (1979a), p. 282

Kaolinite (Na)
Sorption coefficient (Kd) (Log) (ml/g?)
ranges from: ca. 2.3
to: ca. 1.3
Source: Proc NEA Workshop OECD (1979a), p. 282

Kaolinite (Na)
Sorption coefficient (Kd) (Log) (ml/g?)
ranges from: >2
to: <0
Source: Proc NEA Workshop OECD (1979a), p. 282

Nontronite
Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 2.25 x 10(5)
Source: ONWI-486 (1983), p. 73

Palygorskite
Ion exchange capacity (meq/100 g)
ranges from: 20
to: 30
Source: ORNL-6241/V2 (in preparation) p. 152

Shale
Sorption coefficient (Kd) (ml/g)
ranges from: 57
to: 100
Source: ONWI-486 (1983), p. 73

Shale
Sorption coefficient (Kd) (ml/g)
ranges from: 200
to: 1.4 x 10(4)
Source: ONWI-486 (1983), p. 73

Smectite
Arizona
Batch distribution ratio (Rd) (ml/g?)
ranges from: 8.15 x 10(2)
to: 2.7 x 10(3)
Source: PNL-4452 UC-70 (1983), p. 18

Smectite
Texas
Batch distribution ratio (Rd) (ml/g?)
ranges from: 1.4 x 10(3)
to: 1.9 x 10(3)
Source: PNL-4452 UC-70 (1983), p. 18

Smectite
Wyoming
Batch distribution ratio (Rd) (ml/g?)
ranges from: 1.0 x 10(3)
to: 2.0 x 10(3)
Source: PNL-4452 UC-70 (1983), p. 18

Smectite
Ion exchange capacity (meq/100 g)
ranges from: 80
to: 150
Source: ONWI-486 (1983), p. 67

Smectite
Sorption coefficient (Kd) (cm(3)/g) (ml/g)
ranges from: ca. 188
to: ca. 200
Source: NUREG/CP-0052 (1983), p. 186

Smectite
Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.06
to: 0.7
Source: AECL-7812 (1983), p. 25

Smectite
Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.034
to: 0.65
Source: AECL-7812 (1983), p. 25

Smectite
Sorption coefficient (Kd) (m(3)/kg) (?)
ranges from: 0.030
to: 0.6
Source: AECL-7812 (1983), p. 25

Smectite
Sorption coefficient (Kd) (ml/g)
ranges from: 0
to: 4 x 10(5)
Source: ORNL-6241/V2 (in preparation) p. 132-133

Smectite
Arizona
Sorption coefficient (Kd) (ml/g)
ranges from: 260
to: 750
Source: ONWI-486 (1983), p. 73

Smectite
Texas
Sorption coefficient (Kd) (ml/g)
ranges from: 310
to: 685
Source: Sci Basis for Waste Management - V (1982), p. 638

Smectite
Texas
Sorption coefficient (Kd) (ml/g)
ranges from: 410
to: 400
Source: Sci Basis for Waste Management - V (1982), p. 638

Smectite
Texas
Sorption coefficient (Kd) (ml/g)
ranges from: 310
to: 370
Source: Sci Basis for Waste Management - V (1982), p. 638

Smectite
Wyoming
Sorption coefficient (Kd) (ml/g)
ranges from: 170
to: 200
Source: Sci Basis for Waste Management - V (1982), p. 638

Smectite
Sorption coefficient (ml/g)
ranges from: 200
to: 2,000
Source: ONWI-312 (1981), p. 13

Smectite (Ca)
Ion exchange capacity (meq/100 g)
ranges from: 80
to: 150
Source: ORNL-6241/V2 (in preparation) p. 152

Smectite (Ca)
Ion exchange capacity (meq/g) (?)
ranges from: 93
to: 12
Source: ONWI-312 (1981), p. 24

Smectite (Ca)
Sorption coefficient (Kd) (ml/g)
ranges from: 0.4
to: 1.1 x 10(4)
Source: ONWI-486 (1983), p. 73

Smectite (Li)
Ion exchange capacity (meq/g) (?)
ranges from: 56
to: 20
Source: ONWI-312 (1981), p. 24

Smectite (Na)
Ion exchange capacity (meq/100 g)
ranges from: 100
to: 150
Source: ORNL-6241/V2 (in preparation) p. 152

Smectite (Na)
Ion exchange capacity (meq/g) (?)
ranges from: 95
to: 68
Source: ONWI-312 (1981), p. 24

Smectite (Na)
Sorption coefficient (Kd) (ml/g)
ranges from: 0.2
to: 1 x 10(5)
Source: ONWI-486 (1983), p. 73

Vermiculite
Sorption coefficient (Kd) (ml/g)
ranges from: 47
to: 1.5 x 10(3)
Source: ONWI-486 (1983), p. 73

Vermiculite
South Carolina
Sorption coefficient (Kd) (ml/g)
ranges from: 8.9 x 10(2)
to: 1.01 x 10(4)
Source: Sci Basis for Waste Management - V (1982), p. 638

Vermiculite
South Carolina
Sorption coefficient (Kd) (ml/g)
ranges from: 2 x 10(3)
to: 9.8 x 10(2)
Source: Sci Basis for Waste Management - V (1982), p. 638

Vermiculite
Sorption coefficient (Kd) (ml/g?)
ranges from: ca. 40
to: 4 x 10(4)
Source: Proc NEA Workshop OECD (1979), p. 315

Vermiculite
Sorption coefficient (Kd) (ml/g?)
ranges from: 30
to: 4 x 10(6)
Source: Proc NEA Workshop OECD (1979a), p. 304

Vermiculite (a)
Ion exchange capacity (meq/100 g)
ranges from: 100
to: 150
Source: ONWI-486 (1983), p. 67

Vermiculite (b)
Ion exchange capacity (meq/100 g)
ranges from: 100
to: 150+
Source: ORNL-6241/V2 (in preparation) p. 152

Vermiculite and Gibbsite
Sorption coefficient (Kd) (ml/g)
ranges from: 77
to: 1520
Source: ONWI-486 (1983), p. 73

Vermiculite and Shale
Sorption coefficient (Kd) (ml/g)
ranges from: 41
to: 1340
Source: ONWI-486 (1983), p. 73

Vermiculite and Smectite
Sorption coefficient (Kd) (ml/g)
ranges from: 192
to: 3800
Source: ONWI-486 (1983), p. 73

Vermiculite and Zeolite (various)
Sorption coefficient (Kd) (ml/g)
ranges from: 130
to: 5.92 x 10(5)
Source: ONWI-486 (1983), p. 73

Argillite
Nevada
Density (bulk) (g/cm(3))
ranges from: 2.44
to: 2.71
Source: ORNL/Sub/84-64794/1 (1985), p. 406

Argillite
Nevada
Moisture content (%)
ranges from: 2
to: 4
Source: ORNL/Sub/84-64794/1 (1985), p. 406

Argillite
Nevada
Porosity (%)
ranges from: 8 to 16
to: 6 to 12
Source: ORNL/Sub/84-64794/1 (1985), p. 406

Bentonite (a)
Density (bulk) (t/m(3)) (g/cm(3))
ranges from: ca. 2.1
to: -
Source: Proc NEA Workshop OECD (1979b), p. 148

Bentonite (a)
Specific gravity (dimensionless)
ranges from: 2.21
to: -
Source: Proc NEA Workshop OECD (1981), p. 340

Bentonite (a)
Oregon
Specific gravity (g/cm(3))
ranges from: 2.73
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (b)
Black Hills
Specific gravity (dimensionless)
ranges from: 2.18
to: -
Source: Proc NEA Workshop OECD (1981), p. 340

Bentonite (b)
Oregon
Specific gravity (g/cm(3))
ranges from: 2.85
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (c)
Wyoming
Specific gravity (g/cm(3))
ranges from: 2.77
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (Ca)
Density (g/cm(3))
ranges from: <1.7
to: ca. 2.14
Source: PNL-4452 UC-70 (1983), p. 24

Bentonite (Na)
Wyoming
Density (specific) (t/m(3)) (g/cm(3))
ranges from: 2.7
to: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 3

Bentonite (Na)
Wyoming
Specific gravity (dimensionless)
ranges from: 2.66
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na)
Specific surface (m(2)/g)
ranges from: 519
to: 615
Source: AECL-7825 (1984), p. 12

Bentonite (Na) (a)
Density (bulk) (t/m(3)) (g/cm(3))
ranges from: 1.8
to: 2.0
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Bentonite (Na) (a)
Density (g/cm(3))
ranges from: <1.8
to: 2.28
Source: ONWI-312 (1981), p. 32

Bentonite (Na) (b)
Density (bulk) (t/m(3)) (g/cm(3))
ranges from: 1.4
to: 1.7
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Bentonite (Na) (b)
Density (g/cm(3))
ranges from: <1.8
to: ca. 2.5
Source: PNL-4452 UC-70 (1983), p. 21

Bentonite (Na) (c)
Wyoming
Density (bulk) (rho x t/m(3)) (g/cm(3))
ranges from: 2.54
to: 1.08
Source: KBS TEKNISK RAPPORT 74 (1978), p. 4

Bentonite (Na) and Sand
Wyoming
Specific gravity (dimensionless)
ranges from: 2.635
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) and Sand
Specific surface (m(2)/g)
ranges from: 284
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) and Sand (a)
Density (g/cm(3))
ranges from: <1.9
to: ca. 2.8
Source: PNL-4452 UC-70 (1983), p. 22

Bentonite (Na) and Sand (b)
Density (g/cm(3))
ranges from: <1.9
to: ca. 2.7
Source: PNL-4452 UC-70 (1983), p. 23

Bentonite and Sand
Density (dry) (Mg/m(3)) (g/cm(3))
ranges from: 1.81
to: 1.4
Source: AECL-7812 (1983), p. 31

Bentonite and Sand
Moisture content (%)
ranges from: 13
to: 22
Source: AECL-7812 (1983), p. 31

Bentonite and Sand
Porosity (effective) (units not stated)
ranges from: ca 0.4
to: 0.002
Source: AECL-7812 (1983), p. 32

Chlorite
Density (dry) (presumed g/cm(3))
ranges from: 2.6
to: 2.96
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Clay
Belgium
Density (bulk) (kg/m(3))
ranges from: 2010 (2.010 g/cm(3))
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Clay
England
Density (bulk) (kg/m(3))
ranges from: 2210 (2.210 g/cm(3))
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Clay
Italy
Density (bulk) (kg/m(3))
ranges from: 2100 (2.100 g/cm(3))
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Clay
Louisiana
Density (kg/m(3))
ranges from: 1,954 (1.954 g/cm(3))
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Clay
Belgium
Porosity (%)
ranges from: 38.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Clay
England
Porosity (%)
ranges from: 30
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Clay
Italy
Porosity (%)
ranges from: 25
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Clay
Hanford
Specific gravity (g/cm(3))
ranges from: 2.71
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Clay and Sand
Density (dry) (kg/mg(3)) (?) (g/cm(3)) (?)
ranges from: ca. 1.6
to: ca. 2.2
Source: RHO-BWI-SA-80 (1981), p. 6

Clays
Void ratio (dimensionless)
ranges from: ca. 1.5 to 3.0
to: ca. 0.5 to 0.6
Source: ONWI-312 (1981), p. 21

Clays and Shales
Eastern US
Density (grain) (average) (presumed g/cm(3))
ranges from: 2.69
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Illite
Density (presumed g/cm(3))
ranges from: 2.65
to: 2.13
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Illite
Porosity (effective) (units not stated)
ranges from: ca. 0.5
to: ca. 0.002
Source: AECL-7812 (1983), p. 32

Illite and Smectite
Density (presumed g/cm(3))
ranges from: 2.64
to: 1.48
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Kaolinite
Density (dry) (Mg/m(3)) (g/cm(3))
ranges from: ca. 1.2
to: ca. 1.5
Source: AECL-7812 (1983), p. 35

Kaolinite
Density (presumed g/cm(3))
ranges from: 2.60 - 2.68
to: 2.43
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Kaolinite
Porosity (effective) (units not stated)
ranges from: ca. 0.5
to: ca. 0.002
Source: AECL-7812 (1983), p. 32

Kaolinite
Specific gravity (dimensionless)
ranges from: 2.60
to: -
Source: Proc NEA Workshop OECD (1981), p. 340

Kaolinite (Ca)
Void ratio (dimensionless)
ranges from: 2.5
to: 1.0
Source: ONWI-486 (1983), p. 38

Kaolinite (Na)
Void ratio (dimensionless)
ranges from: 2.5
to: 1.0
Source: ONWI-486 (1983), p. 38

Kaolinite and Sand
Density (dry) (Mg/m(3)) (g/cm(3))
ranges from: 2.05
to: 1.45
Source: AECL-7812 (1983), p. 31

Kaolinite and Sand
Moisture content (%)
ranges from: 10
to: 30
Source: AECL-7812 (1983), p. 31

Oil Shales
Density (bulk) (presumed g/cm(3))
ranges from: 1.506
to: 2.37
Source: Y/OWI/SUB-7009/1 (1976), p. 13

Shale
Illinois, Indiana and Kentucky
Density (bulk) (average) (g/cm(3))
ranges from: 2.36
to: 2.53
Source: ORNL-5703 (1983), p. 76

Shale
Michigan
Density (bulk) (g/cm(3))
ranges from: 2.2
to: 2.8
Source: ORNL/Sub/84-64794/1 (1985), p. 96

Shale
Ohio
Density (bulk) (g/cm(3))
ranges from: 2.65
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Shale
Montana
Density (dry) (average) (lbs/ft(3))
ranges from: 118 (1.890 g/cm(3))
to: -
Source: Y/OWI/TM36/6, p. 6-1

Shale
Northern Great Plains
Density (dry) (lb/cu ft)
ranges from: 95 (1.522 g/cm(3))
to: 110 (1.762 g/cm(3))
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale
California
Density (presumed g/cm(3))
ranges from: 2.5
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 12

Shale
Montana
Density (wet) (average) (pounds/ft(3))
ranges from: 135 (2.162 g/cm(3))
to: -
Source: Y/OWI/TM36/6, p. 6-1

Shale
New Mexico
Moisture content (%)
ranges from: 3.7
to: 6.2
Source: Y/OWI/TM36/6, p. 8-5

Shale
Ohio
Moisture content (natural) (%)
ranges from: 2
to: -
Source: Y/OWI/TM36/6, p. 5-14

Shale
Ohio
Moisture content (natural) (%)
ranges from: 4
to: -
Source: Y/OWI/TM36/6, p. 4-12

Shale
New Mexico
Moisture content (rock) (%)
ranges from: 3
to: 11
Source: Y/OWI/TM36/6, p. 8-3

Shale
Porosity (%)
ranges from: 33
to: -
Source: Y/OWI/TM36/6, p. 3-24

Shale
Colorado
Porosity (%)
ranges from: 4.1
to: 5.1
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Shale
Tennessee
Porosity (%)
ranges from: 0.5
to: 1.9
Source: ORNL-6241/V2 (in preparation)
p. 219

Shale
Ohio
Porosity (effective) (%)
ranges from: 4
to: -
Source: Y/OWI/TM36/6, p. 5-14

Shale
Porosity (effective) (units not stated)
ranges from: 0.05
to: 0.005
Source: ORNL-6241/V1 (in preparation)
p. 33

Shale
South Carolina
Porosity (effective) (units not stated)
ranges from: 0.005
to: -
Source: ORNL-6241/V2 (in preparation)
p. 52

Shale
Ohio
Porosity (primary) (%)
ranges from: >3 %
to: -
Source: ORNL/Sub/84-64794/1 (1985),
p. 108

Shale
Porosity (rock mass) (%)
ranges from: 3.0
to: -
Source: Y/OWI/TM36/6, p. 7-8

Shale
Ohio
Porosity (rock mass) (%)
ranges from: 8
to: -
Source: Y/OWI/TM36/6, p. 4-12

Shale
Porosity (total) (units not stated)
ranges from: 0.1
to: 0.01
Source: ORNL-6241/V1 (in preparation)
p. 33

Shale
Great Britain
Porosity (total) (units not stated)
ranges from: 0.020
to: 0.101
Source: ORNL-6241/V2 (in preparation)
p. 52

Shale
Illinois, Indiana, Kentucky
Porosity (total) (units not stated)
ranges from: 0.009
to: 0.046
Source: ORNL-6241/V2 (in preparation)
p. 52

Shale
Kansas
Porosity (total) (units not stated)
ranges from: 0.073
to: 0.106
Source: ORNL-6241/V2 (in preparation)
p. 52

Shale
Kentucky
Porosity (total) (units not stated)
ranges from: 0.074
to: 0.076
Source: ORNL-6241/V2 (in preparation)
p. 52

Shale
Michigan
Porosity (total) (units not stated)
ranges from: 0.03
to: 0.10
Source: ORNL-6241/V2 (in preparation)
p. 52

Shale
Missouri
Porosity (total) (units not stated)
ranges from: 0.113
to: -
Source: ORNL-6241/V2 (in preparation)
p. 52

Shale
Pennsylvania
Porosity (total) (units not stated)
ranges from: 0.010
to: -
Source: ORNL-6241/V2 (in preparation)
p. 52

Shale
    Tennessee
Porosity (total) (units not stated)
    ranges from: 0.005
        to: 0.019
    Source: ORNL-6241/V2 (in preparation)
        p. 52

Shale
    Utah
Porosity (total) (units not stated)
    ranges from: 0.009
        to: -
    Source: ORNL-6241/V2 (in preparation)
        p. 52

Shale
    Michigan
Specific surface (m(2)/g)
    ranges from: 0.05
        to: 1.2
    Source: ORNL-5703 (1983), p. 109

Shale
    Montana
Water content (average) (%)
    ranges from: 15
        to: -
    Source: Y/OWI/TM36/6, p. 6-1

Shale (a)
Density (bulk) (presumed g/cm(3))
    ranges from: 2.1
        to: 2.5
    Source: Y/OWI/SUB-7009/1 (1976), p. 12

Shale (a)
Density (kg/m(3))
    ranges from: 2,123 (2.123 g/cm(3))
        to: 3,003 (3.003 g/cm(3))
    Source: ORNL-6241/V1 (in preparation)
        p. 40

Shale (a)
Moisture content (natural) (%)
    ranges from: 0
        to: 38
    Source: Y/OWI/TM36/6, p. 2-2

Shale (a)
Porosity (%)
    ranges from: 30
        to: 5 to 10
    Source: ORNL-6241/V2 (in preparation)
        p. 218

Shale (a)
    Michigan
Porosity (%)
    ranges from: 3
        to: 10
    Source: ORNL-5703 (1983), p. 106

Shale (a)
    Illinois, Indiana and Kentucky
Porosity (average) (vol. %)
    ranges from: 0.95
        to: 4.64
    Source: ORNL-5703 (1983), p. 76

Shale (a)
Porosity (effective) (units not stated)
    ranges from: 0.01
        to: -
    Source: ORNL-6241/V2 (in preparation)
        p. 99

Shale (a)
Porosity (total) (units not stated)
    ranges from: 0.03
        to: -
    Source: ORNL-6241/V2 (in preparation)
        p. 99

Shale (b)
Density (grain) (average) (presumed g/cm(3))
    ranges from: 2.71
        to: -
    Source: Y/OWI/SUB-7009/1 (1976), p. 10

Shale (b)
Density (kg/m(3))
    ranges from: 2,563 (2.563 g/cm(3))
        to: -
    Source: ORNL-6241/V2 (in preparation)
        p. 99

Shale (b)
Moisture content (natural) (%)
    ranges from: 1.5
        to: -
    Source: Y/OWI/TM36/6, p. 7-8

Shale (b)
    Illinois, Indiana, Kentucky
Porosity (%)
    ranges from: 0.95
        to: 4.64
    Source: ORNL/Sub/84-64794/1 (1985),
        p. 85

Shale (b)
    Michigan
Porosity (%)
    ranges from: 3
        to: 10
    Source: ORNL/Sub/84-64794/1 (1985),
        p. 98

Shale (b)
Porosity (rock mass) (%)
    ranges from: 0
        to: 45
    Source: Y/OWI/TM36/6, p. 2-2

Shale (b)
Porosity (total) (units not stated)
    ranges from: 0.03
        to: -
    Source: ORNL-6241/V2 (in preparation)
        p. 52

Shale (c)
Density (presumed g/cm(3))
    ranges from: 2.4
        to: -
    Source: Y/OWI/SUB-7009/1 (1976), p. 8

Shale (c)
Moisture content (natural) (%)
ranges from: 18
to: -
Source: Y/OWI/TM36/6, p. 3-24

Shale (c)
Porosity (total) (units not stated)
ranges from: 0.003
to: 0.056
Source: ORNL-6241/V2 (in preparation) p. 52

Shale (d)
Density (presumed g/cm(3))
ranges from: 2.65
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Shale (d)
Northern Great Plains
Moisture content (natural) (%)
ranges from: 18
to: 38
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale (d)
Ohio
Porosity (total) (units not stated)
ranges from: 0.03
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Shale (e)
Density (presumed g/cm(3))
ranges from: 2.2
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Shale (e)
Western USA
Moisture content (%)
ranges from: 35
to: 15
Source: Y/OWI/TM36/6, p. 3-1

Shale (e)
Pennsylvania
Porosity (total) (units not stated)
ranges from: 0.0117
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Shale (f)
Density (presumed g/cm(3))
ranges from: 2.3
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Shale (f)
Scotland
Porosity (total) (units not stated)
ranges from: 0.016
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Shale (g)
Density (presumed g/cm(3))
ranges from: 2.2
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Shale (h)
Density (presumed g/cm(3))
ranges from: 2.5
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Shale (i)
Density (presumed g/cm(3))
ranges from: 2.0
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 8

Shale (j)
Gulf Coast
Density (g/cm(3))
ranges from: 2.1
to: 2.3
Source: Y/OWI/SUB-7009/1 (1976), p. 121

Shale (k)
Gulf Coast
Density (presumed g/cm(3))
ranges from: 2.58
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 12

Shales
New York, Kentucky, Virginia and West Virginia
Density (bulk) (average) (g/cm(3))
ranges from: 2.61
to: 2.68
Source: ORNL-5703 (1983), p. 37

Shales
Black Hills
Density (bulk) (presumed g/cm(3))
ranges from: 1.559
to: 2.038
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Shales
Eastern Canada
Density (bulk) (presumed g/cm(3))
ranges from: 2.07
to: 2.68
Source: Y/OWI/SUB-7009/1 (1976), p. 15

Shales
Oklahoma
Density (bulk) (presumed g/cm(3))
ranges from: 2.1
to: 2.62
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Shales
Western Canada
Density (bulk) (presumed g/cm(3))
ranges from: 2.43
to: 2.71
Source: Y/OWI/SUB-7009/1 (1976), p. 17

Shales
Density (dry) (presumed g/cm(3))
ranges from: 1.55
to: 2.55
Source: Y/OWI/SUB-7009/1 (1976), Fig. 1

Shales
Black Hills
Density (grain) (average) (presumed g/cm(3))
ranges from: 2.66
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Shales
Kansas
Density (grain) (average) (presumed g/cm(3))
ranges from: 2.72
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Shales
Venezuela
Density (grain) (average) (presumed g/cm(3))
ranges from: 2.69
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 10

Shales
Density (lbs/ft(3))
ranges from: 117 (1.874 g/cm(3))
to: 188 (3.011 g/cm(3))
Source: Y/OWI/TM36/6, p. A-2, 3 & 4

Shales
Density (wet) (presumed g/cm(3))
ranges from: 1.98
to: 2.67
Source: Y/OWI/SUB-7009/1 (1976), Fig. 1

Shales
Moisture content (natural) (%)
ranges from: 38
to: 12
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Shales
Porosity (%)
ranges from: 0.7 (70% ?)
to: 0.1 (10% ?)
Source: ORNL-6241/V2 (in preparation) p. 199

Shales
Appalachian Basin
Porosity (%)
ranges from: ca. 3
to: -
Source: ORNL-6241/V2 (in preparation) p. 219

Shales
Illinois Basin
Porosity (%)
ranges from: 0.9
to: 4.6
Source: ORNL-6241/V2 (in preparation) p. 219

Shales (a)
Kentucky
Porosity (%)
ranges from: 3.3
to: 10.1
Source: ORNL-6241/V2 (in preparation) p. 219

Shales (b)
Kentucky
Porosity (%)
ranges from: 15
to: 3
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Shales
Michigan Basin
Porosity (%)
ranges from: 3
to: 10
Source: ORNL-6241/V2 (in preparation) p. 219

Shales
Oklahoma
Porosity (%)
ranges from: 25
to: 2
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Shales
USA and Europe
Porosity (%)
ranges from: 19
to: 1
Source: ORNL-6241/V2 (in preparation) p. 219

Shales
Kentucky, New York, Virginia and West Virginia
Porosity (average) (vol. %)
ranges from: 2.86 to 3.87
to: -
Source: ORNL-5703 (1983), p. 37

Shales
Pennsylvania
Porosity (effective) (%)
ranges from: 1.17
to: -
Source: ORNL-6241/V2 (in preparation) p. 219

Shales
South Carolina
Porosity (effective) (%)
ranges from: ca. 0.5
to: -
Source: ORNL-6241/V2 (in preparation) p. 219

Shales (a)
Density (bulk) (g/cm(3))
ranges from: 1.6
to: 2.5
Source: ORNL-6241/V2 (in preparation) p. 199

Shales (a)
Moisture content (%)
ranges from: 1.3
to: 38
Source: Y/OWI/TM36/6, p. A-13, 14 & 15

Shales (a)
Porosity (%)
ranges from: 3
to: 15
Source: ORNL-6241/V2 (in preparation) p. 218

Shales (b)
Density (bulk) (presumed g/cm(3))
ranges from: 2.40
to: 2.43
Source: Y/OWI/SUB-7009/1 (1976), p. 16

Shales (b)
Porosity (%)
ranges from: 15 to 45
to: 3 to 20
Source: ORNL-6241/V2 (in preparation) p. 219

Shales (b)
Water content (vol %)
ranges from: 70 to 90
to: 5 to 10
Source: ORNL-6241/V2 (in preparation) p. 218

Shales (c)
Density (natural) (presumed g/cm(3))
ranges from: 2.43
to: 2.65
Source: Y/OWI/SUB-7009/1 (1976), p. 18

Shales (c)
Porosity (%)
ranges from: 0.4
to: 7.2
Source: Y/OWI/SUB-7009/1 (1976), p. 18

Shales (d)
Porosity (%)
ranges from: 0.0
to: 44.8
Source: Y/OWI/TM36/6, p. A-12

Shales (e)
Germany
Porosity (%)
ranges from: 25
to: ca. 0
Source: Y/OWI/SUB-7009/1 (1976), p. 15

Smectite
Density (presumed g/cm(3))
ranges from: 2.2-2.7
to: 1.77
Source: Y/OWI/SUB-7009/1 (1976), p. 9

Smectite
Specific surface (m(2)/g)
ranges from: 800
to: -
Source: NUREG/CP-0052 (1983), p. 182

Smectite (Ca)
Void ratio (dimensionless)
ranges from: 7.0
to: 1.0
Source: ONWI-486 (1983), p. 38

Smectite (Na)
Void ratio (dimensionless)
ranges from: 30.0
to: 1.0
Source: ONWI-486 (1983), p. 38

Bentonite (Ca)
Hydraulic conductivity (cm/s)
ranges from: 1.3 x 10(-12) and 1.6 x 10(-12)
to:
Source: ONWI-312 (1981), p. 33

Bentonite (Ca)
Hydraulic conductivity (cm/s)
ranges from: 7 x 10(-12)
to: 2 x 10(-12)
Source: PNL-4452 UC-70 (1983), p. 14

Bentonite (Ca) and (Na)
Permeability (m(2))
ranges from: 1 x 10(-16) (9.7 x 10(-8) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Bentonite (Na)
Hydraulic conductivity (cm/s)
ranges from: 2.7 x 10(-9)
to: 0.7 x 10(-9)
Source: ONWI-312 (1981), p. 34

Bentonite (Na)
Wyoming
Hydraulic conductivity (cm/s)
ranges from: Not stated
to: 10(-9)
Source: ONWI-486 (1983), p. 61

Bentonite (Na) (a)
Hydraulic conductivity (cm/s x 10(12))
ranges from: <1 (<1 x 10(-12) cm/s)
to: ca. 8 (ca. 8 x 10(-12) cm/s)
Source: ONWI-312 (1981), p. 11

Bentonite (Na) (b)
Hydraulic conductivity (cm/s)
ranges from: ca. 1 x 10(-13)
to:
Source: ONWI-312 (1981), p. 10

Bentonite (Na) (c)
Hydraulic conductivity (cm/s)
ranges from: 4.6 x 10(-12) and 6.4 x 10(-12)
to:
Source: ONWI-312 (1981), p. 33

Bentonite (Na) (d)
Hydraulic conductivity (cm/s)
ranges from: 6.6 x 10(-10)
to:
Source: ONWI-312 (1981), p. 33

Bentonite (Na) (e)
Hydraulic conductivity (cm/s)
ranges from: 5.6 x 10(-13)
to:
Source: ONWI-312 (1981), p. 33

Bentonite (Na) (f)
Hydraulic conductivity (cm/s)
ranges from: 6 x 10(-12)
to: 6 x 10(-13)
Source: PNL-4452 UC-70 (1983), p. 13

Bentonite (Na) (g)
Hydraulic conductivity (cm/s)
ranges from: 1.2 x 10(-12)
to: 8.3 x 10(-13)
Source: PNL-4452 UC-70 (1983), p. 27

Bentonite (Na) (h)
Permeability (cm/s) (hydraulic conductivity)
ranges from: 1 x 10(-11)
to:
Source: ONWI-312 (1981), p. 10

Bentonite (Na) (i)
Permeability (cm/s) (hydraulic conductivity)
ranges from: 3 x 10(-8)
to: 1.5 x 10(-9)
Source: ONWI-312 (1981), p. 10

Bentonite (Na) (j)
Permeability (m/s) (hydraulic conductivity)
ranges from: 5 x 10(-15) (5 x 10(-13) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
Source: KBS TEKNISK RAPPORT 74 (1978), p. 8

Bentonite (Na) (k)
Permeability (m/s) (hydraulic conductivity)
ranges from: ca. 1 x 10(-11) (ca. 1 x 10(-9) cm/s)
to:
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Bentonite (Na) (l)
Permeability (m/s) (hydraulic conductivity)
ranges from: ca. 3 x 10(-11) (ca. 3 x 10(-9) cm/s)
to:
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Bentonite (Na) (m)
Permeability (m/s) (hydraulic conductivity)
ranges from: 1 x 10(-10) (1 x 10(-8) cm/s) (maximum)
to:
Source: KBS TEKNISK RAPPORT 9 (1977), p. 5

Bentonite (Na) and (Ca)
Various
Hydraulic conductivity (cm/s)
ranges from: 10(-4)
to: 10(-12)
Source: ONWI-486 (1983), p. 36

Bentonite (Na) and Sand
Hydraulic conductivity (cm/s)
ranges from: ca. 10(-9)
to: ca. 10(-12)
Source: PNL-4452 UC-70 (1983), p. 16

Bentonite and Sand
Hydraulic conductivity (m/s)
ranges from: ca. 10(-6) (ca. 1 x 10(-4) cm/s)
to: ca. 10(-14) (ca. 1 x 10(-12) cm/s)
Source: AECL-7812 (1983), p. 29

Bentonite and Sand (a)
Oregon
Permeability (cm/s) (hydraulic conductivity)
ranges from: 9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Bentonite and Sand (b)
Oregon
Permeability (cm/s) (hydraulic conductivity)
ranges from: <9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Bentonite and Sand (c)
Wyoming
Permeability (cm/s) (hydraulic conductivity)
ranges from: <9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Bentonite and Sand (d)
Wyoming
Permeability (cm/s) (hydraulic conductivity)
ranges from: <9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Bentonite and Sand (e)
Wyoming
Permeability (m(2))
ranges from: 3 x 10(-18) (2.9 x 10(-9) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 220

Bentonite and Sand (f)
Wyoming
Permeability (m(2))
ranges from: 8 x 10(-18) (7.8 x 10(-9) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 220

Clay
Permeability (m/s) (hydraulic conductivity)
ranges from: 1 x 10(-9) (1 x 10(-7) cm/s)
to:
Source: KBS TEKNISK RAPPORT 9 (1977), p. 4

Clay
Louisiana
Hydraulic conductivity (cm/s)
ranges from: 10(-8) (est)
to:
Source: ORNL/Sub/84-64794/1 (1985), p. 175

Clay
Belgium
Hydraulic conductivity (m/s)
ranges from: 10(-10) (1 x 10(-8) cm/s)
to: 10(-12) (1 x 10(-10) cm/s)
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clay
England
Hydraulic conductivity (m/s)
ranges from: 10(-12) (1 x 10(-10) cm/s)
to:
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clay
Italy
Hydraulic conductivity (m/s)
ranges from: 10(-11) (1 x 10(-9) cm/s)
to:
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clay and Sand
Hanford
Permeability (cm/s) (hydraulic conductivity)
ranges from: <9.5 x 10(-8)
to:
Source: RHO-BWI-SA-80 (1981), p. 7

Clays and Shales
Permeability (md)
ranges from: 8 x 10(-4) (7.7 x 10(-10) cm/s)
to: 2 x 10(-6) (1.9 x 10(-12) cm/s)
Source: Proc NEA Workshop OECD (1979b), p. 69

Illite (Ca)
Hydraulic conductivity (cm/s)
ranges from: 10(-10)
to: 10(-6)
Source: ONWI-486 (1983), p. 35

Illite (Na)
Hydraulic conductivity (cm/s)
ranges from: 10(-10)
to: 10(-7)
Source: ONWI-486 (1983), p. 35

Kaolinite (a)
Permeability (m(2))
ranges from: 1 x 10(-16) (9.7 x 10(-8) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Kaolinite (b)
Permeability (m(2))
ranges from: 5 x 10(-17) (4.9 x 10(-8) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Kaolinite (Ca)
Hydraulic conductivity (cm/s)
ranges from: 10(-8)
to: 10(-5)
Source: ONWI-486 (1983), p. 35

Kaolinite (Na)
Hydraulic conductivity (cm/s)
ranges from: 10(-8)
to: 10(-5)
Source: ONWI-486 (1983), p. 35

Kaolinite and Sand
Permeability (m(2))
ranges from: 2 x 10(-16) (1.9 x 10(-7) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Shale
Groundwater travel distance (m)
ranges from: 6
to: 40
Source: ORNL-6241/V1 (in preparation) p. 36

Shale
Illinois Basin
Hydraulic conductivity (cm/s)
ranges from: 10(-9)
to:
Source: ORNL-6241/V2 (in preparation) p. 220

Shale
Tennessee
Hydraulic conductivity (cm/s)
ranges from: 6 x 10(-10)
to: 3 x 10(-11)
Source: ORNL-6241/V2 (in preparation) p. 220

Shale
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-10) (1 x 10(-8) cm/s)
to: 1 x 10(-12) (1 x 10(-10) cm/s)
Source: ORNL-6241/V1 (in preparation) p. 33

Shale
Illinois
Hydraulic conductivity (horizontal) (m/s)
ranges from: 2 x 10(-11) (2 x 10(-9) cm/s)
to:
Source: ORNL-6241/V2 (in preparation) p. 42

Shale
Maryland
Hydraulic conductivity (horizontal) (m/s)
ranges from: 0.0(?) (0.0 cm/s) (?)
to: 1 x 10(-9) (1 x 10(-7) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 43

Shale
Michigan
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 X 10(-11) (1 x 10(-9) cm/s)
to: 2 x 10(-8) (2 x 10(-6) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 42

Shale
Pennsylvania
Hydraulic conductivity (horizontal) (m/s)
ranges from: 3 x 10(-11) (3 x 10(-9) cm/s)
to:
Source: ORNL-6241/V2 (in preparation) p. 42

Shale
Pennsylvania
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to:
Source: ORNL-6241/V2 (in preparation) p. 43

Shale
South Carolina
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-13) (1 x 10(-11) cm/s)
to: 1 x 10(-10) (1 x 10(-8) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 42

Shale
South Carolina
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to:
Source: ORNL-6241/V2 (in preparation) p. 43

Shale
South Dakota
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 43

Shale
Tennessee
Hydraulic conductivity (horizontal) (m/s)
ranges from: 3 x 10(-13) (3 x 10(-11) cm/s)
to: 2 x 10(-12) (2 x 10(-10) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 42

Shale
Hydraulic conductivity (vertical) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to: 1 x 10(-13) (1 x 10(-11) cm/s)
Source: ORNL-6241/V1 (in preparation) p. 33

Shale
Hydraulic conductivity (vertical) (m/s)
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to:
Source: ORNL-6241/V2 (in preparation) p. 99

Shale
Inflow (ml/min per m)
ranges from: 1 x 10(-1)
to: 5 x 10(-1)
Source: ORNL-6241/V1 (in preparation) p. 38

Shale
Inflow (ml/min per m)
ranges from: 10
to: <1
Source: ORNL-6241/V2 (in preparation) p. 106

Shale
Ohio
Permeability (ft/yr) (hydraulic conductivity)
ranges from: 10(-3) (9.7 x 10(-10) cm/s)
to: 10(-4) (9.7 x 10(-11) cm/s)
Source: Y/OWI/TM36/6 (1978), p. 5-14

Shale
Permeability (horizontal) (ft/yr) (hydraulic conductivity)
ranges from: 0.01 (9.7 x 10(-9) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 3-24

Shale
Ohio
Permeability (horizontal) (ft/yr) (hydraulic conductivity)
ranges from: 0.1 (9.7 x 10(-8) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale
Permeability (md)
ranges from: 5 x 10(-2) (4.9 x 10(-7) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shale
California
Permeability (md)
ranges from: 4 x 10(-4) (3.8 x 10(-10) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shale
Colorado
Permeability (md)
ranges from: <0.05 (<4.9 x 10(-7) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Shale
Gulf Coast
Permeability (md)
ranges from: 1 x 10(-8) (9.6 x 10(-15) cm/s) (?)
to: 2.5 x 10(-9) (2.4 x 10(-15) cm/s) (?)
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shale
Michigan
Permeability (md)
ranges from: 0.001 (1 x 10(-9) cm/s)
to: 2.0 (1.9 x 10(-6) cm/s)
Source: ORNL/5703 (1983), p. 109

Shale
Michigan
Permeability (md)
ranges from: 0.001 (1 x 10(-9) cm/s)
to: 2.0 (1.9 x 10(-6) cm/s)
Source: ORNL/Sub/84-64794/1 (1985), p. 98

Shale
Permeability (vertical) (factor of K horizontal)
ranges from: 1/2Kh
to: 1/10Kh
Source: Y/OWI/TM36/6 (1978), p. 2-2

Shale
Permeability (vertical) (ft/yr) (hydraulic conductivity)
ranges from: 0.005 (5 x 10(-9) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 3-24

Shale
Ohio
Permeability (vertical) (ft/yr) (hydraulic conductivity)
ranges from: 0.05 (5 x 10(-8) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale
Specific storage (l/m)
ranges from: 1 x 10(-6)
to:
Source: ORNL-6241/V2 (in preparation) p. 99

Shale
Specific storage (l/m)
ranges from: 4.3 x 10(-7)
to: 2.8 x 10(-6)
Source: ORNL-6241/V2 (in preparation) p. 57

Shale
Specific storage (m(-1)) (?)
ranges from: 5 x 10(-6)
to: 5 x 10(-7)
Source: ORNL-6241/V1 (in preparation)
p. 33

Shale
Travel time (years)
ranges from: >100,000
to: >100,000
Source: ORNL-6241/V1 (in preparation)
p. 36

Shale (a)
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to:
Source: ORNL-6241/V2 (in preparation)
p. 106

Shale (a)
Permeability (ft/yr) (hydraulic conductivity)
ranges from: 0.1 (9.7 x 10(-8) cm/s)
to: 0.05 (4.8 x 10(-8) cm/s)
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (a)
Permeability (md)
ranges from: 1.1 x 10(-4) (1.1 x 10(-10) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shale (b)
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-16) (1 x 10(-14) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
Source: ORNL-6241/V2 (in preparation)
p. 42

Shale (b)
Great Plains
Permeability (cm/s) (hydraulic conductivity)
ranges from: 1 x 10(-6)
to: 1 x 10(-10)
Source: ORNL/Sub/84-64794/1 (1985),
p. 293

Shale (b)
Permeability (microdarcies)
ranges from: 100 (1 x 10(-7) cm/s)
to: 0.01 (1 x 10(-9) cm/s)
Source: ORNL-6241/V2 (in preparation)
p. 199

Shale (c)
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to: 7 x 10(-9) (7 x 10(-7) cm/s)
Source: ORNL-6241/V2 (in preparation)
p. 42

Shale (d)
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-11) (1 x 10(-9) cm/s)
to: 1 x 10(-6) (1 x 10(-4) cm/s)
Source: ORNL-6241/V2 (in preparation)
p. 43

Shale (e)
Permeability (horizontal) (ft/yr) (hydraulic conductivity)
ranges from: 1 x 10(-4) (9.7 x 10(-11) cm/s)
to: 1 x 10(3) (9.7 x 10(-4) cm/s)
Source: Y/OWI/TM36/6 (1978), p. 2-2

Shales
East Coast
Hydraulic conductivity (cm/s)
ranges from: 10(-7)
to: 10(-11)
Source: ORNL-6241/V2 (in preparation)
p. 220

Shales
Michigan and Appalachian Basins
Hydraulic conductivity (cm/s)
ranges from: 10(-6)
to: 10(-9)
Source: ORNL-6241/V2 (in preparation)
p. 220

Shales
Northern Great Plains
Hydraulic conductivity (cm/s)
ranges from: 10(-6)
to: 10(-10)
Source: ORNL-6241/V2 (in preparation)
p. 220

Shales
Permeability (md)
ranges from: 8 x 10(-4) (7.7 x 10(-10) cm/s)
to: 2 x 10(-6) (1.9 x 10(-12) cm/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shales
Illinois
Permeability (md)
ranges from: 2 x 10(-6) (1.9 x 10(-12) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shales
Montana
Permeability (md)
ranges from: 6 x 10(-4) (5.8 x 10(-10) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shales
New Mexico
Permeability (md)
ranges from: 2 x 10(-6) (1.9 x 10(-12) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shales
Oklahoma
Permeability (md)
ranges from: 8 x 10(-4) (7.7 x 10(-10) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shales
Texas
Permeability (md)
ranges from: 3 x 10(-4) (2.9 x 10(-10) cm/s)
to: 7 x 10(-6) (6.7 x 10(-12) cm/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shales
Utah
Permeability (md)
ranges from: 7 x 10(-6) (6.7 x 10(-12) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Shales (c)
Hydraulic conductivity (cm/s)
ranges from: 10(-8)
to: 10(-11)
Source: ORNL-6241/V2 (In preparation) p. 218

Shales (d)
Hydraulic conductivity (cm/s)
ranges from: 10(-9)
to: 10(-11)
Source: ORNL-6241/V2 (In preparation) p. 219

Shales (e)
Permeability (m(2))
ranges from: 10(-17) (9.7 x 10(-9) cm/s)
to: 10(-21) (9.7 x 10(-13) cm/s)
Source: ORNL-6241/V2 (In preparation) p. 199

Shales (f)
Various
Permeability (ft/yr) (hydraulic conductivity)
ranges from: 1.0 x 10(-4) (9.7 x 10(-11) cm/s)
to: 1.1 x 10(3) (1.1 x 10(-4) cm/s)
Source: Y/OWI/TM36/6 (1978), p. A-16

Siltstone/Mudstone
South Carolina
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-13) (1 x 10(-11) cm/s)
to: 5 x 10(-10) (5 x 10(-8) cm/s)
Source: ORNL-6241/V2 (In preparation) p. 43

Silty Clay
Hydraulic conductivity (cm/s)
ranges from: 5 x 10(-6)
to: ca. 2 x 10(-8)
Source: ONWI-486 (1983), p. 39

Silty Clay
Hydraulic conductivity (cm/s)
ranges from: 5 x 10(-6)
to: 10(-7)
Source: ONWI-486 (1983), p. 39

Smectite (Ca) (a)
Hydraulic conductivity (cm/s)
ranges from: 10(-11)
to: 10(-6)
Source: ONWI-486 (1983), p. 35

Smectite (Ca) (b)
Permeability (m(2))
ranges from: 3 x 10(-18) (2.9 x 10(-9) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Smectite (Ca) and Sand
Permeability (m(2))
ranges from: 4 x 10(-17) (3.9 x 10(-8) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Smectite (Na) (a)
Hydraulic conductivity (cm/s)
ranges from: 10(-11)
to: 10(-7)
Source: ONWI-486 (1983), p. 35

Smectite (Na) and Sand
Permeability (m(2))
ranges from: 5 x 10(-19) (4.9 x 10(-10) cm/s)
to:
Source: NUREG/CP-0052 (1983), p. 209

Volclay saline seal and Sand
Hydraulic conductivity (cm/s)
ranges from: 2.9 x 10(-12)
to: 4.1 x 10(-12)
Source: ONWI-312 (1981), p. 33

Argillite
Bulk modulus (confined) (GPa)
ranges from: 14.0 (1.4 x 10(4) MPa)
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Argillite
Cohesion (unconfined) (MPa)
ranges from: 8 x 10(-1)
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Argillite
Compressive strength (unconfined) (MPa)
ranges from: 4.75
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Argillite
Friction angle (internal) (deg)
ranges from: 35
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Argillite
Poisson's ratio
ranges from: 0.30
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Argillite
Tensile strength (MPa)
ranges from: 3.5
to: -
Source: Proc NEA Workshop OECD (1979b), p. 81

Argillite (a)
Young's modulus (GPa)
ranges from: 3.7 (3.7 x 10(3) MPa)
to: 16 (MPa)
Source: Proc NEA Workshop OECD (1979b), p. 83

Argillite (b)
Young's modulus (unconfined) (GPa)
ranges from: 3.74 (3.7 x 10(3) MPa)
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Bentonite
Wyoming
Plasticity (liquid limit) (%)
ranges from: 553.1
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite
Wyoming
Plasticity (plastic index) (%)
ranges from: 519.5
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite
Wyoming
Plasticity (plastic limit) (%)
ranges from: 33.6
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite
Wyoming
Poisson's ratio
ranges from: 0.15
to: -
Source: ONWI-486 (1983), p. 63

Bentonite
Swelling distance (mm)
ranges from: 1
to: 11
Source: ONWI-312 (1981), p. 16

Bentonite
Oregon
Swelling pressure (MPa)
ranges from: ca. 0
to: ca. 1.8
Source: AECL-7812 (1983), p. 34

Bentonite
Wyoming
Swelling pressure (MPa)
ranges from: ca. 0
to: ca. 2.2
Source: AECL-7812 (1983), p. 34

Bentonite
Young's modulus (MPa)
ranges from: 300
to: -
Source: ONWI-486 (1983), p. 63

Bentonite (a)
Oregon
Plasticity (liquid limit) (%)
ranges from: 209.6
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (a)
Oregon
Plasticity (plastic index) (%)
ranges from: 168.58
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (a)
Oregon
Plasticity (plastic limit) (%)
ranges from: 41.0
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (a)
Oregon
Plasticity (shrinkage limit) (%)
ranges from: 8.47
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (a)
Swelling (%)
ranges from: 5
to: 20
Source: KBS TEKNISK RAPPORT 9 (1977), p. 5

Bentonite (a)
Swelling pressure (kPa)
ranges from: 30 (0.03 MPa) (?)
to: 110 (0.11 MPa) (?)
Source: KBS TEKNISK RAPPORT 9 (1977), p. 6

Bentonite (b)
Oregon
Plasticity (liquid limit) (%)
ranges from: 212.69
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (b)
Oregon
Plasticity (plastic index) (%)
ranges from: 174.6
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (b)
Oregon
Plasticity (plastic limit) (%)
ranges from: 38.1
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (b)
Oregon
Plasticity (shrinkage limit) (%)
ranges from: 8.96
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (b)
Swelling (%)
ranges from: 15
to: 30
Source: KBS TEKNISK RAPPORT 9 (1977), p. 6

Bentonite (b)
Swelling pressure (kPa)
ranges from: 30 (0.03 MPa) (?)
to: 200 (0.20 MPa) (?)
Source: KBS TEKNISK RAPPORT 9 (1977), p. 6

Bentonite (c)
Swelling (%)
ranges from: 1
to: 50
Source: ONWI-486 (1983), p. 49

Bentonite (c)
Swelling pressure (MPa)
ranges from: 0.7
to: ca. 70
Source: AECL-7812 (1983), p. 33

Bentonite (Ca)
Swelling pressure (MPa)
ranges from: 31.4
to: -
Source: ONWI-312 (1981), p. 31

Bentonite (Na)
Wyoming
Plasticity (liquid limit) (%)
ranges from: 260
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) (a)
Compressive strength (unconfined) (psi)
ranges from: 55.5 (3.8 x 10(-1) MPa)
to: -
Source: ONWI-312 (1981), p. 22

Bentonite (Na) (a)
Plasticity (liquid limit) (%)
ranges from: 98
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) (a)
Wyoming
Plasticity (plastic limit) (%)
ranges from: 50
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) (a)
Wyoming
Plasticity (plasticity index) (%)
ranges from: 210
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) (a)
Shear strength (kPa)
ranges from: 1,600 (1.6 MPa)
to: <15 (<1.5 x 10(-2) MPa)
Source: KBS TEKNISK RAPPORT 74 (1978), p. 16

Bentonite (Na) (a)
Swelling pressure (MPa)
ranges from: >10
to: -
Source: ONWI-312 (1981), p. 15

Bentonite (Na) (b)
Compressive strength (uniaxial) (MPa)
ranges from: 8.9
to: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 14

Bentonite (Na) (b)
Wyoming
Plasticity (plastic limit) (%)
ranges from: 19
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) (b)
Wyoming
Plasticity (plasticity index) (%)
ranges from: 79
to: -
Source: AECL-7825 (1984), p. 12

Bentonite (Na) (b)
Shear strength (MPa)
ranges from: 4.5
to: -
Source: KBS TEKNISK RAPPORT 74 (1978), p. 14

Bentonite (Na) (b)
Swelling pressure (MPa)
ranges from: 57.7
to: -
Source: ONWI-312 (1981), p. 31

Bentonite (Na) (c)
Swelling pressure (MPa)
ranges from: 21.7
to: -
Source: ONWI-312 (1981), p. 31

Bentonite (Na) (d)
Swelling pressure (MPa)
ranges from: ca. 72
to: -
Source: RHO-BWI-SA-80 (1981), p. 6

Bentonite (Na) (e)
Wyoming
Swelling pressure (MPa)
ranges from: ca. 3
to: ca. 8
Source: AECL-7825 (1984), p. 16

Bentonite (Na) (f)
Wyoming
Swelling pressure (MPa)
ranges from: ca. 2
to: ca. 20
Source: AECL-7825 (1984), p. 16

Bentonite (Na) (g)
Wyoming
Swelling pressure (MPa)
ranges from: 1
to: 8
Source: KBS TEKNISK RAPPORT 74 (1978), p. 6

Bentonite (Na) (h)
Wyoming
Swelling pressure (MPa)
ranges from: 2
to: 23
Source: ONWI-486 (1983), p. 51

Bentonite (Na) (i)
Wyoming
Swelling pressure (MPa)
ranges from: 3
to: 26
Source: ONWI-486 (1983), p. 51

Bentonite (Na) (j)
Wyoming
Swelling pressure (MPa)
ranges from: 3
to: 27
Source: ONWI-486 (1983), p. 51

Bentonite and Sand (a)
Oregon
Compressive strength (unconfined) (MPa)
ranges from: ca. 0
to: ca. 1.8
Source: RHO-BWI-SA-80 (1981), Fig. 4

Bentonite and Sand (a)
Oregon
Swelling pressure (MPa)
ranges from: ca. 0
to: ca. 1.8
Source: RHO-BWI-SA-80 (1981), Fig. 3

Bentonite and Sand (a)
Oregon
Young's modulus (MPa)
ranges from: ca. 55
to: ca. 80
Source: RHO-BWI-SA-80 (1981), Fig. 5

Bentonite and Sand (b)
Wyoming
Compressive strength (unconfined) (MPa)
ranges from: ca. 0
to: ca. 3
Source: RHO-BWI-SA-80 (1981), Fig. 4

Bentonite and Sand (b)
Wyoming
Swelling pressure (MPa)
ranges from: ca. 0
to: ca. 2.2
Source: RHO-BWI-SA-80 (1981), Fig. 3

Bentonite and Sand (b)
Wyoming
Young's modulus (MPa)
ranges from: ca. 45
to: 60
Source: RHO-BWI-SA-80 (1981), Fig. 5

Clay
Belgium
Cohesion (MPa)
ranges from: 1 x 10(-1)
to: 1
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
Italy
Cohesion (MPa)
ranges from: 1 x 10(-1)
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    Belgium
Friction angle (angle of shear resistance) (deg)
    ranges from: 19
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    Italy
Friction angle (angle of shear resistance) (deg)
    ranges from: 25
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    Belgium
Plasticity (liquid limit) (%)
    ranges from: 77.5
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    England
Plasticity (liquid limit) (%)
    ranges from: 55
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    Hanford
Plasticity (liquid limit) (%)
    ranges from: 44.6
    to: -
    Source: RHO-BWI-SA-80 (1981), p. 6

Clay
    Hanford
Plasticity (liquid limit) (%)
    ranges from: 63.9
    to: -
    Source: RHO-BWI-SA-80 (1981), p. 6

Clay
    Italy
Plasticity (liquid limit) (%)
    ranges from: 50
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    Hanford
Plasticity (plastic index) (%)
    ranges from: 18.8
    to: -
    Source: RHO-BWI-SA-80 (1981), p. 6

Clay
    Hanford
Plasticity (plastic index) (%)
    ranges from: 40.8
    to: -
    Source: RHO-BWI-SA-80 (1981), p. 6

Clay
    Belgium
Plasticity (plastic limit) (%)
    ranges from: 26.5
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    England
Plasticity (plastic limit) (%)
    ranges from: 26
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    Hanford
Plasticity (plastic limit) (%)
    ranges from: 25.8
    to: -
    Source: RHO-BWI-SA-80 (1981), p. 6

Clay
    Hanford
Plasticity (plastic limit) (%)
    ranges from: 23.1
    to: -
    Source: RHO-BWI-SA-80 (1981), p. 6

Clay
    Italy
Plasticity (plastic limit) (%)
    ranges from: 25
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    Louisiana
Plasticity (plasticity index) (%)
    ranges from: 40
    to: -
    Source: ORNL/Sub/84-64794/1 (1985), p. 173

Clay
    Hanford
Plasticity (shrinkage limit) (%)
    ranges from: 19.75
    to: -
    Source: RHO-BWI-SA-80 (1981), p. 6

Clay
    Belgium
Shear strength (undrained) (MPa)
    ranges from: 0.6
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
    England
Shear strength (undrained) (MPa)
    ranges from: 1.2
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
Italy
Shear strength (undrained) (MPa)
ranges from: 1.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
Louisiana
Strength (MPa)
ranges from: 0.19
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Clay
Belgium
Young's modulus (elastic modulus) (MPa)
ranges from: 170
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Clay
Italy
Young's modulus (elastic modulus) (MPa)
ranges from: 300
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Illite
Plasticity (plasticity index) (%)
ranges from: 0
to: 90
Source: ONWI-486 (1983), p. 45

Illite
Swelling (%)
ranges from: <2
to: 20
Source: ONWI-486 (1983), p. 49

Illite (Ca)
Jackson County, OH
Plasticity (liquid limit) (%)
ranges from: 69
to: -
Source: ONWI-486 (1983), p. 43

Illite (Ca)
Jackson County, OH
Plasticity (plastic limit) (%)
ranges from: 36
to: -
Source: ONWI-486 (1983), p. 43

Illite (Ca) (a)
Fithian, IL
Plasticity (liquid limit) (%)
ranges from: 90
to: -
Source: ONWI-486 (1983), p. 43

Illite (Ca) (a)
Fithian, IL
Plasticity (plastic limit) (%)
ranges from: 40
to: -
Source: ONWI-486 (1983), p. 43

Illite (Ca) (b)
Grundy County, IL
Plasticity (liquid limit) (%)
ranges from: 100
to: -
Source: ONWI-486 (1983), p. 43

Illite (Ca) (b)
Grundy County, IL
Plasticity (plastic limit) (%)
ranges from: 42
to: -
Source: ONWI-486 (1983), p. 43

Illite (Na) (a)
Friction angle (residual) (tan)
ranges from: 0.3
to: 0.7
Source: ONWI-486 (1983), p. 47

Illite (Na) (b)
Friction angle (residual) (tan)
ranges from: 0.47
to: 0.7
Source: ONWI-486 (1983), p. 47

Illite and Bentonite (a)
Swelling (%)
ranges from: 1
to: 54
Source: ONWI-486 (1983), p. 49

Illite and Bentonite (b)
Swelling (%)
ranges from: <2
to: 30
Source: ONWI-486 (1983), p. 49

Illite and Kaolinite
Swelling (%)
ranges from: <2
to: <10
Source: ONWI-486 (1983), p. 49

Kaolinite
Compressive strength (unconfined) (psi)
ranges from: 100.3 (6.9 x 10(-1) MPa)
to: -
Source: ONWI-312 (1981), p. 22

Kaolinite
Friction angle (residual) (tan)
ranges from: 0.27
to: 0.7
Source: ONWI-486 (1983), p. 47

Kaolinite
Plasticity (plasticity index) (%)
ranges from: 0
to: 35
Source: ONWI-486 (1983), p. 45

Kaolinite
Swelling (%)
ranges from: <2
to: 4
Source: ONWI-486 (1983), p. 49

Kaolinite (Ca)
Anna, IL
Plasticity (liquid limit) (%)
ranges from: 73
to: -
Source: ONWI-486 (1983), p. 43

Kaolinite (Ca)
Dry Branch, GA
Plasticity (liquid limit) (%)
ranges from: 34
to: -
Source: ONWI-486 (1983), p. 43

Kaolinite (Ca)
Anna, IL
Plasticity (plastic limit) (%)
ranges from: 36
to: -
Source: ONWI-486 (1983), p. 43

Kaolinite (Ca)
Dry Branch, GA
Plasticity (plastic limit) (%)
ranges from: 26
to: -
Source: ONWI-486 (1983), p. 43

Kaolinite and Bentonite
Swelling (%)
ranges from: 2
to: 35
Source: ONWI-486 (1983), p. 49

Oil Shales
Compressive strength (MPa)
ranges from: 35
to: 138
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Oil Shales
Compressive strength (MPa)
ranges from: 138
to: 172
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Oil Shales
Poisson's ratio
ranges from: 0.2
to: 0.3
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Oil Shales
Poisson's ratio
ranges from: 0.15
to: 0.20
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Oil Shales
Young's modulus (MPa)
ranges from: 7,000 (7 x 10(3))
to: 17,500 (1.75 x 10(4))
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Oil Shales
Young's modulus (MPa)
ranges from: >21,000 (>2.1 x 10(4))
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 348

Shale
Bulk modulus (psi)
ranges from: 7.6 x 10(5) (5.2 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale
Bulk modulus (psi)
ranges from: 77.8 x 10(3) (5.4 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Shale
Ohio
Bulk modulus (psi)
ranges from: 6.3 x 10(5) (4.3 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Shale
Ohio
Bulk modulus (psi)
ranges from: 1.1 x 10(5) (7.6 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale
Ohio
Cohesion (psi)
ranges from: 5,900 (4.1 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Shale
Ohio
Cohesion (psi)
ranges from: 14 (1 x 10(-1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale
Indiana
Compressive strength (MPa)
ranges from: 11
to: 115
Source: ORNL/Sub/84-64794/1 (1985), p. 60

Shale
Compressive strength (psi)
ranges from: 8.5 x 10(3) (5.9 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 6-3

Shale
New Mexico
Compressive strength (psi)
ranges from: 1,000 (6.9 MPa)
to: 6,000 (4.1 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. 8-5

Shale
New Mexico
Compressive strength (psi)
ranges from: 1,000 (6.9 MPa)
to: 8,000 (5.5 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. 8-2

Shale
Ohio
Compressive strength (uniaxial) (MPa)
ranges from: 13.8
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Shale
Ohio
Compressive strength (uniaxial) (psi)
ranges from: 1 x 10(4) (6.9 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Shale
Ohio
Compressive strength (uniaxial) (psi)
ranges from: 2 x 10(3) (1.4 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale
Ohio
Friction angle (deg)
ranges from: 23.4
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Shale
Ohio
Friction angle (deg)
ranges from: 22
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale
Montana
Plasticity (liquidity index)
ranges from: -0.11
to: -
Source: Y/OWI/TM36/6 (1978), p. 6-1

Shale
Great Plains
Plasticity (plasticity index) (%)
ranges from: 30
to: 110
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale
Poisson's ratio
ranges from: 0.2
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Shale
Ohio
Poisson's ratio
ranges from: 0.1
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Shale
Ohio
Poisson's ratio
ranges from: 0.25
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale
Ratio of strength to overburden stress
ranges from: 1.3
to: 6.0
Source: ORNL-6241/V1 (in preparation) p. 53

Shale
Shear modulus (psi)
ranges from: 6.2 x 10(5) (4.3 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale
Shear modulus (psi)
ranges from: 58.3 x 10(3) (4 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Shale
Ohio
Shear modulus (psi)
ranges from: 6.8 x 10(5) (4.7 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Shale
Ohio
Shear modulus (psi)
ranges from: 6.8 x 10(4) (4.7 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale
    Canada
Swelling (potential) (%)
    ranges from: 2
        to: 20
    Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale
    Great Plains
Swelling (potential) (%)
    ranges from: 3
        to: 5
    Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale
Swelling pressure (MPa)
    ranges from: 10
        to: 0.5
    Source: KBS TEKNISK RAPPORT 74 (1978), p. 7

Shale
    Ohio
Tensile strength (psi)
    ranges from: 200 (1.4 MPa)
        to: -
    Source: Y/OWI/TM36/6 (1978), p. 5-14

Shale
Young's modulus (elastic modulus) (psi x 10(6))
    ranges from: 1.48 (1 x 10(4) MPa)
        to: -
    Source: Y/OWI/TM36/6 (1978), p. 6-3

Shale
    Great Plains
Young's modulus (elastic modulus) (psi x 10(6))
    ranges from: 0.02 (1.4 x 10(2) MPa)
        to: 0.014 (9.6 x 10(1) MPa)
    Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale
Young's modulus (psi)
    ranges from: 1.4 x 10(5) (9.7 x 10(2) MPa)
        to: -
    Source: Y/OWI/TM36/6 (1978), p. 3-24

Shale
    Ohio
Young's modulus (psi)
    ranges from: 1.5 x 10(6) (1 x 10(4) MPa)
        to: -
    Source: Y/OWI/TM36/6 (1978), p. 5-14

Shale
    Ohio
Young's modulus (psi)
    ranges from: 1.7 x 10(5) (1.2 x 10(3) MPa)
        to: -
    Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale (a)
Cohesion (psi)
    ranges from: 0 (0 MPa)
        to: 4,250 (3 x 10(1) MPa)
    Source: Y/OWI/TM36/6 (1978), p. 2-2

Shale (a)
    Montana
Compressive strength (kg/cm(2))
    ranges from: 122 (1.2 x 10(1) MPa)
        to: 25 (2.5 MPa)
    Source: Y/OWI/TM36/6 (1978), p. 6-13

Shale (a)
Compressive strength (uniaxial) (psi)
    ranges from: 70 (4.8 x 10(-1) MPa)
        to: 3.7 x 10(4) (2.5 x 10(2) MPa)
    Source: Y/OWI/TM36/6 (1978), p. 2-2

Shale (a)
Compressive strength (uniaxial) (psi)
    ranges from: 2.1 x 10(3) (1.4 x 10(1) MPa)
        to: -
    Source: Y/OWI/TM36/6 (1978), p. 3-24

Shale (a)
Friction angle (deg)
    ranges from: 4.2
        to: 56
    Source: Y/OWI/TM36/6 (1978), p. 2-2

Shale (a)
Friction angle (deg)
    ranges from: 5.3
        to: -
    Source: Y/OWI/TM36/6 (1978), p. 3-24

Shale (a)
    Great Plains
Plasticity (liquid limit) (%)
    ranges from: 36
        to: 113
    Source: ORNL/Sub/84-64794/1 (1985), p. 291

Shale (a)
    Great Plains
Plasticity (plastic limit) (%)
    ranges from: 20
        to: 62
    Source: ORNL/Sub/84-64794/1 (1985), p. 291

Shale (a)
Poisson's ratio
    ranges from: 0.03
        to: 0.50
    Source: Y/OWI/TM36/6 (1978), p. 2-2

Shale (a)
Tensile strength (psi)
    ranges from: 0 (0 MPa) (?)
        to: 1,540 (1.1 x 10(1) MPa)
    Source: Y/OWI/TM36/6 (1978), p. 2-2

Shale (a)
Young's modulus (MPa)
ranges from: 10
to: 32
Source: ORNL-6241/V1 (in preparation) p. 47

Shale (b)
Cohesion (psi)
ranges from: 6 x 10(3) (4.1 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (b)
Montana
Compressive strength (kg/cm(2))
ranges from: 25 (2.5 MPa)
to: 55 (5.4 MPa)
Source: Y/OWI/TM36/6 (1978), p. 6-13

Shale (b)
Great Plains
Compressive strength (psi)
ranges from: 70 (4.8 x 10(-1) MPa)
to: 2,530 (1.7 x 10(1) MPa)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale (b)
Compressive strength (uniaxial) (psi)
ranges from: 1 x 10(4) (6.9 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (b)
Friction angle (deg)
ranges from: 26
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (b)
Great Plains
Friction angle (internal) (deg)
ranges from: 8
to: 25
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale (b)
Great Plains
Plasticity (liquid limit) (%)
ranges from: 55
to: 202
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale (b)
Great Plaines
Plasticity (plastic limit (%)
ranges from: 22
to: 39
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale (b)
Poisson's ratio
ranges from: 0.15
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (b)
Tensile strength (psi)
ranges from: 200 (1.4 MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (b)
Young's modulus (MPa)
ranges from: 10
to: 32
Source: ORNL-6241/V1 (in preparation) p. 47

Shale (c)
Cohesion (psi)
ranges from: 206 (1.4 MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Shale (c)
Friction angle (dilation angle) (deg)
ranges from: +5
to: -5
Source: Y/OWI/TM36/6 (1978), p. 2-2

Shale (c)
Ohio
Tensile strength (MPa)
ranges from: 0.34
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Shale (c)
Young's modulus (psi)
ranges from: 2 x 10(3) (1.4 x 10(1) MPa)
to: 6.4 x 10(6) (4.4 x 10(4) MPa)
Source: Y/OWI/TM36/6 (1978), p. 2-2

Shale (d)
Great Plains
Cohesion (psi)
ranges from: 2 (1.4 x 10(-2) MPa)
to: 30 (2.1 x 10(-1) MPa)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Shale (d)
Friction angle (internal) (deg)
ranges from: 14.2
to: 51.0
Source: ORNL-6241/V1 (in preparation) p. 47

Shale (d)
Ohio
Tensile strength (psi)
ranges from: 50 (3.4 x 10(-1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Shale (d)
Young's modulus (psi)
ranges from: 1.6 x 10(6) (1.1 x 10(4) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (e)
Tensile strength (psi)
ranges from: 50 (3.4 x 10(-1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Shales
Bulk modulus (Pa x 10(10))
ranges from: ca. 50 (ca. 5 x 10(5) MPa)
to: ca. 200 (ca. 2 x 10(6) MPa)
Source: ORNL-6241/V2 (in preparation) p. 199

Shales
Western Ohio
Compressive strength (MPa)
ranges from: 20
to: 32
Source: ORNL/Sub/84-64794/1 (1985), p. 71

Shales
Various
Tensile strength (psi)
ranges from: <100 (<6.9 x 10(-1) MPa)
to: 1,538 (1.1 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. A-7

Shales (a)
Compressive strength (unconfined) (MPa)
ranges from: 25.2
to: 113.6
Source: ORNL-6241/V3 (in preparation) p. 110

Shales (a)
Poisson's ratio
ranges from: 0.11
to: 0.31
Source: ORNL-6241/V3 (in preparation) p. 110

Shales (a)
Shear modulus (Pa x 10(10))
ranges from: 0.1 (1 x 10(3) MPa)
to: 100 (1 x 10(6) MPa)
Source: ORNL-6241/V2 (in preparation) p. 199

Shales (a)
Young's modulus (GPa)
ranges from: 9.9 (9.9 x 10(3) MPa)
to: 31.7 (3.17 x 10(4) MPa)
Source: ORNL-6241/V3 (in preparation) p. 110

Shales (b)
Various
Compressive strength (unconfined) (psi)
ranges from: <100 (<6.9 x 10(-1) MPa)
to: 3.7 x 10(4) (2.5 x 10(2) MPa)
Source: Y/OWI/TM36/6 (1978), p. A-4,5,6

Shales (b)
Various
Poisson's ratio
ranges from: 0.03
to: 0.77
Source: Y/OWI/TM36/6 (1978), p. A-11

Shales (b)
Various
Shear modulus (psi)
ranges from: 1.7 x 10(6) (1.2 x 10(4) MPa)
to: 3.6 x 10(6) (2.5 x 10(4) MPa)
Source: Y/OWI/TM36/6 (1978), p. A-10

Shales (b)
Young's modulus (Pa x 10(10))
ranges from: 1 (1 x 10(4) MPa)
to: 500 (5 x 10(6) MPa)
Source: ORNL-6241/V2 (in preparation) p. 199

Shales (c)
Various
Young's modulus (psi)
ranges from: 0.0020 x 10(6) (1.4 x 10(1) MPa)
to: 15.0 x 10(6) (1 x 10(5) MPa)
Source: Y/OWI/TM36/6 (1978), p. A-8,9

Shales, Mudstones, Siltstones
Various
Plasticity (liquid limit) (%)
ranges from: 17.8
to: 224
Source: Y/OWI/TM36/6 (1978), p. 6-20 to 6-26

Shales, Mudstones, Siltstones
Various
Plasticity (plastic limit) (%)
ranges from: 16.0
to: 45.5
Source: Y/OWI/TM36/6 (1978), p. 6-20 to 6-26

Shales, Mudstones, Siltstones
Various
Plasticity (plasticity index) (%)
ranges from: 1.8
to: 192
Source: Y/OWI/TM36/6 (1978), p. 6-20 to 6-26

Smectite (Ca)
Belle Fourche, SD
Plasticity (liquid limit) (%)
ranges from: 177
to: -
Source: ONWI-486 (1983), p. 43

Smectite (Ca)
Cheto, AZ
Plasticity (liquid limit) (%)
ranges from: 155
to: -
Source: ONWI-486 (1983), p. 43

Smectite (Ca)
Omsted, IL
Plasticity (liquid limit) (%)
ranges from: 123
to: -
Source: ONWI-486 (1983), p. 43

Smectite (Ca)
Pontotoc, MS
Plasticity (liquid limit) (%)
ranges from: 166
to: -
Source: ONWI-486 (1983), p. 43

Smectite (Ca)
Belle Fourche, SD
Plasticity (plastic limit) (%)
ranges from: 63
to: -
Source: ONWI-486 (1983), p. 43

Smectite (Ca)
Cheto, AZ
Plasticity (plastic limit) (%)
ranges from: 65
to: -
Source: ONWI-486 (1983), p. 43

Smectite (Ca)
Omsted, IL
Plasticity (plastic limit) (%)
ranges from: 79
to: -
Source: ONWI-486 (1983), p. 43

Smectite (Ca)
Pontotoc, MS
Plasticity (plastic limit) (%)
ranges from: 65
to: -
Source: ONWI-486 (1983), p. 43

Smectite (Na)
Plasticity (plasticity index) (%)
ranges from: 0
to: 500
Source: ONWI-486 (1983), p. 45

Smectite (Na) (a)
Friction angle (residual) (tan)
ranges from: 0.09
to: 0.7
Source: ONWI-486 (1983), p. 47

Smectite (Na) (b)
Friction angle (residual) (tan)
ranges from: 0.18
to: 0.7
Source: ONWI-486 (1983), p. 47

Smectite (Na), Kaolinite, Sand Mixtures (a)
Osage, NY
Compressive strength (psi)
ranges from: 76.5 (5.3 x 10(-1) MPa)
to: 541.0 (3.7 MPa)
Source: ONWI-312 (1981), p. 24

Smectite (Na), Kaolinite, Sand Mixtures (b)
Osage, NY
Compressive strength (psi)
ranges from: 9.1 (6.3 x 10(-2) MPa)
to: 85.5 (5.9 x 10(-1) MPa)
Source: ONWI-312 (1981), p. 24

Argillite
Coefficient of linear expansion (deg C(-1)) (K(-1))
ranges from: 8 x 10(-6)
to: 15 x 10(-6)
Source: Proc NEA Workshop OECD (1979b), p. 77

Argillite (a)
Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
ranges from: ca. 1.80
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Argillite (b)
Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
ranges from: ca. 1.48
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Argillite (c)
Nevada
Thermal conductivity (W/m-K)
ranges from: 1.28
to: 2.7
Source: ORNL-6241/V3 (in preparation) p. 341, 342

Bentonite (a)
Heat conductivity (W/m-deg C) (thermal conductivity) (W/m-K)
ranges from: 0.5
to: 2.0
Source: KBS TEKNISK RAPPORT 9 (1977), p. 8

Bentonite (b)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: ca. 0.75
to: -
Source: Proc NEA Workshop OECD (1979b), p. 148

Bentonite (c)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.7
to: 3.0
Source: Proc NEA Workshop OECD (1981), p. 342

Bentonite (Ca)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.71
to: 1.10
Source: PNL-4452 UC-70 (1983), p. 20

Bentonite (d)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.5
to: 1.0
Source: Proc NEA Workshop OECD (1981), p. 342

Bentonite (e)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.9
to: 1.3
Source: ONWI-486 (1983), p. 63

Bentonite (f)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 1
to: 3.5
Source: ONWI-486 (1983), p. 63

Bentonite (g)
Wyoming
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: ca. 0.0
to: ca. 1.2
Source: Proc NEA Workshop OECD (1981), p. 334

Bentonite (h)
Wyoming
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.78
to: -
Source: ONWI-486 (1983), p. 61

Bentonite (Na)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.52
to: 0.96
Source: PNL-4452 UC-70 (1983), p. 20

Bentonite (Na)
Thermal diffusivity (cm(2)/s x 10(3))
ranges from: 3.03 (3.03 x 10(-7) m(2)/s)
to: 3.47 (3.47 x 10(-7) m(2)/s)
Source: PNL-4452 UC-70 (1983), p. 18, 19

Bentonite and Crushed Granite (a)
Wyoming
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 2.7
to: 0.8
Source: Proc NEA Workshop OECD (1981), p. 334

Bentonite and Crushed Granite (b)
Wyoming
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: ca. 0.6
to: ca. 1.5
Source: Proc NEA Workshop OECD (1981), p. 334

Bentonite and Salt (a)
Thermal conductivity (W/m-K)
ranges from: 1.12
to: 0.99
Source: ONWI-486 (1983), p. 53

Bentonite and Salt (b)
Thermal conductivity (W/m-K)
ranges from: 1.01
to: 1.12
Source: ONWI-486 (1983), p. 53

Bentonite and Sand (a)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.5
to: 2.0
Source: ONWI-486 (1983), p. 63

Bentonite and Sand (b)
Thermal conductivity (W/m-K)
ranges from: 0.58-0.80
to: 1.06-1.17
Source: ONWI-486 (1983), p. 53

Clay
Belgium
Specific heat (J/Kg-K) (specific heat capacity)
ranges from: 9.21 x 10(2)
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clay
Italy
Specific heat (J/Kg-K) (specific heat capacity)
ranges from: 9.21 x 10(2)
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clay
S. Paolo mine
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.014 (1.4 W/m-K)
to: 0.016 (1.6 W/m-K)
Source: ORNL-tr-5110 (1981), p. 12

Clay
England
Thermal conductivity (W/m-K)
ranges from: 1.56
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clay
Italy
Thermal conductivity (W/m-K)
ranges from: 1.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clay
S. Paolo mine
Thermal diffusivity (cm(2)/h)
ranges from: 20 (5.56 x 10(-7) m(2)/s)
to: -
Source: ORNL-tr-5110 (1981), p. 12

Clay
Belgium
Thermal diffusivity (m(2)/s)
ranges from: 8.1 x 10(-7)
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clay
Italy
Thermal diffusivity (m(2)/s)
ranges from: 7.8 x 10(-7)
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clay (a)
Belgium
Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
ranges from: ca. 0.3
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Clay (b)
Belgium
Thermal conductivity (W/m-K)
ranges from: 1.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Clayey Sandstones
Heat conductivity (millical/cm-s-deg C) (thermal conductivity)
ranges from: 2.5 (1.05 W/m-K)
to: -
Source: Y/OWI/SUB-7009/1 (1976), p. 23

Hectorite
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.5
to: 2 to 3
Source: ONWI-312 (1981), p. 18

Illite (a)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: ca. 0.6
to: ca. 1.6
Source: Proc NEA Workshop OECD (1981), p. 336

Illite (b)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 1.4
to: 4.0
Source: Proc NEA Workshop OECD (1981), p. 342

Illite (c)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.8
to: 1.8
Source: Proc NEA Workshop OECD (1981), p. 342

Illite and Crushed Granite
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: ca. 0.9
to: ca. 1.9
Source: Proc NEA Workshop OECD (1981), p. 336

Kaolinite (a)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 1.7
to: 3.5
Source: Proc NEA Workshop OECD (1981), p. 342

Kaolinite (b)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.9
to: 2.0
Source: Proc NEA Workshop OECD (1981), p. 342

Kaolinite and Crushed Granite
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 3.4
to: 2.3
Source: Proc NEA Workshop OECD (1981), p. 334

Shale
Heat capacity (BTU/lb-deg F)
ranges from: 0.20 (8.4 x 10(2) J/Kg-K)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale
Thermal conductivity (W/m-K)
ranges from: 1.42
to: 1.94
Source: ORNL-6241/V3 (In preparation) p. 341

Shale
Kansas
Thermal conductivity (W/m-K)
ranges from: 0.7
to: 4.3
Source: ORNL-6241/V3 (In preparation) p. 343

Shale
Michigan
Thermal conductivity (W/m-K)
ranges from: 2.64
to: -
Source: ORNL-6241/V3 (In preparation) p. 341

Shale
Orange Free State
Thermal conductivity (W/m-K)
ranges from: 1.97
to: 2.89
Source: ORNL-6241/V3 (In preparation) p. 341

Shale
South Africa
Thermal conductivity (W/m-K)
ranges from: 2.76
to: -
Source: ORNL-6241/V3 (In preparation) p. 343

Shale (a)
Coefficient of linear thermal expansion (deg F(-1))
ranges from: 4 x 10(-6) (2.2 x 10(-6) K(-1))
to: -
Source: Y/OWI/TM36/6 (1978), p. 2-2

Shale (a)
Heat capacity (J/Kg-K)
ranges from: 5.5 x 10(2)
to: 1.042 x 10(3)
Source: ORNL-6241/V1 (In preparation) p. 40

Shale (a)
England
Thermal conductivity (millical/cm-s-deg C)
ranges from: 2.2 (9.2 x 10(-1) W/m-K)
to: 5.3 (2.22 W/m-K)
Source: Y/OWI/SUB-7009/1 (1976), p. 26

Shale (b)
Coefficient of linear thermal expansion (horizontal) (deg F(-1))
ranges from: 4.5 x 10(-6) (2.5 x 10(-6) K(-1))
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (b)
Heat capacity (J/Kg-K)
ranges from: 7.12 x 10(2)
to: 1.170 x 10(3)
Source: ORNL-6241/V3 (in preparation) p. 345

Shale (b)
Thermal conductivity (horizontal) (BTU/hr-ft-deg F)
ranges from: 1.1 (1.9 W/m-K)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (c)
Coefficient of linear thermal expansion (vertical) (deg F(-1))
ranges from: 9 x 10(-6) (5 x 10(-6) K(-1))
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (c)
Specific heat (J/Kg-deg C) (specific heat capacity) (J/Kg-K)
ranges from: 7.96 x 10(2)
to: -
Source: ORNL-6241/V2 (In preparation) p. 57

Shale (c)
Thermal conductivity (horizontal) (J/s m-deg C) (W/m-K)
ranges from: 1.89
to: -
Source: ORNL-6241/V2 (In preparation) p. 99

Shale (d)
Thermal conductivity (horizontal) (W/m-K)
ranges from: 1.52
to: 2.26
Source: ORNL-6241/V1 (in preparation) p. 40

Shale (e)
Thermal conductivity (vertical) (BTU/hr-ft-deg F)
ranges from: 0.8 (1.4 W/m-K)
to: -
Source: Y/OWI/TM36/6 (1978), p. 7-8

Shale (f)
Thermal conductivity (vertical) (W/m-K)
ranges from: 1.21
to: 1.57
Source: ORNL-6241/V1 (in preparation) p. 40

Shale (g)
Thermal conductivity ratio (vertical/horizontal)
ranges from: 0.76
to: -
Source: ORNL-6241/V2 (in preparation) p. 99

Shale (h)
England
Thermal conductivity (millical/cm-s-deg C)
ranges from: 3.0 (1.26 W/m-K)
to: 4.3 (1.80 W/m-K)
Source: Y/OWI/SUB-7009/1 (1976), p. 26

Shale (i)
England
Thermal conductivity (W/m-K)
ranges from: 1.26
to: 1.80
Source: ORNL-6241/V3 (in preparation) p. 341

Shale (j)
Massachusetts
Thermal conductivity (W/m-K)
ranges from: 1.62
to: -
Source: ORNL-6241/V3 (in preparation) p. 341

Shale (k)
Sunderland, MA
Thermal conductivity (millical/cm-s-deg C)
ranges from: 3.87 (1.62 W/m-K)
to: 4.25 (1.78 W/m-K)
Source: Y/OWI/SUB-7009/1 (1976), p. 28

Shale (l)
Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
ranges from: 0.7 to 2.1
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Shale (m)
Thermal conductivity (W/m-K)
ranges from: 0.715
to: 2.20
Source: ORNL-6241/V3 (in preparation) p. 340

Shale (n)
Thermal conductivity (W/m-K)
ranges from: 1.38
to: 1.9
Source: ORNL-6241/V3 (in preparation) p. 341

Shales
Thermal conductivity (vertical) (W/m-K)
ranges from: 1.21
to: 1.57
Source: ORNL-6241/V3 (in preparation) p. 115

Shales
Thermal conductivity (W/m-K)
ranges from: 1.47
to: 2.00
Source: ORNL-6241/V3 (in preparation) p. 340

Shales
California
Thermal conductivity (W/m-K)
ranges from: 0.99 +/- 0.3
to: 1.63 +/- 0.3
Source: ORNL-6241/V3 (in preparation) p. 341

Shales (a)
Coefficient of linear thermal expansion (K(-1))
ranges from: 2.5 x 10(-6)
to: 15.8 x 10(-6)
Source: ORNL-6241/V3 (in preparation) p. 345

Shales (a)
Heat capacity (BTU/lb-deg F)
ranges from: 0.16 (6.7 x 10(2) J/Kg-K)
to: 0.20 (8.4 x 10(2) J/Kg-K)
Source: Y/OWI/TM36/6 (1978), p. A-19

Shales (a)
Thermal conductivity (horizontal) (W/m-K)
ranges from: ca. 1.60
to: ca. 2.20
Source: ORNL-6241/V3 (in preparation) p. 117

Shales (b)
Coefficient of thermal expansion (K(-1))
ranges from: 2.9 x 10(-6)
to: 12.9 x 10(-6)
Source: ORNL-6241/V1 (in preparation) p. 47

Shales (b)
Specific heat (J/Kg-K) (specific heat capacity)
ranges from: 5.50 x 10(2)
to: 1.042 x 10(3)
Source: ORNL-6241/V3 (in preparation) p. 115

Shales (b)
Various
Thermal conductivity (BTU/ft-hr-deg F)
ranges from: 0.34 (5.9 x 10(-1) W/m-K)
to: 1.77 (3.1 W/m-K)
Source: Y/OWI/TM36/6 (1978), p. A-18

Silt/Clay Soil (a)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.8
to: 2.0
Source: ONWI-486 (1983), p. 54

Silt/Clay Soil (b)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.4
to: 0.85
Source: ONWI-486 (1983), p. 54

Silt/Clay Soil (c)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.5
to: 1.1
Source: ONWI-486 (1983), p. 54

Silt/Clay Soil (d)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.6
to: 1.3
Source: ONWI-486 (1983), p. 54

Silt/Clay Soil (e)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.7
to: 1.5
Source: ONWI-486 (1983), p. 54

Silt/Clay Soil (f)
Thermal conductivity (W/m-deg C) (W/m-K)
ranges from: 0.75
to: 1.75
Source: ONWI-486 (1983), p. 54

Soils
Bristol, VA
Thermal conductivity (Btu per hr-sq ft) (deg F per ft) (?)
ranges from: 0.14
to: 0.60
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Soils
Columbus, MS
Thermal conductivity (Btu per hr-sq ft) (deg F per ft) (?)
ranges from: 0.28
to: 2.28
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Soils
Thermal conductivity (k x 10(4)) (?)
ranges from: 3
to: 5
Source: Y/OWI/SUB-7009/1 (1976), p. 19

Soils
Thermal conductivity (k x 10(4)) (?)
ranges from: 3-4
to: 8-12
Source: Y/OWI/SUB-7009/1 (1976), p. 19

Soils
Bristol, VA
Thermal diffusivity (ft(2) per hr)
ranges from: 0.0090 (2.3 x 10(-7) m(2)/s)
to: 0.016 (4.13 x 10(-7) m(2)/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Soils
Columbus, MS
Thermal diffusivity (ft(2) per hr)
ranges from: 0.016 (4.13 x 10(-7) m(2)/s)
to: 0.046 (1.19 x 10(-7) m(2)/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Soils (a)
Cleveland, TN
Thermal conductivity (Btu per hr-sq ft) (deg F per ft) (?)
ranges from: 0.15
to: 0.94
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Soils (a)
Cleveland, TN
Thermal diffusivity (ft(2) per hr)
ranges from: 0.0115 (2.97 x 10(-7) m(2)/s)
to: 0.022 (5.68 x 10(-7) m(2)/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

Soils (b)
Murfreesboro, TN
Thermal conductivity (Btu per hr-sq ft) (deg F per ft) (?)
ranges from: 0.21
to: 0.84
Source: Y/OWI/SUB-7009/1 (1976), p. 20

Soils (b)
Murfreesboro, TN
Thermal diffusivity (ft(2) per hr)
ranges from: 0.0145 (3.74 x 10(-7) m(2)/s)
to: 0.0235 (6.06 x 10(-7) m(2)/s)
Source: Y/OWI/SUB-7009/1 (1976), p. 21

13.4 Appendix D. FORMATION NAMES

Boom Clay
    Belgium
Ion exchange capacity (meq/100 g)
    ranges from: ca. 20
        to: -
    Source: Proc NEA Workshop OECD (1979a),
        p. 88

Boom Clay
    Belgium
Sorption coefficient (Kd) (ml/g?)
    ranges from: 0.87
        to: 6.12
    Source: Proc NEA Workshop OECD (1979a),
        p. 97

Conasauga Shale
Sorption coefficient (Kd) (ml/g)
    ranges from: 57
        to: 100
    Source: ONWI-486 (1983), p. 73

Conasauga Shale
Sorption coefficient (Kd) (ml/g)
    ranges from: 41
        to: 1340
    Source: ONWI-486 (1983), p. 73

Dewey Lake Redbeds
Sorption coefficient (Kd) (ml/g)
    ranges from: 200
        to: 1.4 x 10(4)
    Source: ONWI-486 (1983), p. 73

Eleana Argillite
Sorption coefficient (Kd) (ml/g)
    ranges from: 0
        to: 1 x 10(5)
    Source: ONWI-486 (1983), p. 73

Antrim Shale
Michigan
Density (bulk) (g/cm(3))
ranges from: 2.2
to: 2.8
Source: ORNL/Sub/84-64794/1 (1985), p. 96

Antrim Shale
Michigan
Porosity (%)
ranges from: 3
to: 10
Source: ORNL-5703 (1983), p. 106

Antrim Shale
Michigan
Porosity (%)
ranges from: 3
to: 10
Source: ORNL/Sub/84-64794/1 (1985), p. 98

Antrim Shale
Michigan
Specific surface (m(2)/g)
ranges from: 0.05
to: 1.2
Source: ORNL-5703 (1983), p. 109

Arnheim and Waynesville Fms
Ohio
Moisture content (natural) (%)
ranges from: 2
to: -
Source: Y/OWI/TM36/6, p. 5-14

Arnheim and Waynesville Fms
Ohio
Porosity (effective) (%)
ranges from: 4
to: -
Source: Y/OWI/TM36/6, p. 5-14

Bearpaw Shale
Montana
Density (dry) (average) (lbs/ft(3))
ranges from: 118 (1.890 g/cm(3))
to: -
Source: Y/OWI/TM36/6, p. 6-1

Bearpaw Shale
Montana
Density (wet) (average) (pounds/ft(3))
ranges from: 135 (2.162 g/cm(3))
to: -
Source: Y/OWI/TM36/6, p. 6-1

Bearpaw Shale
Montana
Water content (average) (%)
ranges from: 15
to: -
Source: Y/OWI/TM36/6, p. 6-1

Blue Clay
Italy
Density (bulk) (kg/m(3))
ranges from: 2100 (2.100 g/cm(3))
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Blue Clay
Italy
Porosity (%)
ranges from: 25
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Boom Clay
Belgium
Density (bulk) (kg/m(3))
ranges from: 2010 (2.010 g/cm(3))
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Boom Clay
Belgium
Porosity (%)
ranges from: 38.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Chagrin Shale
Ohio
Moisture content (natural) (%)
ranges from: 4
to: -
Source: Y/OWI/TM36/6, p. 4-12

Chagrin Shale
Ohio
Porosity (rock mass) (%)
ranges from: 8
to: -
Source: Y/OWI/TM36/6, p. 4-12

Chanute Shale
Kansas
Porosity (total) (units not stated)
ranges from: 0.073
to: 0.106
Source: ORNL-6241/V2 (in preparation) p. 52

Chattanooga Shale
Kentucky
Porosity (total) (units not stated)
ranges from: 0.074
to: 0.076
Source: ORNL-6241/V2 (in preparation) p. 52

Conasauga Shale
Tennessee
Porosity (%)
ranges from: 0.5
to: 1.9
Source: ORNL-6241/V2 (in preparation) p. 219

Conasauga Shale
Tennessee
Porosity (total) (units not stated)
ranges from: 0.005
to: 0.019
Source: ORNL-6241/V2 (in preparation)
p. 52

Eleana Argillite
Nevada
Density (bulk) (g/cm(3))
ranges from: 2.44
to: 2.71
Source: ORNL/Sub/84-64794/1 (1985),
p. 406

Eleana Argillite
Nevada
Moisture content (%)
ranges from: 2
to: 4
Source: ORNL/Sub/84-64794/1 (1985),
p. 406

Eleana Argillite
Nevada
Porosity (%)
ranges from: 8 to 16
to: 6 to 12
Source: ORNL/Sub/84-64794/1 (1985),
p. 406

Graneros, Greenhorn, Niobara and Pierre Shales
Black Hills
Density (bulk) (presumed g/cm(3))
ranges from: 1.559
to: 2.038
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Green River Fm
Density (bulk) (presumed g/cm(3))
ranges from: 1.506
to: 2.37
Source: Y/OWI/SUB-7009/1 (1976), p. 13

Hamilton Shale
Missouri
Porosity (total) (units not stated)
ranges from: 0.113
to: -
Source: ORNL-6241/V2 (in preparation)
p. 52

Ireton Fm
Western Canada
Density (bulk) (presumed g/cm(3))
ranges from: 2.43
to: 2.71
Source: Y/OWI/SUB-7009/1 (1976), p. 17

Lewis Shale
New Mexico
Moisture content (%)
ranges from: 3.7
to: 6.2
Source: Y/OWI/TM36/6, p. 8-5

Mancos Fm
New Mexico
Moisture content (rock) (%)
ranges from: 3
to: 11
Source: Y/OWI/TM36/6, p. 8-3

Martinsburg Shale
Pennsylvania
Porosity (total) (units not stated)
ranges from: 0.010
to: -
Source: ORNL-6241/V2 (in preparation)
p. 52

Muddy Shale
Colorado
Porosity (%)
ranges from: 4.1
to: 5.1
Source: Y/OWI/SUB-7009/1 (1976), p. 14

New Albany Shale
Illinois, Indiana and Kentucky
Density (bulk) (average) (g/cm(3))
ranges from: 2.36
to: 2.53
Source: ORNL-5703 (1983), p. 76

New Albany Shale
Illinois, Indiana, Kentucky
Porosity (%)
ranges from: 0.95
to: 4.64
Source: ORNL/Sub/84-64794/1 (1985),
p. 85

New Albany Shale
Illinois, Indiana and Kentucky
Porosity (average) (vol. %)
ranges from: 0.95
to: 4.64
Source: ORNL-5703 (1983), p. 76

New Albany Shale
Illinois, Indiana, Kentucky
Porosity (total) (units not stated)
ranges from: 0.009
to: 0.046
Source: ORNL-6241/V2 (in preparation)
p. 52

Olentangy and Huron Shale
Ohio
Porosity (primary) (%)
ranges from: >3 %
to: -
Source: ORNL/Sub/84-64794/1 (1985),
p. 108

Olentangy and Huron Shales
Ohio
Density (bulk) (g/cm(3))
ranges from: 2.65
to: -
Source: ORNL/Sub/84-64794/1 (1985),
p. 108

Ophir Shale
Utah
Porosity (total) (units not stated)
ranges from: 0.009
to: -
Source: ORNL-6241/V2 (in preparation) p. 52

Oxford Clay
England
Density (bulk) (kg/m(3))
ranges from: 2210 (2.210 g/cm(3))
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Oxford Clay
England
Porosity (%)
ranges from: 30
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle, v. 6 (1985), p. 54

Panther Creek Clay
Density (g/cm(3))
ranges from: <1.7
to: ca. 2.14
Source: PNL-4452 UC-70 (1983), p. 24

Pierre Shale
Northern Great Plains
Density (dry) (lb/cu ft)
ranges from: 95 (1.522 g/cm(3))
to: 110 (1.762 g/cm(3))
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Western USA
Moisture content (%)
ranges from: 35
to: 15
Source: Y/OWI/TM36/6, p. 3-1

Pierre Shale
Moisture content (natural) (%)
ranges from: 18
to: -
Source: Y/OWI/TM36/6, p. 3-24

Pierre Shale
Northern Great Plains
Moisture content (natural) (%)
ranges from: 18
to: 38
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Porosity (%)
ranges from: 33
to: -
Source: Y/OWI/TM36/6, p. 3-24

Pierre, Bearpaw and Claggett Shales
Moisture content (natural) (%)
ranges from: 38
to: 12
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Porter's Creek Clay
Louisiana
Density (kg/m(3))
ranges from: 1,954 (1.954 g/cm(3))
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Antrim Shale
Michigan
Permeability (md)
ranges from: 0.001 (1 x 10(-9) cm/s)
to: 2.0 (1.9 x 10(-6) cm/s)
Source: ORNL/5703 (1983), p. 109

Antrim Shale
Michigan
Permeability (md)
ranges from: 0.001 (1 x 10(-9) cm/s)
to: 2.0 (1.9 x 10(-6) cm/s)
Source: ORNL/Sub/84-64794/1 (1985), p. 98

Arnheim and Waynesville Fms
Ohio
Permeability (ft/yr) (hydraulic conductivity)
ranges from: 10(-3) (9.7 x 10(-10) cm/s)
to: 10(-4) (9.7 x 10(-11) cm/s)
Source: Y/OWI/TM36/6 (1978), p. 5-14

Blue Clay
Italy
Hydraulic conductivity (m/s)
ranges from: 10(-11) (1 x 10(-9) cm/s)
to:
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Boom Clay
Belgium
Hydraulic conductivity (m/s)
ranges from: 10(-10) (1 x 10(-8) cm/s)
to: 10(-12) (1 x 10(-10) cm/s)
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Chagrin Shale
Ohio
Permeability (horizontal) (ft/yr) (hydraulic conductivity)
ranges from: 0.1 (9.7 x 10(-8) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 4-12

Chagrin Shale
Ohio
Permeability (vertical) (ft/yr) (hydraulic conductivity)
ranges from: 0.05 (5 x 10(-8) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 4-12

Conasauga Shale
Tennessee
Hydraulic conductivity (cm/s)
ranges from: 6 x 10(-10)
to: 3 x 10(-11)
Source: ORNL-6241/V2 (in preparation) p. 220

Conasauga Shale
Tennessee
Hydraulic conductivity (horizontal) (m/s)
ranges from: 3 x 10(-13) (3 x 10(-11) cm/s)
to: 2 x 10(-12) (2 x 10(-10) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 42

Maquoketa Shale
Illinois Basin
Hydraulic conductivity (cm/s)
ranges from: 10(-9)
to:
Source: ORNL-6241/V2 (in preparation) p. 220

Maquoketa Shale
Illinois
Hydraulic conductivity (horizontal) (m/s)
ranges from: 2 x 10(-11) (2 x 10(-9) cm/s)
to:
Source: ORNL-6241/V2 (in preparation) p. 42

Muddy Shale
Permeability (md)
ranges from: 5 x 10(-2) (4.9 x 10(-7) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Muddy Shale
Colorado
Permeability (md)
ranges from: <0.05 (<4.9 x 10(-7) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 14

Oxford Clay
England
Hydraulic conductivity (m/s)
ranges from: 10(-12) (1 x 10(-10) cm/s)
to:
Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Panther Creek Clay
Hydraulic conductivity (cm/s)
ranges from: 7 x 10(-12)
to: 2 x 10(-12)
Source: PNL-4452 UC-70 (1983), p. 14

Pierre Shale
South Dakota
Hydraulic conductivity (horizontal) (m/s)
ranges from: 1 x 10(-12) (1 x 10(-10) cm/s)
to: 1 x 10(-11) (1 x 10(-9) cm/s)
Source: ORNL-6241/V2 (in preparation) p. 43

Pierre Shale
Great Plains
Permeability (cm/s) (hydraulic conductivity)
ranges from: 1 x 10(-6)
to: 1 x 10(-10)
Source: ORNL/Sub/84-64794/1 (1985),
p. 293

Pierre Shale
Permeability (horizontal) (ft/yr) (hydraulic conductivity)
ranges from: 0.01 (9.7 x 10(-9) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre Shale
Permeability (md)
ranges from: 1.1 x 10(-4) (1.1 x 10(-10) cm/s)
to:
Source: Y/OWI/SUB-7009/1 (1976), p. 11

Pierre Shale
Permeability (vertical) (ft/yr) (hydraulic conductivity)
ranges from: 0.005 (5 x 10(-9) cm/s)
to:
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre, Bearpaw and Claggett Shales
Northern Great Plains
Hydraulic conductivity (cm/s)
ranges from: 10(-6)
to: 10(-10)
Source: ORNL-6241/V2 (in preparation)
p. 220

Porters Creek Clay
Louisiana
Hydraulic conductivity (cm/s)
ranges from: 10(-8) (est)
to:
Source: ORNL/Sub/84-64794/1 (1985),
p. 175

Arnheim and Waynesville Fms
Ohio
Bulk modulus (psi)
ranges from: 6.3 x 10(5) (4.3 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Arnheim and Waynesville Fms
Ohio
Cohesion (psi)
ranges from: 5,900 (4.1 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Arnheim and Waynesville Fms
Ohio
Compressive strength (uniaxial) (psi)
ranges from: 1 x 10(4) (6.9 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Arnheim and Waynesville Fms
Ohio
Friction angle (deg)
ranges from: 23.4
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Arnheim and Waynesville Fms
Ohio
Poisson's ratio
ranges from: 0.1
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Arnheim and Waynesville Fms
Ohio
Shear modulus (psi)
ranges from: 6.8 x 10(5) (4.7 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Arnheim and Waynesville Fms
Ohio
Tensile strength (psi)
ranges from: 200 (1.4 MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Arnheim and Waynesville Fms
Ohio
Young's modulus (psi)
ranges from: 1.5 x 10(6) (1 x 10(4) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 5-14

Bearpaw Shale
Montana
Compressive strength (kg/cm(2))
ranges from: 122 (1.2 x 10(1) MPa)
to: 25 (2.5 MPa)
Source: Y/OWI/TM36/6 (1978), p. 6-13

Bearpaw Shale
Montana
Compressive strength (kg/cm(2))
ranges from: 25 (2.5 MPa)
to: 55 (5.4 MPa)
Source: Y/OWI/TM36/6 (1978), p. 6-13

Bearpaw Shale
Montana
Plasticity (liquidity index)
ranges from: -0.11
to: -
Source: Y/OWI/TM36/6 (1978), p. 6-1

Blue Clay
Italy
Cohesion (MPa)
ranges from: 1 x 10(-1)
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Blue Clay
Italy
Friction angle (angle of shear resistance) (deg)
ranges from: 25
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Blue Clay
Italy
Plasticity (liquid limit) (%)
ranges from: 50
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Blue Clay
Italy
Plasticity (plastic limit) (%)
ranges from: 25
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Blue Clay
Italy
Shear strength (undrained) (MPa)
ranges from: 1.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Blue Clay
Italy
Young's modulus (elastic modulus) (MPa)
ranges from: 300
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Boom Clay
Belgium
Cohesion (MPa)
ranges from: 1 x 10(-1)
to: 1
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Boom Clay
Belgium
Friction angle (angle of shear resistance) (deg)
ranges from: 19
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Boom Clay
Belgium
Plasticity (liquid limit) (%)
ranges from: 77.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Boom Clay
Belgium
Plasticity (plastic limit) (%)
ranges from: 26.5
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Boom Clay
Belgium
Shear strength (undrained) (MPa)
ranges from: 0.6
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Boom Clay
Belgium
Young's modulus (elastic modulus) (MPa)
ranges from: 170
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Chagrin Shale
Ohio
Bulk modulus (psi)
ranges from: 1.1 x 10(5) (7.6 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Chagrin Shale
Ohio
Cohesion (psi)
ranges from: 14 (1 x 10(-1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Chagrin Shale
Ohio
Compressive strength (uniaxial) (MPa)
ranges from: 13.8
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Chagrin Shale
Ohio
Compressive strength (uniaxial) (psi)
ranges from: 2 x 10(3) (1.4 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Chagrin Shale
Ohio
Friction angle (deg)
ranges from: 22
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Chagrin Shale
Ohio
Poisson's ratio
ranges from: 0.25
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Chagrin Shale
Ohio
Shear modulus (psi)
ranges from: 6.8 x 10(4) (4.7 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Chagrin Shale
Ohio
Tensile strength (MPa)
ranges from: 0.34
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 108

Chagrin Shale
Ohio
Tensile strength (psi)
ranges from: 50 (3.4 x 10(-1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Chagrin Shale
Ohio
Young's modulus (psi)
ranges from: 1.7 x 10(5) (1.2 x 10(3) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 4-12

Eleana Argillite
Bulk modulus (confined) (GPa)
ranges from: 14.0 (1.4 x 10(4) MPa)
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Eleana Argillite
Cohesion (unconfined) (MPa)
ranges from: 8 x 10(-1)
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Eleana Argillite
Compressive strength (unconfined) (MPa)
ranges from: 4.75
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Eleana Argillite
Friction angle (internal) (deg)
ranges from: 35
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Eleana Argillite
Poisson's ratio
ranges from: 0.30
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Eleana Argillite
Tensile strength (MPa)
ranges from: 3.5
to: -
Source: Proc NEA Workshop OECD (1979b), p. 81

Eleana Argillite
Young's modulus (GPa)
ranges from: 3.7 (3.7 x 10(3) MPa)
to: 16 (MPa)
Source: Proc NEA Workshop OECD (1979b), p. 83

Eleana Argillite
Young's modulus (unconfined) (GPa)
ranges from: 3.74 (3.7 x 10(3) MPa)
to: -
Source: Proc NEA Workshop OECD (1979b), p. 87

Hucknall Shale
Compressive strength (psi)
ranges from: 8.5 x 10(3) (5.9 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 6-3

Hucknall Shale
Young's modulus (elastic modulus) (psi x 10(6))
ranges from: 1.48 (1 x 10(4) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 6-3

Lewis Shale
New Mexico
Compressive strength (psi)
ranges from: 1,000 (6.9 MPa)
to: 6,000 (4.1 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. 8-5

Mancos Fm
New Mexico
Compressive strength (psi)
ranges from: 1,000 (6.9 MPa)
to: 8,000 (5.5 x 10(1) MPa)
Source: Y/OWI/TM36/6 (1978), p. 8-2

Maquoketa Group
Indiana
Compressive strength (MPa)
ranges from: 11
to: 115
Source: ORNL/Sub/84-64794/1 (1985), p. 60

Oxford Clay
England
Plasticity (liquid limit) (%)
ranges from: 55
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Oxford Clay
England
Plasticity (plastic limit) (%)
ranges from: 26
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Oxford Clay
England
Shear strength (undrained) (MPa)
ranges from: 1.2
to: -
Source: Rad Waste Management and Nuclear Fuel Cycle v.6 (1985), p. 54

Pierre Shale
Bulk modulus (psi)
ranges from: 77.8 x 10(3) (5.4 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre Shale
Cohesion (psi)
ranges from: 206 (1.4 MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre Shale
Great Plains
Cohesion (psi)
ranges from: 2 (1.4 x 10(-2) MPa)
to: 30 (2.1 x 10(-1) MPa)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Great Plains
Compressive strength (psi)
ranges from: 70 (4.8 x 10(-1) MPa)
to: 2,530 (1.7 x 10(1) MPa)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Compressive strength (uniaxial) (psi)
ranges from: 2.1 x 10(3) (1.4 x 10(1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre Shale
Friction angle (deg)
ranges from: 5.3
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre Shale
Great Plains
Friction angle (internal) (deg)
ranges from: 8
to: 25
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Great Plains
Plasticity (liquid limit) (%)
ranges from: 36
to: 113
Source: ORNL/Sub/84-64794/1 (1985), p. 291

Pierre Shale
Great Plains
Plasticity (liquid limit) (%)
ranges from: 55
to: 202
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Great Plains
Plasticity (plastic limit) (%)
ranges from: 20
to: 62
Source: ORNL/Sub/84-64794/1 (1985), p. 291

Pierre Shale
Great Plains
Plasticity (plastic limit) (%)
ranges from: 22
to: 39
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Great Plains
Plasticity (plasticity index) (%)
ranges from: 30
to: 110
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Poisson's ratio
ranges from: 0.2
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre Shale
Shear modulus (psi)
ranges from: 58.3 x 10(3) (4 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre Shale
Great Plains
Swelling (potential) (%)
ranges from: 3
to: 5
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Tensile strength (psi)
ranges from: 50 (3.4 x 10(-1) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre Shale
Great Plains
Young's modulus (elastic modulus) (psi x 10(6))
ranges from: 0.02 (1.4 x 10(2) MPa)
to: 0.014 (9.6 x 10(1) MPa)
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Pierre Shale
Young's modulus (psi)
ranges from: 1.4 x 10(5) (9.7 x 10(2) MPa)
to: -
Source: Y/OWI/TM36/6 (1978), p. 3-24

Pierre Shale (equivalent)
Canada
Swelling (potential) (%)
ranges from: 2
to: 20
Source: ORNL/Sub/84-64794/1 (1985), p. 293

Porters Creek Clay
Louisiana
Plasticity (plasticity index) (%)
ranges from: 40
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Porters Creek Clay
Louisiana
Strength (MPa)
ranges from: 0.19
to: -
Source: ORNL/Sub/84-64794/1 (1985), p. 173

Blue Clay
    Italy
Specific heat (J/Kg-K)   (specific heat capacity)
    ranges from: 9.21×10^{2}
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Blue Clay
    Italy
Thermal conductivity (W/m-K)
    ranges from: 1.5
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Blue Clay
    Italy
Thermal diffusivity (m^{2}/s)
    ranges from: 7.8×10^{-7}
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Boom Clay
    Belgium
Specific heat (J/Kg-K)   (specific heat capacity)
    ranges from: 9.21×10^{2}
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Boom Clay
    Belgium
Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
    ranges from: ca. 0.3
    to: -
    Source: Proc NEA Workshop OECD (1979b), p. 87

Boom Clay
    Belgium
Thermal conductivity (W/m-K)
    ranges from: 1.5
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Boom Clay
    Belgium
Thermal diffusivity (m^{2}/s)
    ranges from: 8.1×10^{-7}
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Conasauga Shale
Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
    ranges from: 0.7 to 2.1
    to: -
    Source: Proc NEA Workshop OECD (1979b), p. 87

Conasauga Shale
Thermal conductivity (W/m-K)
    ranges from: 0.715
    to: 2.20
    Source: ORNL-6241/V3 (in preparation) p. 340

Eleana
Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
    ranges from: ca. 1.80
    to: -
    Source: Proc NEA Workshop OECD (1979b), p. 87

Eleana
Thermal conductivity (matrix) (W/m-deg C) (W/m-K)
    ranges from: ca. 1.48
    to: -
    Source: Proc NEA Workshop OECD (1979b), p. 87

Eleana Argillite
Coefficient of linear expansion (deg C^{-1}) (K^{-1})
    ranges from: 8×10^{-6}
    to: 15×10^{-6}
    Source: Proc NEA Workshop OECD (1979b), p. 77

Eleana Argillite
    Nevada
Thermal conductivity (W/m-K)
    ranges from: 1.28
    to: 2.7
    Source: ORNL-6241/V3 (in preparation) p. 341, 342

Karoo Shale
    Orange Free State
Thermal conductivity (W/m-K)
    ranges from: 1.97
    to: 2.89
    Source: ORNL-6241/V3 (in preparation) p. 341

Nonesuch Shale
    Michigan
Thermal conductivity (W/m-K)
    ranges from: 2.64
    to: -
    Source: ORNL-6241/V3 (in preparation) p. 341

Oxford Clay
    England
Thermal conductivity (W/m-K)
    ranges from: 1.56
    to: -
    Source: Rad Waste Management and Nuclear Fuel Cycle v. 6 (1985), p. 54

Pierre Shale
Thermal conductivity (W/m-K)
    ranges from: 1.42
    to: 1.94
    Source: ORNL-6241/V3 (in preparation) p. 341

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