

!" #&/
4;O <548G=>3> 70AB>AC20==O ;V:0@AL:>3> 70A>1C
&!"

!::04:
4VNG0 @5G>28=0: 1 ?0:5B 0F5B8;F8AB5W=C 100 <3 01> 200 <3, 01> 600 <3;
4>?>28=8: :8A;>B0 0A:>@1V=>20; 0@><0B870B>@ «0?5;LA8=», I> BC 0A:>@1V=>2C, 0;LD0-
B>:>D5@>;, AV@:8 4V>:A84 (220); FC:>@ ?@5A>20=89.

V:0@AL:0 D>@<0. >@>H>: 4;O >@0;L=>3> @>7G8=C.
A=>2=V DV78:>-EVABV: ?>@>H>: 1V;>3> 01> 1V;>3> 7 6>2BC20B8< 2V4BV=:>< :>;L>@C 7 D@C:B>28
< 70?0E>

\$0@<0:>B5@0?52B8G=0 3@C?0. C:>;VB8G=V 70A>18. >4 AT% R05C B01.

\$0@<0:>;>3VG=V 2;0AB82>ABV.

\$0@<0:>48=0N-0F5B8;-L-F8AB5W= (&) <0T 28@065=C ;VB8G=C 4VN =0 A;87>289 V A;878AB>-
3=V9=89 A5:@5B8 70 @0EC=>: 45?>;V<5@870FVW ?@>B5W=>28E :>28E :8A;>B, O:V =040NBL
2'O7:VABL 3V0;V=>28< V 3=V9=>=5=B0< <>:@>B8==O B0 V=H8< A5:@5B040B:>2V 2;0AB82>ABV:
7=865==O V=4C:>20=>W 3V?5@?;07VW F8BV2, ?V428I5==O ?@>4C:C20==O AC@D0:B0=BC 70
@0EC=>: AB8ABV F8;V0@=>3> 0?0@0BC, I> ?@872>48BL 4> ?>;V?H5==O F8;V0@=>3> ;V@5=AC.
& B0:>6 G8=8BL ?@O:A840=B=C 4VN 70 @0EC=>: =0O2=>ABV =C;;5>DV;L=>W 2V;L=>W BV>;L=>W
3@C?8 (SH), O:0 740B=0 157?>A5@54=L> 270T<>4VOB8 7 5;5:B@>DV;L=8<8 3@C?0<8 >:8A=8E
@048:0;V2. & >15@V30T □-1-0=B8B@8?A8= D5@<5=B, I> V=3V1CT 5;0AB07C, 2V4 V=0:B820FVW
E;>@=C20B8AB>N :8A;>B>N (HOCl) A8;L=>4VNG8<>:8A=N20G5<, I> ?@>4C:CTBLAO
?5@>:A8407>N D5@<5=B<< 0:B82>20=8E D03>F8BV2.
@V< B>3>, <>;5:C;O@=0 AB@C:BC@0 & 40T 9>W 0:8A;>B8 4;O A8=B57C 3;CB0BV>=C. &, 1C4CG8
?@5:C@A>@>< 3;CB0Bi>=C, ?@>O2;OT =5?@O<89 0=B8>:A840=B=89 5D5:B. ;CB0BV>= T
28A>:>0:B82=8< B@8?5?B84<, ?>2AN4=> ?>H8@5=8< C @V7=8E B:0=8=0E B20@8=, V =570=0;L=>W
740B=>ABV ;;VB8=8 B0 WW <>@D>;>3VG=>W FV;VA=>ABV. V= T G0AB8=>N =09206;82VH>3>
2=CB@VH=L>;;VB8==>3> 70E8A=>3> <5E0=V7:8A=8E @048:0;V2, O: 5:7>- , B0: V 5=4>35==8E, V
45O:8E F8B>B>:A8G=8E @5G>28=, 2;;NG0NG8 ?0@0F5B0<>;
0@0F5B0<>; G8=8BL F8B>B>:A8G=C 4VN H;OE<< ?@>3@5ACNG>3> 7=865==O 2=C. & 2V4V3@0T
?5@H>@O4=C @>;L C 715@565==V 045:20B=8E @V2=V2 3;CB0Bi>=C, B0:8< G8=>< ?>A8;NNG8
;;VB8==89 70E8AB. =0A;V4>: FL>3> & T A?5F8DVG=8< 0=B84>B<< ?@8 >B@CT==V ?0@0F5B0<>;>
E2>@8E =0 E@>=VG=C >1AB@C:B82=C E2>@>1C ;535=L ?@89<< 1200 <3 & =0 4>1C 2?@>4>26 6
B86=V2 ?@872>482 4> 7=0G=>3> ?V428I5==O >1AO3C 248EC V \$(D>@A>20=0 68BBT20 T<=VABL
;535=L), <>6;82>, 2=0A;V4>: 7<5=H5==O ?>2VB@O=>3> 70E>?;5==O.
E2>@8E =0 \$(V4V>?0B8G=89 DV1@>7 ;535=V2) 70AB>AC20==O & ?5@>@0;L=> ?> 600 <3 3 @078 =0
4>1C 2?@>4>26 1 @>:C C ?>T4=0==V 7V AB0=40@B=>N B5@0?VTN \$(?@54=V7>;>= V 070BV>?@8=)
A?@8O;> 715@565==N (68BBT2>W T<=>ABV ;535=V2) V 48DC7=>W 740B=>ABV ;535=V2, 28
D>@W B5@0?VW 2?@>4>26 1 @>:C & A?@8O2 7=865==N V=B5=A82=>ABV ?@>3@5AC20==O
70E2>@N20==O C E2>@8E =0 \$.
@8 70AB>AC20==V E2>@8< =0 2VAF84>7 C 4C65 28A>:8E 4>70E (4> 3000<3 I>4=O C?@>4>26 4
B86=V2) & =5 G8=82 7=0G=>W B>:A8G=>W 4VW.
=B8>:A840=B=0 5D5:B82=VABL & ?>2'O70=0 7 28@065=8< 7=865==O< 0:B82=>ABV 5;0AB078 C
<>:@>B8==V, I> T =097=0G=VH8< ?>:07=8:>> DC=:FVW ;535=V2 C E2>@8E =0 2VAF84>7. 0 4>40B>: 4>
FL>3>, =0 B;V ;V:C20==O 2V47=0G5=> 7=865==O :=F5=B@0FVW =59B@>DV;V2 C 48E0;L=8E
H;OE0E, 2;;NG0NG8 :V;L:VABL =59B@>DV;V2, O:V V=B5=A82=> 282V;L=ONBL 3@0=C;8, 1030BV
5;0AB07>N.
\$0@<0:>:V=5B8:0.
1A>@1FVO. # ;N48=8 ?VA;O ?5@>@0;L=>3> 70AB>AC20==O & ?>2=VABN 01A>@1CTBLAO. '5@57
<5B01>;V7< C ABV=:0E :8H5G=8:C V 5D5:B «?5@H>3> ?@>E>465==O» 1V>4>ABC?=VABL & ?@8
?5@>@0;L=>AC20==V 4C65 =87L:0 (?@81;87=> 10 %). ;O @V7=8E ;V:0@AL:8E D>@< 2V4AB59 =5
28O2;5=>. # E2>@8E 7 @V7=8<8 48E0;L=8<8 V A5@F528<8 70E2>@N20==O<8 <0:A8<0;L=0

:>=F5=B@0FVO & C ?;072V 4>AO30TBLAO G5@57 1-3 3>48=8 ?VA;O 70AB>AC20==O V 70;8H0TBLAO
28A>:>N 2?@>4>26 24 3>48=
>7?>4V;.: ?OTBLAO 2 >@30=V7 2V= 28O2;OTBLAO C ?5GV=FV, =8@:0E, ;535=OE V 1@>=EV0;L=>2V4
0,33 4> 0,47 ;/:3. 2'O7C20==O 7 1V;:0<8 ?;07<8 :@>2V AB0=>28BL 1;87L:> 50 % G5@57 4 3>48=8 ?VA;O
70AB>AC20==O. <5=HCTBLAO 4> 20 % G5@57 12 3>48=
5B01>;V7< V 282545==O. VA;O ?5@>@0;L=>3> 70AB>AC20==O & H284:> B0 5:AB5=A82=>
<5B01>;V7CTBLAO C ABV=:0E :8H5G=8:C V ?5GV=:8. #B2>@5=89<5B01>;VB F8AB5W=
>73;O40TBLAO 2 O:>ABV 0:B82=>3>. 0;V & V F8AB5W=<5B01>;V7CNBLAO >4=8< V B8< 65 H;OE>
30 % 4>78 282>48BLAO =8@:0<8. 5@V>4 =0?V2282545==O & AB0=>28BL 6,25 3>48=8.

;V=VG=V E0@0:B5@8AB8:8.

>:070==O. V:C20==O 3>AB@8E B0 E@>=VG=8E 70E2>@N20=L 1@>=E>;535=52>W A8AB5<8, I>
AC?@>2>46CNBLAO ?V428I5=8< CB2>@5==O< <@>B8==O.
5@54>7C20==O ?0@0F5B0<>;>

@>B8?>:070==O. □V4><0 3V?5@GCB;82VABL 4> 1C4L-O:8E :>5=BV2 ?@5?0@0BC. 8@07:>20
E2>@>10 H;C=:0 V 420=04FOB8?0;>W :8H:8 C AB04VW 703>AB@5==O, :@>2>E0@:0==O, ;535=520
:@>2>B5G0.

70T<>4VO 7 V=H8<8 ;V:0@AL:8<8 70A>10<8 B0 V=HV 2848 270T<>4V9. A=CNBL 40=V 270T<>4VW
BV;L:8 C 4>@>A;8E.

0AB>AC20==O @07>< 7 ?L>28E 70A>1V2 <>65 ?>A8;8B8 70ABV9 <@>B8==O G5@57 ?@83=VG5==O
:0H;L>2>3> @5D;5:AC.

:B82>20=5 2C3V;;O 7=86CT 5D5:B82=VABL &.

@8 >4=>G0A=>AC20==V 7 B0:8<8 0=B81V>B8:0<8, O: B5B@0F8;;V=8 (70 28=OB:>< 4>:A8F8;;V=C), 0
B5@8F8=, F5D0;>A?>@8=8, 03;V:>7848, <>6;820 WE 270T<>4VO 7 BV>;>2>N 3@C?>N &, I>

?@872>48BL 4> 7=865==O 0:B82=>ABV >1>E ?@5?0@0BV2. ">AC20==O< F8E ?@5?0@0BV2 <0T
AB0=>28B8 =5 <5=H5 2 3>48=. &5 =5 AB>ACTBLAO F5DV:A8@0:0@15DC.

@8 >4=>G0A=> 70AB>AC20==V =VB@>3;VF5@8=C V □& 28O2;5=V 7=0G=V 3V?>B5=7VO V
@>7H8@5==O A:@>=52>W 0@B5@VW. @8 =5>1EV4=>ABV >4=>G0A=>3> 70AB>AC20==O

=VB@>3;VF5@8=C V □& C ?0FVT=BV2 A;V4 :>=B@>;N20B8 3V?>B5=7VN, O:0 <>65 =>A8B8 BO6:89
E0@0:B5@, V A;V4 ?>?5@548B8 WE ?@> <>6;82VABL 28=8:=5==O3>;>2=>3> 1>;N.

& <>65 1CB8 4>=>@>< F8AB5W=C B0 ?V428IC20B8 @V25=L 3;CB0BV>=C, O:89 A?@8OT
45B>:A8:0FVW 2V;L=8E @048:0;V2 :8A=N B0 ?52=8E B>:A8G=8E @5G>28= 2 >@30=V7

?;82 =0 ;01>@0B>@=V 4>A;V465==O. & <>65 2?;820B8 =0 :>;>@8<5B@8G=5 4>A;V465==O
A0;VF8;0BV2 B0 =0 287=0G5==O :5B>=>28E BV; C A5GV.

A>1;82>ABV 70AB>AC20==O. 0FVT=B0<, O:V AB@0640NBL =0 1@>=EV0;L=C 0AB@8< :>=B@>;5< C
E>4V ;V:C20==O G5@57 <>6;8289 @>728B>: 1@>=E>A?07=E>A?07 ?@8?8=8B8.

5:><5=4CTBLAO 7 >15@56=VABN ?@89<0B8 ?@5?0@0B ?0FVT=B0< V7 28@07:>N H;C=:0 B0
420=04FOB8?0;>W :8H:8 2 0=0<=57V, >A>1;82> C @07V AC?CB=L>3> ?@89>1V2, I> ?>4@07=NNBL
A;87>2C >1>;>=:C H;C=:0.

0FVT=B0< V7 70E2>@N20==O<8 ?5GV=:8 01>=8@>: & A;V4 ?@87=0G0B8 7 >15@56=VABN 4;O
C=8:=5==O =0:>?8G5==O 07>B>228= 2 >@30=V7

& 2?;820T =0 <5B01>;V7< 3VAB023>B@820;C B5@0?VN ?0FVT=B0< 7 =5?5@5=>A8A;V;L:8 F5 <>65
?@8725AB8 4> ?>O28 A8A8<>ABV (3>;>2=89 1V;L, 207>>B>@=89 @8=VB, A25@1V6).

0AB>AC20==O &, 3>;>2=8< G8=><=0 ?>G0B:C ;V:C20==O, <>65 A?@8G8=8B8 @>7@V465==O
1@>=EV0;L=>3> A5:@5BC V 71V;LH8B8 9>3> >1'T?0FVT=B =5 740B=89 5D5:B82=> 2V4:0H;N20B8

<@>B8==O, =5>1EV4=V ?>ABC@0;L=89 4@5=06 V 1@>=E>0A?V@0FVO.
53:89 AV@G0=89 70?0E =5 T >7=0:>N 7

C:>;VB8G=V 70A>18 <>6CBL A?@8G8=8B8 1@>=EV0;L=C >1AB@C:FVN C 4VB59 2V:>4> 2 @>:V2.
\$0:B8G=> G5@57 DV7V>;>3VG=C >A>1;82VABL 48E0;L=>W A8AB5<8 4VB59 C FV9 2V:>2V9 3@C?V,7

40B=VABL>G8I5==O A5:@5BC 48E0;L=8E H;OEV2 >1<565=0. ">;VB8:8 =5 A;V4 70AB>A>2C20B8
4VBO< 2V:>4> 2 @>:V2.

!V@:8 4V>:A84 @V4:> <>65 A?@8G8=OB8 @50:FVW 3V?5@GCB;82>ABV B0 1@>=E>A?07

/I> C ?0FVT=B0 2AB0=>2;5=0 =5?5@5=>A8:>=AC;LBC20B8AO 7 ;V:0@<5<, ?5@H =V6 ?@89<0B8 F59 ?@5?0@0B. # 7207:C 7 =002=VABN FC:@C ?@5?0@0B <>65 1CB8 H:V4;828< 4;O 7C1V2. =D>@<0FVO 4;O E2>@8E =0 FC:@>289 4V015B. 1 ?0:5B (100 <3 &) W >48=8FV); 1 ?0:5B (200 <3 &) W >48=8FV); 1 ?0:5B (600 <3 &) W >48=8FV).

0AB>AC20==O C ?5@V>4 203VB=>ABV 01> 3>4C20==O 3@C44N.

03VB=VABL. ;V=VG=V 40=V ?@> 70AB>AC20==O & 203VB=8< 6V=:0< >1<565=V. # B20@8= =5 2802;5=> ?@O<8E G8 =5?@O<8E =530B82=8E 2?;82V2 =0 203VB=VABL, 5<1@V>-D5B0;L=89 @>728B>:, ?>;>38 B0 ?>AB=0B0;L=89 @>728B>:.

>4C20==O 3@C44N. =D>@<0FVO ?@> ?@>=8=:5==O C 3@C4=5 <>;> 2V4ACB=O.

0AB>A>2C20B8 ?@5?0@0B C ?5@i>4 203VB=>ABV 01> 3>4C20==O 3@C44N <>6=0 BV;L:8 ?VA;O @5B5;L=>W >FV=:8 A?V22V4=>H5==O :>@8ABL/@878:.

40B=VABL 2?;820B8 =0 H284:VABL @50:FVW ?@8 :5@C20==V 02B>B@0=A?>@B< 01> V=H8<8

<5E0=V7<0<8. 5<0T ?V4B25@465==O, I> & 2?;820T =0 740B=VABL :5@C20B8 02B>>1V;5< B0 V=H8<8 <5E0=V7<0<8.

!?!>AV1 70AB>AC20==O B0 4>78.

>@>A;8 400-600 <3 =0 4>1C, @>7?>4V;5=V =0 1-3 ?@89<8 70;56=> 2V4 ;;V=VG=8E C<>2.

VBO

2V:< 2-6 @>:V2: 200-400 <3 =0 4>1C, @>7?>4V;5=V =0 1-3 ?@89<8;

2V:< 6-12 @>:V2: 400-600 <3 =0 4>1C, @>7?>4V;5=V =0 1-3 ?@89<8;

2V:< 2V4 12 @>:V2 4>78 O: 4;O 4>@>A;8E.

7G8=8B8 C 1/2A;:O=:8 2>48, A>:C 01> E>;>4=>3> G0N 157?>A5@54=L> ?5@54 ?@89><>

"@820;VABL :C@AC ;V:C20==O ;V:0@ 287=0G0T V=482V4C0;L=> 70;56=> 2V4 E0@0:B5@C

70E2>@N20==O (3>AB@5 01> E@>=VG=5).

5@54>7C20==O ?0@0F5B0<>;<. # ?5@HV 10 3>48= ?VA;O 70AB>AC20==O B>:A8G=>W @5G>28=8

A;V4 O=:09H284H5 22>48B8 ?@5?0@0B 7 @>7@0EC=:C 140 <3/:3, 40;V 7 @>7@0EC=:C 70 <3/:3 :>6=V 4 3>48=8 V 2?@>4>26 1-3 4=V2.

@5?0@0B =5>1EV4=> 70AB>AC20B8 157 72>;V:0==O, >4@07C 6 ?VA;O ?@83>BC20==O @>7G8=C.

VB8. >@>H>: ?> 100 <3 01> 200 <3: 70AB>A>2C20B8 4VBO< 2V:< 2V4 2 @>:V2.

>@>H>: ?> 600 <3: 70AB>A>2C20B8 4VBO< 2V:< 2V4 12 @>:V2.

5@54>7C20==O. 5<0T 40=8E ?@> 28?04:8 ?5@54>7C20==O ;V:0@AL:8E D>@< □&, ?@87=0G5=8E 4;O 70AB>AC20==O 2=CB@VH=L>.

@8 70AB>AC20==V 11,6 3 □& =0 4>1C 2?@>4>26 3 7=V ?>1VG=V 5D5:B8 =5 28=8:0;8.

& ?@8 70AB>AC20==V C 4>70E 500 <3/:3/4>1C =5 A?@8G8=OT >7=0: B0 A87C20==O.

!8<8. 5@54>7C20==O <>65 ?@>O2;OB8AO H;C=:>2>:8H:>28<8 A8<0<8, B0:8<8 O: =C4>B0, 1;N20==O V 4V0@5O.

V:C20==O. !?5F8DVG=>3> 0=B84>BC ?@8 >B@CT==V & =5<0T, B5@0?VO A8<0B8G=0.

>1VG=V @50:FVW.

I>:C VW A8AB5<8: 3V?5@GCB;82VABL, 0=0DV;0:B8G=V/0=0DV;0:B>W4=V @50:FVW, 0=0DV;0:B8G=89 H>:.

I>:C =5@2>2>W A8AB5<8: 3>;>2=89 1V;L.

I>:C :@>2V B0 ;VW A8AB5<8: 0=5

I>:C >@30=V2 A;CEC B0 ;01V@8=BC: 472V= C 2CE0E.

I>:C A5@FO: B0EV:0@4VO.

I>:C AC48=: 35<>@03VW.

I>:C >@30=V2 3@C4=>W ;;VB:8 B0 A5@54>ABV==O: 1@>=E>A?07<, 48A?=>5.

I>:C H;C=:>2>:8H:>2>3> B@0:BC: 1;N20==O, 4V0@5O, AB<0B8B8, 014>B0, 48A?5?AVO, =5?@8T <=89 70?0E 7 @>B0.

I>:C H:V@8 V?V4H:V@=8E B:0=8=: :@>?82'O=:0, 28A8?0==O, =01@O: 2V=:5, A25@1V6, 5:75<0.

I>:C 48E0;L=>W A8AB5<8: @8=>@5O.

030;L=V @>7;048: 3V?5@B5@1;8GGO.

>A;V465==O: 7=865==O 0@B5@V0;L=>3> B8A:C.

4C65 @V4:VA=8E 28?04:0E, C 72'O7:C 7 70AB>AC20==O< &, ?>2V4><;O;>AO ?@> BO6:V H:V@=V @50:FVW, B0:V O:, =0?@8:;04, A8=4@< !BV25=A0-6>=A>=0 V A8=4@< □09T;;0. # 1V;LH>ABV 28?04:V2, O: , I5 >48= ;V:0@AL:89 70AV1 <>65 7 1V;LH>N V<>2V@=VABN 1CB8 ?@8G8=>N ?@>O2C H:V@=>-A;87>2>3> A8=4@> "> ?@8 ?>O2V 1C4L-O:8E =>28E 7 =0 H:V@V 01> A;87>28E >1>;>=:0E ?>B@V1=> 725@=CB8AO 4> ;V:0@O V =5309=> 2V4AC20==O &.

V47=0G0;8 28?04:8 7=865==O 03@530FVW B@><1>F8BV2, 0;5 ;;V=VG=5 7=0G5==O FL>3> =5 287=0G5=>.

"5@ABV. 3 @>:8.

#<>28 715@V30==O. 15@V30B8 2 >@83V=0;L=V9 C?0:>2FV ?@8 B5□.

15@V30B8 C =54>ABC?=>

5AC@8 @>7G8=5==V & =5>1EV4=> :>@8ABC20B8AO A:;O=8< ?>AC4<>, C=8:0B8 :>=B0:BC 7 <5B0;528 <8 B0 3C<>28<8 ?>25@E=O<8.

5 @5:><5=4CTBLAO @>7G8=OB8 2 >4=V9 A:;O=FV & 7 V=H8<8 ?@5?0@0B0<8.

#?0:>2:0.> 3 3 C ?0:5B0E □□10 01> C ?0:5B0E A?0@5=8E 2□5 C :>@>1FV.

0B53>@VO 2V4?CA:C. 57 @5F5?B0.

□8@>1=8:.. ">20@8AB2> 7 >1<565=>N 2V4?>2V40;L=VABN «\$0@<0F52B8G=0 :>@>2□O».

VAF57=0E>465==O 28@>1=8:0 B0 9>3> 04@5A020465==O 4VO;L=>ABV.

#: @0W=0, 61013, %0@:V2AL:0 >1;., %0@:V2, 2C;8FO (52G5=:0, 1C48=>: 22.