



COLORADO

Water Quality
Control Commission

Department of Public Health & Environment

NOTICE OF PUBLIC RULEMAKING HEARING BEFORE THE COLORADO WATER QUALITY CONTROL COMMISSION

SUBJECT:

For consideration of the adoption of revisions to the molybdenum standards in the Basic Standards and Methodologies for Surface Water, Regulation #31 (5 CCR 1002-31), and resolution of the molybdenum temporary modification on Segment 14 of the Blue River in the Classifications and Numeric Standards for for Upper Colorado River Basin and North Platte River (Planning Region 12), Regulation #33 (5 CCR 1002-33). Revisions proposed by Climax Molybdenum Company, along with a proposed Statement of Basis, Statutory Authority and Purpose are attached to this notice as Exhibits 1 and 2.

In these attachments, proposed new language is shown with double-underlining and proposed deletions are shown with ~~strikeouts~~. Any alternative proposals related to the subject of this hearing will also be considered.

SCHEDULE OF IMPORTANT DATES

Proponent's prehearing statement due	09/27/2017 5 pm	Additional information below.
Party status requests due	10/04/2017 5 pm	Additional information below.
Responsive prehearing statements due	10/27/2017 5 pm	Additional information below.
Rebuttal statements due	11/22/2017 5 pm	Additional information below.
Last date for submittal of motions	11/27/2017 5 pm	Additional information below.
Notify commission office if participating in prehearing conference by phone	11/27/2017 by noon	Send email to cdphe.wqcc@state.co.us with participant(s) name(s)
Prehearing Conference (mandatory for parties)	11/29/2017 1:00 pm	Snow Conference Room Department of Public Health and Environment 4300 Cherry Creek Drive South Denver, CO 80246 Call-in: 1-857-216-6700, Code: 425132
Rulemaking Hearing	12/12/2017 10:00 am	Florence Sabin Conference Room Department of Public Health and Environment 4300 Cherry Creek Drive South Denver, CO 80246

HEARING SUBMITTALS:

For this hearing, the commission will receive all submittals electronically. Submittals must be provided as PDF documents, except for raw data exhibits which may be provided as Excel workbooks. Submittals may be emailed to cdphe.wgcc@state.co.us, provided via an FTP site, CD or flash drive, or otherwise conveyed to the commission office so as to be received no later than the specified date.

PARTY STATUS:

Party status requests must be in writing and must provide:

- the organization's name,
- one contact person,
- a mailing address,
- a phone number, and
- email addresses of all individuals associated with the party who wish to be notified when new submittals are available on the commission's website for review.

In accordance with section 25-8-104(2)(d), C.R.S., any person who believes that the actions proposed in this notice have the potential to cause material injury to his or her water rights is requested to so indicate, along with an explanation of the alleged harm, in their party status request.

PREHEARING AND REBUTTAL STATEMENTS:

Each party must submit a prehearing statement: parties that have proposed revisions attached as exhibits to the notice must submit a proponent's prehearing statement. All other parties must submit a responsive prehearing statement. Proponents may also submit responsive prehearing statements when there are multiple proposals attached to the notice.

Each prehearing and rebuttal statement must be provided as a separate PDF document from any accompanying written testimony or exhibits.

Following the rebuttal statement due date, no other written materials will be accepted from parties except for good cause shown.

Oral testimony at the hearing should primarily summarize written material previously submitted. The hearing will emphasize commission questioning of parties and other interested persons about their written prehearing submittals. Introduction of written material at the hearing by those with party status will not be permitted unless authorized by the commission.

PREHEARING CONFERENCE:

Attendance at the prehearing conference is mandatory for all persons requesting party status. Parties needing to participate by telephone are encouraged to notify the commission office prior to the prehearing conference. Remote participants can call 1-857-216-6700 and enter the conference code 425132.

Following the cut-off date for motions, no motions will be accepted, except for good cause shown.

PUBLIC PARTICIPATION ENCOURAGED:

The commission encourages input from non-parties, either orally at the hearing or in writing prior to the hearing. Written submissions should be emailed to cdphe.wqcc@state.co.us by November 29, 2017.

SPECIFIC STATUTORY AUTHORITY:

The provisions of sections 25-8-202(1)(a), (b), and (2); 25-8-203; 25-8-204; and 25-8-402, C.R.S., provide the specific statutory authority for consideration of the regulatory amendments proposed by this notice. Should the commission adopt the regulatory language as proposed in this notice or alternative amendments, it will also adopt, in compliance with section 24-4-103(4) C.R.S., an appropriate Statement of Basis, Specific Statutory Authority, and Purpose.

Dated this 9th day of August, 2017 at Denver, Colorado.

WATER QUALITY CONTROL COMMISSION

Trisha Oeth, Administrator

EXHIBIT 1
CLIMAX MOLYBDENUM COMPANY

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

Water Quality Control Commission

REGULATION NO. 31 - THE BASIC STANDARDS AND METHODOLOGIES FOR SURFACE WATER

5 CCR 1002-31

31.16 TABLES

...

(3) REFERENCES

...

- (O) [Raisbeck, M.F., S. L. Riker, C. M. Tate, R. Jackson, M. A. Smith, K. J. Reddy and J. R. Zygmunt. 2008. Water quality for Wyoming livestock and wildlife. University of Wyoming AES Bulletin B-4483](#)[Kistner, M.J., J.J. Wagner, J. Evans, S. Chalberg, S. Jalali, K. Sellins, M.L. Kesel, T. Holt, and T.E. Engle. 2017. The effects of molybdenum water concentration on feedlot performance, tissue mineral concentrations, and carcass quality of feedlot steers. J. Anim. Sci. 95:2758-2766.](#)
- (P) [Murray, F. Jay, F.M. Sullivan, A.K. Tiwary, S. Carey. 2014. 90-Day subchronic toxicity study of sodium molybdate dihydrate in rats. J. of Regulatory Toxicology & Pharmacology 70:579-588;](#)[Murray, F. Jay, R.W. Tyl, F.M. Sullivan, A.K. Tiwary, S. Carey. 2014. Developmental toxicity study of sodium molybdate dihydrate administered in the diet to Sprague Dawley rats. Reproductive Toxicology 40:202-208;](#)[Two-Generation \(One Litter per Generation\) Reproduction Study of Sodium Molybdate Dihydrate in Rats, Study Conducted by Charles River Laboratories, USA, April 2017, International Molybdenum Association.](#)

...

TABLE III - METAL PARAMETERS

TABLE III METAL PARAMETERS (Concentration in µg/l)						
METAL ⁽¹⁾	AQUATIC LIFE ^{(1)(3)(4)(J)}		AGRICULTURE ⁽²⁾	DOMESTIC WATER-SUPPLY ⁽²⁾	WATER + FISH ⁽⁷⁾	FISH INGESTION ⁽¹⁰⁾
	ACUTE	CHRONIC				
Aluminum	$e^{(1.3695[\ln(\text{hardness}))+1.8308]}$ (tot.rec.)	87 or $e^{(1.3695[\ln(\text{hardness}))-0.1158]}$ (tot.rec.) ⁽¹¹⁾			---	---
Antimony				6.0 (30-day)	5.6	640
Arsenic	340	150	100 ^(A) (30-day)	0.02 – 10 ⁽¹³⁾ (30-day)	0.02	7.6
Barium				1,000 ^(E) (1-day) 490 (30-day)	---	---
Beryllium			100 ^(A,B) (30-day)	4.0 (30-day)	---	---
Cadmium	$(1.136672-[\ln(\text{hardness}) \times e^{0.9151[\ln(\text{hardness}))-3.1485} (0.041838)]) \times e^{(1.136672-[\ln(\text{hardness}) \times e^{0.9151[\ln(\text{hardness}))-3.6236} (0.041838)])}$ (Trout)	$(1.101672-[\ln(\text{hardness}) \times e^{0.7998[\ln(\text{hardness}))-4.4451} (0.041838)]) \times e^{(1.101672-[\ln(\text{hardness}) \times e^{0.7998[\ln(\text{hardness}))-4.4451} (0.041838)])}$	10 ^(B) (30-day)	5.0 ^(E) (1-day)	---	---
Chromium III ⁽⁵⁾	$e^{(0.819[\ln(\text{hardness}))+2.5736]}$	$e^{(0.819[\ln(\text{hardness}))+0.5340]}$	100 ^(B) (30-day)	50 ^(E) (1-day)	---	---
Chromium VI ⁽⁵⁾	16	11	100 ^(B) (30-day)	50 ^(E) (1-day)	100(30-day)	---
Copper	$e^{(0.9422[\ln(\text{hardness}))-1.7408]}$	$e^{(0.8545[\ln(\text{hardness}))-1.7428]}$	200 ^(B)	1,000 ^(F) (30-day)	1,300	---
Iron		1,000(tot.rec.) ^(A,C)		300(dis) ^(F) (30-day)	---	---
Lead	$(1.46203-[(\ln(\text{hardness}) * (0.145712))] * e^{(1.273[\ln(\text{hardness}))-1.46]}$	$(1.46203-[(\ln(\text{hardness}) * (0.145712))] * e^{(1.273[\ln(\text{hardness}))-4.705]}$	100 ^(B) (30-day)	50 ^(E) (1-day)	—	---
Manganese	$e^{(0.3331[\ln(\text{hardness}))+6.4676]}$	$e^{(0.3331[\ln(\text{hardness}))+5.8743]}$	200 ^(B) (30-day) ⁽¹²⁾	50(dis) ^(F) (30-day)	—	---
Mercury		FRV(fish) ⁽⁶⁾ = 0.01 (Total)		2.0 ^(E) (1-day)	—	---
Molybdenum			300 1000 ^(O) (30-day) ⁽¹⁵⁾	240 9000 ^(P) (30-day)		
Nickel	$e^{(0.846[\ln(\text{hardness}))+2.253]}$	$e^{(0.846[\ln(\text{hardness}))+0.0554]}$	200 ^(B) (30-day)	100 ^(E) (30-day)	610	4,600

TABLE III METAL PARAMETERS (Concentration in µg/l)						
METAL ⁽¹⁾	AQUATIC LIFE ^{(1)(3)(4)(J)}		AGRICULTURE ⁽²⁾	DOMESTIC WATER-SUPPLY ⁽²⁾	WATER + FISH ⁽⁷⁾	FISH INGESTION ⁽¹⁰⁾
	ACUTE	CHRONIC				
Selenium ⁽⁹⁾	18.4	4.6	20 ^(B,D) (30-day)	50 ^(E) (30-day)	170	4,200
Silver	$\frac{1}{2}e^{(1.72[\ln(\text{hardness})]-6.52)}$	$e^{(1.72[\ln(\text{hardness})]-9.06)}$ (Trout) = $e^{(1.72[\ln(\text{hardness})]-10.51)}$		100 ^(F) (1-day)	—	---
Thallium		15 ^(C)		0.5 (30-day)	0.24	0.47
Uranium ⁽¹⁶⁾	$e^{(1.1021[\ln(\text{hardness})]+2.7088)}$	$e^{(1.1021[\ln(\text{hardness})]+2.2382)}$		16.8 – 30 ⁽¹³⁾ (30-day)	---	---
Zinc	$0.978 * e^{(0.9094[\ln(\text{hardness})]+0.9095)}$	$0.986 * e^{(0.9094[\ln(\text{hardness})]+0.6235)}$ (sculpin) ⁽¹⁴⁾ = $e^{(2.140[\ln(\text{hardness})]-5.084)}$	2000 ^(B) (30-day)	5,000 ^(F) (30-day)	7,400	26,000

NOTE: Capital letters in parentheses refer to references listed in section 31.16(3); Numbers in parentheses refer to Table III footnote

Table III – Footnotes

...

- (15) In determining whether adoption of a molybdenum standard is appropriate for a segment, the Commission will consider whether livestock or irrigated forage is present or expected to be present. The table value assumes that copper and molybdenum concentrations in forage are ~~79.8~~ 79.8 mg/kg and ~~0.5-0.6~~ 0.5-0.6 mg/kg respectively, forage intake is ~~6-8~~ 11.4 kg/day, copper concentration in water is 0.008 mg/l, water intake is ~~54-628.2~~ 1 l/day, copper supplementation is ~~480~~ 480 mg/day, and that a Cu:Mo ratio of ~~4:42.8:1~~ 4:42.8:1 is appropriate with a 0.075 mg/l molybdenum margin of safety. Numeric standards different than the table-value may be adopted on a site-specific basis where appropriate justification is presented to the Commission. In evaluating site-specific standards, the relevant factors that should be considered include the presence of livestock or irrigated forage, and the total intake of copper, molybdenum, and sulfur from all sources (i.e., food, water, and dietary supplements). In general, site-specific standards should be based on achieving a safe copper:molybdenum total exposure ratio, with due consideration given to the sulfur exposure. A higher Cu:Mo ratio may be necessary where livestock exposure to sulfur is also high. Species specific information shall be considered where cattle are not the most sensitive species.

...

31.57 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE; DECEMBER 12, 2017 RULEMAKING; EFFECTIVE JUNE 30, 2018

The provisions of sections 25-8-202(1)(b), 25-8-204; and 25-8-402, C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

BASIS AND PURPOSE:

The Commission adopted revised total recoverable molybdenum standards of 9,000 µg/L to protect the water supply use, and 1,000 µg/L to protect the agriculture use.

Water Supply Standard

The water supply standard of 9,000 µg/L is based on three recent toxicity studies and application of the following equation included in Policy 96-2 for the development of "Statewide Standards and Table Value Criteria for Domestic Water Supply":

$$\text{Drinking Water Standard, } \mu\text{g/L} = \frac{\text{RfD} \times 70 \times 1000 \mu\text{g/mg} \times \text{RSC}}{2 \times \text{UF}}$$

As applied in this hearing:

- Reference Dose (RfD) = 0.566 mg Mo/kg/day (based on a NOAEL of 17 mg Mo/kg/day and composite uncertainty factor (UF) of 30)
- Weight of average adult = 70 kg
- Drinking water consumption = 2 L/day
- Relative Source Contribution (RSC) = 0.5
- Uncertainty Factor (UF) = 1.0 (molybdenum is not a Group C chemical)

The RfD is derived from the "no observable adverse effect level" (NOAEL) of 17 mg Mo/kg/day which is the most sensitive NOAEL from the following toxicity studies:

- F. Jay Murray et al. 90-Day subchronic toxicity study of sodium molybdate dihydrate in rats. Journal of Regulatory Toxicology & Pharmacology, Vol. 70 (2014), 579-588.

- F. Jay Murray et al. Developmental toxicity study of sodium molybdate dihydrate administered in the diet to Sprague Dawley rats. *Reproductive Toxicology*, Vol. 40 (2014), 202-208.
- Two-Generation (One Litter per Generation) Reproduction Study of Sodium Molybdate Dihydrate in Rats, Study Conducted by Charles River Laboratories, USA (April 2017), International Molybdenum Association.

These studies resulted in NOAELs of 17, 40 and 17 mg/L respectively. The lowest (most sensitive) NOAEL of 17 mg/L was used and was divided by the UF=30 to obtain the RfD=0.566 mg/Mo/kg/day. The three toxicity studies are recent state of the art studies performed according to Organization for Economic Cooperation and Development (OECD) guidelines. They indicate that the toxicity of molybdenum is significantly lower than indicated in older toxicity studies, including the Fungwe et al. (1990) study that was considered by the Commission in 2010 when it adopted the molybdenum standard of 210 µg/L.

The UF of 30 used to calculate the RfD is based on application of an interspecies uncertainty factor of 10 to account for possible differences between rats and humans and an intraspecies uncertainty factor of 3 to account for possible variability among humans. In using the total UF=30 for calculating the RfD, the Commission considered that molybdenum is an essential element and that the body has homeostatic mechanisms to regulate levels of essential elements.

The RSC is the percentage of the total daily exposure to molybdenum contributed by drinking water. The RSC of 0.5 is based on discussions with EPA and other stakeholders, which assumes that one-half of the daily molybdenum consumption would come from water.

The UF specified by Policy 96-2 in the denominator of the equation is 1.0 for most chemicals. For certain Group C chemicals, a UF of 10 is employed according to Policy 96-2. Since molybdenum is not a Group C chemical, a UF of 1.0 is used.

The drinking water consumption of 2 L/day and the average adult weight of 70 kg are values that have been regularly used by EPA and the Commission in calculating drinking water standards.

Application of the values above in the Policy 96-2 equation results in a drinking water standard for molybdenum of 9,905 µg/L. This value was reduced to 9,000 µg/L to include a margin of safety.

Agriculture Standard

The agriculture standard of 1,000 µg/L is based on the results of a study done at Colorado State University, *The Effects of Molybdenum Water Concentration on Feedlot Performance, Tissue Mineral Concentrations, and Carcass Quality of Feedlot Steers*, Kistner et al., *Journal of Animal Science* Vol. 95 (2017), 2758-2766, as well as an equation that was developed by the Division in the 2010 Basic Standards hearing.

In the Kistner et al. study, 30 young steers received molybdenum in drinking water at five target dose levels (0, 160, 320, 480, and 960 µg/L) in a randomized block design whereby animals in two replicate groups were chronically exposed to molybdenum in water from February through November of 2015. The results of this study showed that molybdenum added in drinking water up to 1026.8 µg/L¹ had no impact on performance, mineral status, water intake, and carcass characteristics. The dose of 1026.8 µg/L is considered to be a NOAEL which provides a basis for the water quality standard of 1,000 µg/L. Because the highest dose tested was 1026.8 µg/L, it is possible that a true NOAEL would be even higher. Therefore, a standard of 1,000 µg/L is justified based on the results of the Kistner et al. study.

The existing agriculture standard of 300 µg/L was based on the following equation, which was developed by the Division in the 2010 Basic Standards hearing:

¹ The Kistner et al. study notes that the target dose of 960 µg/L was actually 1026.8 µg/L, based on the measured mean molybdenum concentration.

$$\frac{(Cu_{\text{forage}} \times \text{Forage}_{\text{intake}}) + (Cu_{\text{water}} \times \text{Water}_{\text{intake}}) + Cu_{\text{supp}}}{\text{Cu:Mo Safe Ratio}} - (\text{Mo}_{\text{Forage}} \times \text{Forage}_{\text{intake}})$$

TVS=

$\text{Water}_{\text{intake}}$

The 300 µg/L standard was disapproved by EPA in 2011 because it included an assumption for copper supplementation. The other assumptions used to develop the 2010 standard were based on various anecdotal sources. Basing the inputs to the Division's equation on the following actual values of data obtained in the Kistner et al. study and excluding the copper supplementation factor, the resulting calculated table value standard is 1,100 µg/L.

Copper concentration in forage (Cu_{forage}):	9.8 mg/kg	CSU median
Molybdenum concentration in forage (Mo_{forage}):	0.6 mg/kg	CSU median
Forage intake rate ($\text{Forage}_{\text{intake}}$):	11.4 kg/day	CSU median
Copper concentration in water (Cu_{water}):	0.008 mg/L	WQCD mean
Water intake rate ($\text{Water}_{\text{intake}}$):	28.2 L/day	CSU median
Copper supplementation in feed (Cu_{supp}):	0	
Cu:Mo exposure ratio (Cu:Mo Safe Ratio):	2.8	Ratio at highest CSU dose
Margin of safety:	0.075 mg/L	

The Commission adopted a standard of 1,000 µg/L based on the results of the Kistner et al. study and application of actual data from the Kistner et al. study in the equation.

EXHIBIT 2
CLIMAX MOLYBDENUM COMPANY

DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

Water Quality Control Commission

REGULATION NO. 33 - CLASSIFICATIONS AND NUMERIC STANDARDS FOR UPPER COLORADO RIVER BASIN AND NORTH PLATTE RIVER (PLANNING REGION 12)

5 CCR 1002-33

33.60 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE; DECEMBER 12, 2017 RULEMAKING; FINAL ACTION JANUARY 8, 2018; EFFECTIVE DATE JUNE 30, 2018

The provisions of C.R.S. 25-8-202(1)(a), (b) and (2); 25-8-203; 25-8-204; and 25-8-402; provide the specific statutory authority for adoption of these regulatory amendments. The Commission also adopted in compliance with 24-4-103(4) C.R.S. the following statement of basis and purpose.

BASIS AND PURPOSE

The Commission adopted updated molybdenum standards for agriculture and water supply in Regulation 31, Section 31.16, Table III. Contemporaneously, the Commission updated the molybdenum standards on the following segments in the Upper Colorado River Basin:

Upper Colorado River Segment 8: The Commission removed the agriculture-based standard of 190(T) µg/L and replaced it with the updated agriculture-based standard of 1000(T) µg/L.

Blue River Segment 14: The Commission removed the water-supply based standard of 210(T) µg/L and replaced it with the updated drinking water supply-based standard of 9000(T) µg/L. The Commission removed the existing temporary modification for molybdenum of "current conditions."

The Commission made no changes to molybdenum standards on other Upper Colorado River Basin segments or segments in other basins. The Commission will update molybdenum standards in this and other basins in future rulemakings.

**COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
WATER QUALITY CONTROL COMMISSION**

5 CCR 1002-33

**REGULATION NO. 33
CLASSIFICATIONS AND NUMERIC STANDARDS
FOR
UPPER COLORADO RIVER BASIN AND
NORTH PLATTE RIVER (PLANNING REGION 12)**

**APPENDIX 33-1
Stream Classifications and Water Quality Standards Tables**

Effective ~~06/30/2017~~ 06/30/2018

REGULATION #33 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS Upper Colorado River Basin

8. Mainstem of the Williams Fork River, including all tributaries and wetlands from the source to the confluence with the Colorado River, except for those tributaries listed in Segment 9.						
COUCUC08	Classifications	Physical and Biological			Metals (ug/L)	
Designation		DM	MWAT		acute	chronic
Reviewable	Agriculture					
	Aq Life Cold 1	CS-I	CS-I	Temperature °C	---	---
	Recreation E	acute	chronic			
	Water Supply	---	6.0	D.O. (mg/L)	---	---
Qualifiers:		---	7.0	D.O. (spawning)	TVS(tr)	TVS
Other:		6.5 - 9.0	---	pH	50(T)	TVS
Temporary Modification(s):		---	150	chlorophyll a (mg/m ²)	TVS	TVS
Arsenic(chronic) = hybrid		---	126	E. Coli (per 100 mL)	TVS	TVS
Expiration Date of 12/31/2021					---	WS*
*Iron(chronic) = Point of compliance at Aspen Canyon Ranch well.					---	1000(T)
*Manganese(chronic) = Point of compliance at Aspen Canyon Ranch well.					---	TVS
					TVS	TVS
					---	WS*
					---	0.01(t)
					---	199100Q(T)
					TVS	TVS
					TVS	TVS
					---	---
					TVS	TVS(tr)
					---	---
					TVS	TVS
					---	TVS(sc)

14. Mainstem of Tenmile Creek, including all tributaries and wetlands from a point immediately above the confluence with West Tenmile Creek to Dillon Reservoir, except for the specific listing in Segment 16.

COUCBL14	Classifications	Physical and Biological			Metals (ug/L)		
Designation	Agriculture	DM	MWAT	acute	chronic		
Reviewable	Aq Life Cold 1	Temperature °C	CS-I	CS-I	Aluminum	---	---
	Recreation E		acute	chronic	Arsenic	340	0.02(T)
	Water Supply	D.O. (mg/L)	---	6.0	Beryllium	---	---
Qualifiers:		D.O. (spawning)	---	7.0	Cadmium	TVS(tr)	TVS
Other:		pH	6.5 - 9.0	---	Chromium III	50(T)	TVS
Temporary Modification(s):		chlorophyll a	---	150*	Chromium VI	TVS	TVS
Arsenic(chronic) = hybrid		E. Coli (per 100 ml)	---	126	Copper	TVS	TVS
Expiration Date of 12/31/2021					Iron	---	WS
Molybdenum(chronic) = current conditions					Iron	---	1000(T)
Expiration Date of 12/31/2017					Lead	TVS	TVS
*chlorophyll a (mg/m ²)(chronic) = applies only above the facilities listed at 33.5(4).					Manganese	TVS	TVS
*Phosphorus(chronic) = applies only above the facilities listed at 33.5(4).					Manganese	---	WS
					Mercury	---	0.01(t)
					Molybdenum	---	2499000 (T)
					Nickel	TVS	TVS
					Selenium	TVS	TVS
					Silver	TVS	TVS(tr)
					Uranium	---	---
					Zinc	TVS	TVS
					Zinc	---	TVS(sc)