ENVIRONMENTAL AUDIT, INC.®

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February 16, 1995

Project No. 1233-

Ms. Medula Logan
Alameda County
Environmental Health Department
Environmental Protection Division
1131 Harbor Bay Parkway, #250
Alameda, CA 94502-6577

RE: RESPONSES TO COMMENTS
ADDENDUM TO RISK BASED CORRECTIVE ACTIONS ANALYSIS
Montgomery Ward Auto Service Center and
Enea Properties Sites
Dublin, California

Dear Ms. Logan:

Pursuant to a telephone conversation with you on February 14, 1995, the following are the revised calculations for benzene and TPH emissions into outdoor and indoor (enclosed space) air (see Attachment) for the risk based corrective actions (RBCA) analyses for the Montgomery Ward and Enea Properties sites in Dublin, California. These revised calculations reflect a depth to ground water (DTW) of approximately nine feet below ground surface (bgs). In our letter dated February 6, 1995 titled, "Addendum to Risk Based Corrective Actions Analysis" (Environmental Audit, Inc. [EAI], 1995), we used a DTW of approximately 10 feet (305 centimeters [cm]) in our calculations for emissions into outdoor and indoor air. Review of recent data contained in Table 3 of EAI, 1995 document indicates that the DTW at the Montgomery Ward site is approximately 11 to 12 feet bgs, while the DTW at the Enea Properties site ranges from approximately nine to 10 feet bgs. Therefore, these data support the use of the "10 feet DTW" value used in the calculations contained in the EAI, 1995 document. As stated above, we used a DTW of nine feet (274 cm) in the revised calculations contained herein and the results of these revised calculations are, therefore, conservative.

Table 1 summarizes the outdoor and indoor (enclosed space) air, health risk assessment based on incremental cancer risks of 1×10^{-6} and 1×10^{-5}. These TPH and benzene results were compared to recent data, that is 1994 quarterly ground water monitoring data (see Tables 1 and 2 in EAI, 1995 document), which reflect current conditions. The following provides a summary of these results for the Enea Properties and Montgomery Ward sites.

ENEA PROPERTIES

Outdoor Air

None of the concentrations in ground water exceed the maximum allowable benzene or TPH concentration in ground water for emissions into outdoor air using either a risk of either 1×10^{-6} and 1×10^{-5} (see Table 1).

Indoor (Enclosed Space)

Use of a risk of 1×10^{-5} results in calculations that demonstrate that none of the constituents in ground water at the Enea Properties site have exceeded the maximum allowable benzene and TPH concentration in ground water for emissions into indoor air emissions (see Table 1).

Based on a risk of 1×10^{-6}, the calculations show that none of the benzene concentrations in ground water at the Enea Properties site exceeded the calculated maximum benzene concentration of 65.3 micrograms/liter (ug/l) during 1994. The benzene concentration in ground water at the Enea Properties site exceed the calculated maximum allowable benzene concentration in well MW-1 for only one sampling event (October 14, 1993 in which 76 ug/l of benzene was detected) (see Table 1 and Table 1 of EAI, 1995).

Quarterly monitoring shows that dissolved TPH detected in water samples from wells MW-1 and MW-3 have exceeded maximum allowable TPH concentration in ground water of 1,113 ug/l during all sampling events in 1994 (see Table 1 of EAI, 1995). No problematic concentrations of TPH, however, were detected in wells MW-2 and MW-4. As stated in EAI, 1995, the use of a toxicity factor of 0.0017 $(mg/kg\text{-}day)^{-1}$ for gasoline is probably not appropriate for the Enea Properties site, since this toxicity factor is derived from a gasoline sample which is probably dissimilar in original composition and is not weathered as compared to the dissolved material in ground water at the site. Consequently, the calculated maximum value for TPH emissions from ground water based on the toxicity factor of 0.0017 $(mg/kg\text{-}day)^{-1}$ is too conservative and is probably not appropriate (see EAI, 1995).

Montgomery Ward Site (including off-site wells MW-100, 101, and 102)

Outdoor Air

None of the concentrations in ground water exceed the maximum allowable benzene or TPH concentration in ground water for emissions into outdoor air using either a cancer risk level of either 1×10^{-6} or 1×10^{-5} (see Table 1).

Indoor Air

Use of a cancer risk level of 1×10^{-5} results in no problematic concentrations of TPH or benzene in ground water for emissions into indoor air (see Table 1).

The maximum benzene concentration in ground water is 65.3 ug/l based on use of a 1×10^{-6} risk. Water samples obtained from wells B-5, B-10, and B-12 contain benzene which exceed this maximum allowable concentration.

Analytical testing of water samples from wells B-5, B-10, B-12, and MW-100 show that TPH detected in samples from these wells exceed the maximum allowable TPH limit of

1,113 ug/l which is based on a risk of 1 x 10^{-6}. As stated above, use of this toxicity factor of 0.0017 $(mg\text{-}kg/day)^{-1}$ may not be appropriate since the toxicity factor used is based on a gasoline sample of likely dissimilar composition to the TPH in ground water at the site.

LIMITATION

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable environmental consultants in this or similar localities. No other warranty, expressed or implied, is made as to the professional advice contained in this report.

Please call if you have any questions or need additional information.

Sincerely,

ENVIRONMENTAL AUDIT, INC.

Frank S. Muramoto

Frank S. Muramoto, R.G.
Senior Geologist

Debra A. Bright

Debra A. Bright, M.P.H.
Senior Vice President

FSM:DAB:sh

attachments

cc: E. Chu, Alameda County
C. West, Montgomery Ward
G. Jonas, Montgomery Ward
M. Gilmartin, Straw & Gilmartin
R. Enea, Enea Properties
R. Arulanantham, BARWQCB

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TABLE 1

SUMMARY OF OUTDOOR AND INDOOR (ENCLOSED SPACE) AIR HEALTH RISK ASSESSMENT

RISK	$1x10^{-6}$		$1x10^{-5}$	
	TPH	BENZENE	TPH	BENZENE
	µg/l	µg/l	µg/l	µg/l
OUTDOOR AIR	35,216	2,064	352,164	20,644
INDOOR AIR	1,113	65.3	11,132	653.3

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MONTGOMERY WARDS – DUBLIN
HEALTH RISK ASSESSMENT
Benzene Impacts – Indoor air

RBSL(air) = (TR)(BW)(ATc)(365)(1000)/(SFi*IR*EF*ED)

RBSL(air)	4.933793	(ug/m3)
TR	0.00001	
BW	70	kg
ATc	70	years
SFi	0.029	(mg/kg–day)–1
IRair	20	m3/day
EF	250	days/year
ED	25	years

Ds = Dair (Oas^3.33/Ot^3.33) + Dwat(1/H)(Ows^3.33/Ot^3.33)

Ds	0.026283	(cm2/sec)
Dair	0.093	cm2/s
Oas	0.26	
Ot	0.38	
Dwat	0.000011	cm2/s
H	0.22	l water/l air
Ows	0.12	

Dcrack = Dair (Oacrack^3.33/Ot^3.33) + Dwat(1/H)(Owcrack^3.33/Ot^3.33)

Dcrack	0.026283	cm2/sec
Dair	0.093	cm2/sec
Oacrack	0.26	
Ot	0.38	
Dwat	0.000011	cm2/s
H	0.22	l water/l air
Owcrack	0.12	

Dcap = Dair (Oacap^3.33/Ot^3.33) + Dwat(1/H)(Owcap^3.33/Ot^3.33)

Dcap	0.093035	cm2/sec
Dair	0.093	cm2/sec
Ocap	0.38	
Ot	0.38	
Dwat	0.000011	cm2/s
H	0.22	l water/l air
Owcap	0.342	

Dws = (Hcap + Hv)(Hcap/Dcap + Hv/Ds)^–1

Dws	0.026632	cm2/s
Hcap	5	cm
Hv	269	cm
Dcap	0.093035	cm2/s
Ds	0.026283	
1st Term	274	
2nd Term	0.000097	

VFwesp = H(Dws/Lgw/(ER*Lb)/1+(Dws/Lgw/(ER*Lb) + Dws/Lgw/(Dcrack/Lcrack)^n x1000

VFwesp	0.007552	kg/m3
H	0.22	l water/l air
Dws	0.026602	
Lgw	274	
ER	0.0028	
Lb	1010	
Dcrack	0.026283	g/cm3
Lcrack	15	
n	0.01	
1st Term	0.007553	
2nd Term	0.000034	
3rd Term	0.000103	

RBSLw = RBSLair x 0.001/VFwesp

RBSLw	0.653332	mg/l
or	653.3318	ug/l

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MONTGOMERY WARDS – DUBLIN
HEALTH RISK ASSESSMENT
Benzene Impacts – Indoor air

RBSL(air) = (TR)(BW)(ATc)(365)(1000)/(SFi*IR*EF*ED)

RBSL(air)	0.493379	(ug/m3)

TR	1.0E−06	
BW	70	kg
ATc	70	years
SFi	0.029	(mg/kg−day)−1
IRair	20	m3/day
EF	250	days/year
ED	25	years

Ds = Dair (Oas^3.33/Ot^3.33) + Dwat(1/H)(Ows^3.33/Ot^3.33)

Ds	0.026283	(cm2/sec)
Dair	0.093	cm2/s
Oas	0.26	
Ot	0.38	
Dwat	0.000011	cm2/s
H	0.22	l water/l air
Ows	0.12	

Dcrack = Dair (Oacrack^3.33/Ot^3.33) + Dwat(1/H)(Owcrack^3.33/Ot^3.33)

Dcrack	0.026283	cm2/sec
Dair	0.093	cm2/sec
Oacrack	0.26	
Ot	0.38	
Dwat	0.000011	cm2/s
H	0.22	l water/l air
Owcrack	0.12	

Dcap = Dair (Oacap^3.33/Ot^3.33) + Dwat(1/H)(Owcap^3.33/Ot^3.33)

Dcap	0.093035	cm2/sec
Dair	0.093	cm2/sec
Ocap	0.38	
Ot	0.38	
Dwat	0.000011	cm2/s
H	0.22	l water/l air
Owcap	0.342	

Dws = (Hcap + Hv)(Hcap/Dcap + Hv/Ds)^−1

Dws	0.026632	cm2/s
Hcap	5	cm
Hv	269	cm
Dcap	0.093035	cm2/s
Ds	0.026283	

1st Term	274
2nd Term	0.000097

VFwesp = H(Dws/Lgw/(ER*Lb)/1+(Dws/Lgw/(ER*Lb) + Dws/Lgw/(Dcrack/Lcrack)^n x1000

VFwesp	0.007552	kg/m3
H	0.22	l water/l air
Dws	0.026602	
Lgw	274	
ER	0.0028	
Lb	1010	
Dcrack	0.026283	g/cm3
Lcrack	15	
n	0.01	

1st Term	0.007553
2nd Term	0.000034
3rd Term	0.000103

RBSLw = RBSLair x 0.001/VFwesp

RBSLw	0.065333 mg/l
or	65.33318 ug/l

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MONTGOMERY WARDS – DUBLIN
HEALTH RISK ASSESSMENT
Gasoline Vapor Impacts/Revised assumptions – Indoor Air

RBSL(air) = (TR)(BW)(ATc)(365)(1000)/(SFi*IR*EF*ED)

RBSL(air) 84.16471 (ug/m3)

TR	0.00001
BW	70 kg
ATc	70 years
SFi	0.0017 (mg/kg–day)–1
IRair	20 m3/day
EF	250 days/year
ED	25 years

Ds = Dair (Oas^3.33/Ot^3.33) + Dwat(1/H)(Ows^3.33/Ot^3.33)

Ds	0.026283 (cm2/sec)
Dair	0.093 cm2/s
Oas	0.26
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Ows	0.12

Dcrack = Dair (Oacrack^3.33/Ot^3.33) + Dwat(1/H)(Owcrack^3.33/Ot^3.33)

Dcrack	0.026283 cm2/sec
Dair	0.093 cm2/sec
Oacrack	0.26
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Owcrack	0.12

Dcap = Dair (Oacap^3.33/Ot^3.33) + Dwat(1/H)(Owcap^3.33/Ot^3.33)

Dcap	0.093035 cm2/sec
Dair	0.093 cm2/sec
Ocap	0.38
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Owcap	0.342

Dws = (Hcap + Hv)(Hcap/Dcap + Hv/Ds)^–1

Dws	0.026632 cm2/s
Hcap	5 cm
Hv	269 cm
Dcap	0.093035 cm2/s
Ds	0.026283 cm2/sec
1st Term	274
2nd Term	0.000097

VFwesp = H(Dws/Lgw/(ER*Lb)/1+(Dws/Lgw/(ER*Lb) + Dws/Lgw/(Dcrack/Lcrack)^n x1000

VFwesp	0.00756 kg/m3
H	0.22 l water/l air
Dws	0.026632 cm2/sec
Lgw	274 cm
ER	0.0028 1/sec
Lb	1010 cm
Dcrack	0.026283 g/cm3
Lcrack	15 cm
n	0.01
1st Term	0.007561
2nd Term	0.000034
3rd Term	0.000104

RBSLw = RBSLair x 0.001/VFwesp

RBSLw	11.13245 mg/l
or	11132.45 ug/l

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MONTGOMERY WARDS – DUBLIN
HEALTH RISK ASSESSMENT
Gasoline Vapor Impacts/Revised assumptions – Indoor Air

RBSL(air) = (TR)(BW)(ATc)(365)(1000)/(SFi*IR*EF*ED)

RBSL(air) 8.416471 (ug/m3)

TR	1.0E−06	
BW	70	kg
ATc	70	years
SFi	0.0017	(mg/kg−day)−1
IRair	20	m3/day
EF	250	days/year
ED	25	years

Ds = Dair (Oas^3.33/Ot^3.33) + Dwat(1/H)(Ows^3.33/Ot^3.33)

Ds	0.026283	(cm2/sec)
Dair	0.093	cm2/s
Oas	0.26	
Ot	0.38	
Dwat	0.000011	cm2/s
H	0.22	l water/l air
Ows	0.12	

Dcrack = Dair (Oacrack^3.33/Ot^3.33) + Dwat(1/H)(Owcrack^3.33/Ot^3.33)

Dcrack	0.026283	cm2/sec
Dair	0.093	cm2/sec
Oacrack	0.26	
Ot	0.38	
Dwat	0.000011	cm2/s
H	0.22	l water/l air
Owcrack	0.12	

Dcap = Dair (Oacap^3.33/Ot^3.33) + Dwat(1/H)(Owcap^3.33/Ot^3.33)

Dcap	0.093035	cm2/sec
Dair	0.093	cm2/sec
Ocap	0.38	
Ot	0.38	
Dwat	0.000011	cm2/s
H	0.22	l water/l air
Owcap	0.342	

Dws = (Hcap + Hv)(Hcap/Dcap + Hv/Ds)^−1

Dws	0.026632	cm2/s
Hcap	5	cm
Hv	269	cm
Dcap	0.093035	cm2/s
Ds	0.026283	cm2/sec
1st Term	274	
2nd Term	0.000097	

VFwesp = H(Dws/Lgw/(ER*Lb)/1+(Dws/Lgw/(ER*Lb) + Dws/Lgw/(Dcrack/Lcrack)^n x1000

VFwesp	0.00756	kg/m3
H	0.22	l water/l air
Dws	0.026632	cm2/sec
Lgw	274	cm
ER	0.0028	1/sec
Lb	1010	cm
Dcrack	0.026283	g/cm3
Lcrack	15	cm
n	0.01	
1st Term	0.007561	
2nd Term	0.000034	
3rd Term	0.000104	

RBSLw = RBSLair x 0.001/VFwesp

RBSLw	1.113245	mg/l
or	1113.245	ug/l

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MONTGOMERY WARDS – DUBLIN
HEALTH RISK ASSESSMENT
Benzene Impacts – Outdoor Air Concentrations

RBSL(air) = (TR)(BW)(ATc)(365)(1000)/(SFi*IR*EF*ED)

RBSL(air) 4.933793 (ug/m3)

TR	0.00001
BW	70 kg
ATc	70 years
SFi	0.029 (mg/kg–day)–1
IRair	20 m3/day
EF	250 days/year
ED	25 years

RBSL(water) = RBSL(air)*0.001/VFwamb
RBSL 20.64413 mg/l–H2O
20644.13 ug/l–H2O

RBSL(a) 4.933793 (ug/m3)
VFwamb 0.000239 (mg/m3)(mg/l)

VFwamb = H x 1000 l/m3/[1+(Uair*oair*Lgw/(W*Dws)]
VFwamb 0.000239 (mg/m3)(mg/l)

H	0.22 l water/l air
Uair	894 cm/s
oair	244 cm
Lgw	274 cm
W	2438 cm
Dws	0.026632 cm2/sec

Ds = Dair (Oas^3.33/Ot^3.33) + Dwat(1/H)(Ows^3.33/Ot^3.33)

Ds	0.026283 (cm2/sec)
Dair	0.093 cm2/s
Oas	0.26
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Ows	0.12

Dcap = Dair (Oacap^3.33/Ot^3.33) + Dwat(1/H)(Owcap^3.33/Ot^3.33)

Dcap	0.093035 cm2/sec
Dair	0.093 cm2/sec
Ocap	0.38
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Owcap	0.342

Dws = (Hcap + Hv)(Hcap/Dcap + Hv/Ds)^–1

Dws	0.026632 cm2/s
Hcap	5 cm
Hv	269 cm
Dcap	0.093035 cm2/s
Ds	0.026283

1st Term	274
2nd Term	0.000097

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MONTGOMERY WARDS – DUBLIN
HEALTH RISK ASSESSMENT
Benzene Impacts – Outdoor Air Concentrations

RBSL(air) = (TR)(BW)(ATc)(365)(1000)/(SFi*IR*EF*ED)

RBSL(air)	0.493379 (ug/m3)

TR	1.0E–06
BW	70 kg
ATc	70 years
SFi	0.029 (mg/kg–day)–1
IRair	20 m3/day
EF	250 days/year
ED	25 years

RBSL(water) = RBSL(air)*0.001/VFwamb

RBSL	2.064413 mg/l–H2O
	2064.413 ug/l–H2O

RBSL(a)	0.493379 (ug/m3)
VFwamb	0.000239 (mg/m3)(mg/l)

VFwamb = H x 1000 l/m3/[1+(Uair*oair*Lgw/(W*Dws)]

VFwamb	0.000239 (mg/m3)(mg/l)

H	0.22 l water/l air
Uair	894 cm/s
oair	244 cm
Lgw	274 cm
W	2438 cm
Dws	0.026632 cm2/sec

Ds = Dair (Oas^3.33/Ot^3.33) + Dwat(1/H)(Ows^3.33/Ot^3.33)

Ds	0.026283 (cm2/sec)
Dair	0.093 cm2/s
Oas	0.26
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Ows	0.12

Dcap = Dair (Oacap^3.33/Ot^3.33) + Dwat(1/H)(Owcap^3.33/Ot^3.33)

Dcap	0.093035 cm2/sec
Dair	0.093 cm2/sec
Ocap	0.38
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Owcap	0.342

Dws = (Hcap + Hv)(Hcap/Dcap + Hv/Ds)^–1

Dws	0.026632 cm2/s
Hcap	5 cm
Hv	269 cm
Dcap	0.093035 cm2/s
Ds	0.026283

1st Term	274
2nd Term	0.000097

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HEALTH RISK ASSESSMENT
TPH Impacts–Outdoor Air Concentrations

RBSL(air) = (TR)(BW)(ATc)(365)(1000)/(SFi*IR*EF*ED)

RBSL(air)	84.16471 (ug/m3)

TR	0.00001
BW	70 kg
ATc	70 years
SFi	0.0017 (mg/kg–day)–1
IRair	20 m3/day
EF	250 days/year
ED	25 years

RBSL(water) = RBSL(air)*0.001/VFwamb

RBSL	352.1646 mg/l–H2O
	352164.6 ug/l–H2O

RBSL(a)	84.16471 (ug/m3)
VFwamb	0.000239 (mg/m3)(mg/l)

VFwamb = H x 1000 l/m3/[1+(Uair*oair*Lgw/(W*Dws)]

VFwamb	0.000239 (mg/m3)(mg/l)

H	0.22 l water/l air
Uair	894 cm/s
oair	244 cm
Lgw	274 cm
W	2438 cm
Dws	0.026632 cm2/sec

Ds = Dair (Oas^3.33/Ot^3.33) + Dwat(1/H)(Ows^3.33/Ot^3.33)

Ds	0.026283 (cm2/sec)
Dair	0.093 cm2/s
Oas	0.26
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Ows	0.12

Dcap = Dair (Oacap^3.33/Ot^3.33) + Dwat(1/H)(Owcap^3.33/Ot^3.33)

Dcap	0.093035 cm2/sec
Dair	0.093 cm2/sec
Ocap	0.38
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Owcap	0.342

Dws = (Hcap + Hv)(Hcap/Dcap + Hv/Ds)^–1

Dws	0.026632 cm2/s
Hcap	5 cm
Hv	269 cm
Dcap	0.093035 cm2/s
Ds	0.026283

1st Term	274
2nd Term	0.000097

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HEALTH RISK ASSESSMENT
TPH Impacts–Outdoor Air Concentrations

RBSL(air) = (TR)(BW)(ATc)(365)(1000)/(SFi*IR*EF*ED)

RBSL(air) 8.416471 (ug/m3)

TR	1.0E–06
BW	70 kg
ATc	70 years
SFi	0.0017 (mg/kg–day)–1
IRair	20 m3/day
EF	250 days/year
ED	25 years

RBSL(water) = RBSL(air)*0.001/VFwamb
RBSL 35.21646 mg/l–H2O
35216.46 ug/l–H2O

RBSL(a) 8.416471 (ug/m3)
VFwamb 0.000239 (mg/m3)(mg/l)

VFwamb = H x 1000 l/m3/[1+(Uair*oair*Lgw/(W*Dws)]
VFwamb 0.000239 (mg/m3)(mg/l)

H	0.22 l water/l air
Uair	894 cm/s
oair	244 cm
Lgw	274 cm
W	2438 cm
Dws	0.026632 cm2/sec

Ds = Dair (Oas^3.33/Ot^3.33) + Dwat(1/H)(Ows^3.33/Ot^3.33)

Ds	0.026283 (cm2/sec)
Dair	0.093 cm2/s
Oas	0.26
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Ows	0.12

Dcap = Dair (Oacap^3.33/Ot^3.33) + Dwat(1/H)(Owcap^3.33/Ot^3.33)

Dcap	0.093035 cm2/sec
Dair	0.093 cm2/sec
Ocap	0.38
Ot	0.38
Dwat	0.000011 cm2/s
H	0.22 l water/l air
Owcap	0.342

Dws = (Hcap + Hv)(Hcap/Dcap + Hv/Ds)^–1

Dws	0.026632 cm2/s
Hcap	5 cm
Hv	269 cm
Dcap	0.093035 cm2/s
Ds	0.026283

1st Term	274
2nd Term	0.000097

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