

A NOTE OF INFORMATION REGARDING
TO ALKALI - AGGREGATE REACTIONS
IN TURKEY

by

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It has been observed in Turkey that some reactive aggregates have been used in the constructions of some large dams some years ago. Fortunately no damage of concrete has been occurred so far. Upon this observations however, certain measures have immediately been taken in controlling of all cements and aggregates to be used for large constructions, very closely. All cements and aggregates used by Department of State Hydraulic Works (The organization responsible for the construction of big dams and irrigation works) have been tested very carefully in according to the ASTM test methods, for the past ten years.

Although quite a lot of reactive aggregates exist in Turkey (See table 1) no serious disintegration has taken place in the constructions completed by State Hydraulic Works so far due to alkali-aggregate reactions.

As it is known, reactive-aggregates cause some expansion without any harmful effect, when they are used with cements of low-alkali content. Almost all of the cement plants which were set up as to operate according to the wet process during the last decades, have been converted into dry systems. Only very few number of kilns are still operating according to the wet system out of 30 plants running in Turkey now. However, it was observed that cements produced by converted plants contain higher amount of alkalis. Certain protective measures were taken thereupon and alkali contents were decreased. At the present, nearly 85% of cement produced in Turkey have alkali contents less than 0.66%. Nevertheless, statistics show that cements produced by dry process contains higher quantity of alkalis than those produced by wet process.

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On the other hand, as it is seen in Table 1, 29% of all aggregates obtained from 25 different sources in Turkey are reactive ones. These results have been determined according to the ASTM C 289 and ASTM C 227 methods and also petrographical investigations. These reactive - aggregates were used with cements of low - alkali content as a precaution, since a better way of protection is not yet available. However, pozzolans have been incorporated into cements in certain cases, where reactive aggregates have to be used and where cements with low alkali contents were not available. For example, the aggregate used in Kaletepe Weir was a reactive one. The cement to be used also had a high alkali content. A high expansion was observed in the laboratory tests made with mortar bars. Since either changing the deposit of aggregate or the cement already stocked were impossible, 25% fly ash by weight has been mixed with cement. After this process, no expansion (or un-measurable) was observed with mortar bars.

As it was mentioned above, very close investigations are carried out on every aggregate and cements to be used for any construction to be built by State Hydraulic Works and certain protective measures are taken, such as incorporation of pozzolans, replacing of aggregates with non - reactive types or utilization of cements with low - alkali contents.

Table 1
 Reactivity of Aggregates
 (According to ASTM C 289)

The Work where the aggregate is used	Soluble Silica (Sc) milimol/lt	Alkali Reduction (Rc) milimol/lt	Evaluation of the Aggregate
Yazıcı Dam	113	225	Deleterious
Kumkale Channel	84	138	Innocuous
Siverek Dam	28	44	Innocuous
Muradiye-Ayrancılar			
Small Dam	524	92	Deleterious
Kozan Small Dam	147	160	Innocuous
Aşağı Kent Dam	149	241	Innocuous
Ekincik Dam	165	214	Innocuous
Uluslu Small Dam	46	165	Innocuous
Bulanık Small Dam	125	208	Innocuous
Keban Dam A	70	160	Innocuous
Keban Dam B	126	180	Innocuous
Keban Dam C	74	184	Innocuous
Keban Dam D	151	175	Innocuous
Keban Dam E	33	175	Innocuous
Sakaryabaşı Small Dam	440	178	Deleterious
Madra Dam	141	173	Innocuous
Almus Dam, Tunnel	89	179	Innocuous
Bafra Project A	91	111	Innocuous
Bafra Project B	218	128	Deleterious
Şarkışla Project	300	16	Innocuous
Aşağı Fırat Project	28	2	Innocuous
Bedir Project	112.5	62	Innocuous
Karkamış Dam	135	258	Deleterious
Altinkaya Dam	117.5	76	Innocuous
Uzunlu Project	57.5	15	Innocuous

The Work where the aggregate is used	Soluble Silica (Sc) milimol/lt	Alkali Reduction (Rc) milimol/lt	Evaluation of the Aggregate
Berdan Dam	2.5	7	Innocuous
Karaçay Project	65	37	Innocuous
Karademir Dam	27.5	20.6	Innocuous
Van-Engil Project	137.5	28	Innocuous
Özköy Dam	92.5	126.5	Deleterious
Çamlıdere Project	275	441	Deleterious
Çifteler Kör Hasan Project	140	530	Deleterious
Avşar Dam	48	20	Innocuous
Çayırköy Small Dam	385	246	Innocuous
Bozkır Dam	115	30	Innocuous
Yunak Deresi Project	90	30	Innocuous
Kaletepe Small Dam	140	450	Deleterious
Bâlâ ovası Irrigation Works	130	160	Deleterious
İzmir Drinking Water Project	200	420	Deleterious
Ivriz Dam	38	2	Innocuous
Manyas Dam	170	390	Deleterious