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Adjunct Professor of Hydrology, NM Tech
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Rebuttal testimony in the matter of the application of the New Mexico Oil Conservation Division for repeal of existing rule 709, 710, and 711 concerning surface waste management and adoption of new rules governing surface waste management

Case No. 13586

Daniel B. Stephens & Associates, Inc.

Summary of Testimony

- Natural processes lead to very low net infiltration in dry climates;
- Waste acceptance criteria should be flexible to allow for risk-based analysis with site specific data;
- Proposed monitoring is excessive;
- Proposed soil corrective action can be triggered without a threat to groundwater.
- Closure criteria are unreasonable

Inconsistent Basis for Standards

- 3103 constituents: DAF=1
- Chloride: DAF=20
  - MCL=250
  - 1000 mg/kg soil = 5000 mg/L pore water
  - Mixing vadose zone flow and groundwater flow 20:1

Rebuttal to "Study to Determine Allowed 'Salt' Content..."

- Misrepresents prior modeling
- Has numerous typographical errors
- Inappropriately utilizes available data
- Contains calculation errors
- Shows w/rt chloride,
  - "one size doesn't fit all"
  - 2000 mg/kg or more is protective at small landfarms

OCD Misrepresents Prior Modeling

OCD Averaged Chloride Predicted by Four Models

- Two of the models are identical
  - 'EPA Infinite Source Model'
  - 'ASTM (NMRBCA) Chloride Working Group'
- OCD used different input to each model
- Should compare three approaches based on same assumptions and input

EPA Steady-State Infinite Source Model

RBSL soils = GW standard (250 mg/L) × (DAF) × (water filled porosity)/(soil dry density)

$$RBSL_s = 250 \text{ mg/L} \times DAF\ \theta/\rho_b$$

ASTM (NMRBCA) Chloride Working Group

$$RBSL_s = (RBSL_{gw}) \, x \, K_s / LF$$

$$RBSL_s = 250\, mg/L \; x \; \frac{\theta}{\rho_b} \Big/ \, ^1\!/_{DAF}$$

$$RBSL_s = 250\, mg/L \; x \; DAF \; x \; ^{\theta}\!/_{\rho_b}$$

OCD Analysis Contains Numerous Typographical Errors

Spelling Errors

Chloride Working Group Tier 1 Evaluation of the soil to Groundwater Pathway for Chlorides-Draft 5/23/01

Objective: Develop a New Mexico Tier 1 screening value for chlorides in soil that is protective of GW and is acceptable to operators and regulators. The screening value could be used as a practical limit for delineation.

Proposed Approach: ASTM (NMRBCA) simple fate and transport moleding

Assumptions:

1. 250 mg/l will be threshold for groundwater protection.
2. Salt in soil above 5 feet below grade surface will tend to move upward due to NM high evaporation rates.
3. Recharge is extreanely low in NM. I.e. .25 cm/yr. Data complied by DB Stephens throughout NM.
4. No siting or restrictions on location.
5. State wide data for GW Darcy velocity Ugw = 51 ft/year
6. GW mixing zone thickness = 10 ft
7. Size of site was 50 feet parallel to GW flow. No width was given. Width was assumed to be 1 ft.
8. Infiltration rate was set 10 times for safety which was 1.16 in per yr.

ASTM equations: ***RBSLs = (RBSLgw) X (Ks/LF)*** ***ASTM E2081-00***

LF (dilution factor in groundwater) = 1/ (1 + Ugw X MZt)/ (I x W)
where Ugw is GW Darcy velocity
where MZt is mixing zone thickness
where I is infiltration rate (recharge)
where W is length of the GW source

RBSLgw is groundwater to be protected NM standard is 250 mg/l.
Ks is the total soil concentration to pore water concentration ratio and is given Ksw= (Ow+Kd*Ps + (Heff*Oa)/ Ps
where Ow is the water filled porosity of the unsaturated zone
where Kd soil water partition coefficient
where Ps is dry soil bulk density
Oa is the soil air content

Heff and Kd was set to = 0

[redacted] ***mg/kg*** ***Chloride Working Group*** ***with a DAF of 109***

EPA standard is 20 for small sites less than .5 acre

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Incorrect Reference Citation

OCD utilized the API's vadsat model and the followin

Landfill typical parameters:

Cell size:	5 acres
Depth of waste:	2 feet
Minimum depth to groundwater:	50 feet
Liners:	none
Waste Type:	salt contaminated soil-like material @ 1000 mg/kg
Location:	Lea County, NM
Hydrologic Input:	Ogallala

USGS/NM State Engr. Stu Report #84-4062
Groundwater Recharge in the Southern High Plains.

Reference? Title of USGS report 84-4062 is "Projected water-level declines in the Ogallala aquifer in Lea County, New Mexico"

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OCD Inappropriately Selected Data

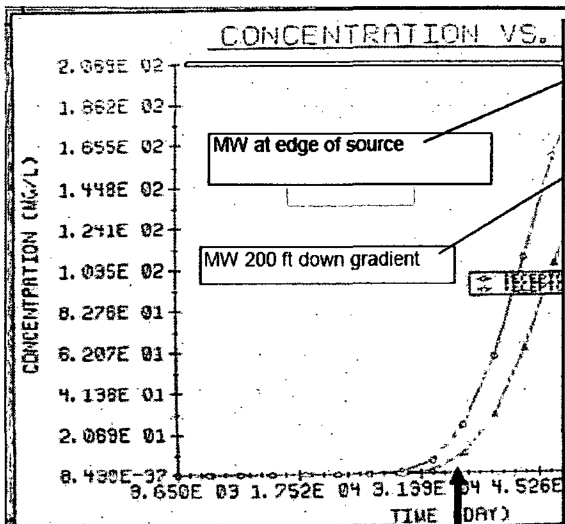
Undocumented Permeability Data

American Petroleum Institute (API) VADSAT Modeling Program:

A Vadose and Saturated Zone Transport Model for Assessing the Effects on Groundwater Quality from Petroleum Production Waste.

INPUT Parameters:

Waste Type:	*Soil with salt*								
Model Period:	*200 years*								
source:	*5 acres*	*1000 mg/kg*		*square 465'x465'*	*waste zone thickness 2 feet.*		*no liners*		
vadose zone:	*48 feet*	*bio-na*	*OC-na*	*Sand Hycond .888 m/d*	*Por .43*	*VG=2.68*	*Rwater = .045*		*VertDis-yes*
Groundwater:	*10 feet*	*bio-na*	*OC-na*	*Sand Hycond .888 m/d*	*Por .30*	*Ldis-yes*	*L/Tdis-=3*	*T/Vdis=87*	*Gradient = .01*
Net Infiltration:	*.38 in/yr*								
Receptors:	*1 ft*	*200 ft*							



Break through starts in about 90-100

Hydraulic conductivity of 2.9 ft/d does not match ranges in USGS source.

USGS (1984) gave plausible range of 10 to 170 ft/day and used a range of 16 to 155 ft/day in their model

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Undocumented Porosity Data

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INPUT Parameters:

Waste Type:	Soil with salt								
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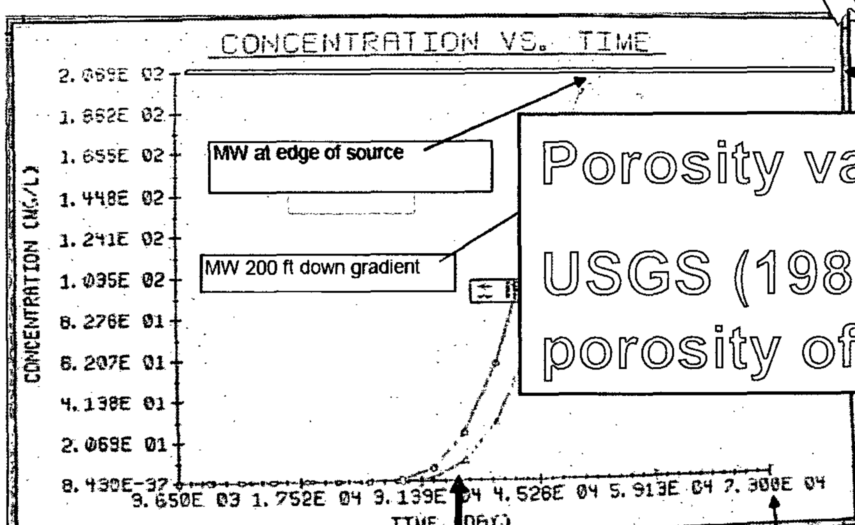
source:	5 acres	1000 mg/kg		square 465'x465'	waste zone thickness 2 feet.		no liners		
vadose zone:	48 feet	bio-na	OC-na	Sand Hycond .888 m/d	Por .43	VG=2.68	Rwater = .045		VertDis-yes
Groundwater:	10 feet	bio-na	OC-na	Sand Hycond .888 m/d	Por .30	Ldis-yes	L/Tdis-=3	T/Vdis=87	Gradient = .01
Net Infiltration:	.38 in/yr								
Receptors:	1 ft	200 ft							



Porosity values not in source

USGS (1984) gives average porosity of 0.35

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Models Use Inconsistent Hydraulic Conductivities (Permeability)

- 3 ft/d: VADSAT Model [Tab 3]
- 40 ft/d: EPA infinite source model [Tab 4]
- 61 ft/d (est.): ASTM (RBCA) Chloride working group [Tab 5]

Models Have Inconsistent Source Areas

- 5 acres: VADSAT Model, EPA infinite source model and interpretation of EPA DAF study used 5 acres [Tabs 3, 4 and 7]
- 0.001 acres: ASTM (RBCA) Chloride working group [Tab 5]
- Small land farm,1400 cu. yd (0.43 ac), was not modeled.

Models Used Inconsistent Recharge

- 0.38 in/yr: VADSAT Model and EPA infinite source model [Tabs 3 and 4]
- 1.17 in/yr: ASTM (RBCA) Chloride working group [Tab 5]

Models Used Inconsistent Gradients

- 0.01: VADSAT Model [Tab 3]
- 0.0023: EPA infinite source model [Tab 4]
- Unknown gradient for ASTM (RBCA) Chloride working group [Tab 5]

OCD Analysis Contains Calculation Errors

Incorrect Formulation of Equation

Chloride Working Group Tier 1 Evaluation of the soil to Groundwater Pathway for Chlorides-Draft 5/23/01

Objective: Develop a New Mexico Tier 1 screening value for chlorides in soil that is protective of GW and is acce
The screening value could be used as a practical limit for delineation.

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6. GW mixing zone thickness = 10 ft
7. Size of site was 50 feet parallel to GW flow. No width was given. Width was assumed
8. Infiltration rate was set 10 times for safety which was 1.16 in per yr.

ASTM equations: ***RBSLs = (RBSLgw) X (Ks/LF)*** ***ASTM E2081-00***

LF (dilution factor in groundwater) = 1/ (1 + Ugw X MZt)/ (I x W)
where Ugw is GW Darcy velocity
where MZt is mixing zone thickness
where I is infiltration rate (recharge)
where W is length of the GW source

RBSLgw is groundwater to be protected NM standard is 250 mg/l.
Ks is the total soil concentration to pore water concentration ratio and is given Ksw= (Ow
where Ow is the water filled porosity of the unsaturated zone
where Kd soil water partition coefficient
where Ps is dry soil bulk density
Oa is the soil air content

Heff and Kd was set to = 0

1938 *mg/kg* ***Chloride Working Group*** ***with a DAF of 109***

EPA standard is 20 f

Using the given equations and parameter values (e.g., 1.16 in/yr recharge, 0.3 water content, and 1.5 kg/L bulk density) the chloride standard for soil is 104,781 mg/kg, which is a DAF of 2100. It appears that the LF equation given is wrong

Conversion Error

Chloride Working Group Tier 1 Evaluation of the soil to Groundwater Pathway for Chlorides-Draft 5/23/01

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where Ugw is GW Darcy velocity
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where I is infiltration rate (recharge)
where W is length of the GW source

RBSLgw is groundwater to be protected NM standard is 250 mg/l.
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where Ow is the water filled porosity of the unsaturated zone
where Kd soil water partition coefficient
where Ps is dry soil bulk density
Oa is the soil air content

Heff and Kd was set to = 0

1938 *mg/kg* ***Chloride Working Group*** ***with a DAF of 109***

EPA standard is 20 for small sites less than .5 acre

0.25 cm/yr with a multiplier of 10 converts to 0.98 in/yr; not 1.16 in/yr as given by NMOCD. A 15% relative error.

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Math Error

Chloride Working Group Tier 1 Evaluation of the soil to Groundwater Path

Objective: Develop a New Mexico Tier 1 screening value for chlorides in soil that is protective of GW and is acc
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8. Infiltration rate was set 10 times for safety which was 1.16 in per yr.

ASTM equations: ***RBSLs = (RBSLgw) X (Ks/LF)*** ***ASTM E2081-00***

LF (dilution factor in groundwater) = 1/ (1 + Ugw X MZt)/ (I x W)
where Ugw is GW Darcy velocity
where MZt is mixing zone thickness
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where W is length of the GW source

RBSLgw is groundwater to be protected NM standard is 250 mg/l.
Ks is the total soil concentration to pore water concentration ratio and is given Ks = (Ow
where Ow is the water filled porosity of the unsaturated zone
where Kd soil water partition coefficient
where Ps is dry soil bulk density
Oa is the soil air content

Heff and Kd were set to = 0

1938 *mg/kg* ***Chloride Working Group*** ***with a DAF of 109***

EPA standard is 20

Assuming the DAF of 109 was calculated correctly, the reported chloride limit of 1,938 mg/kg is in error.

Using the DAF of 109 and the water content and bulk density given by the NMOCD on tab 4 of this spreadsheet gives a chloride standard of 5,450 mg/kg.

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Interpolation Error

Table 5. Variation of DAF with Size of Source Area for SSL EPACMTP Modeling Effort

Area (acres)	DAF 85th	DAF 90th	DAF 95th
0.02	1.42E+07	2.09E+05	946
0.04	9.19E+05	2.83E+04	211
0.11	5.54E+04	2.74E+03	44
0.23	1.16E+04	644	15
0.50	2.50E+03	170	7.0
0.69	1.43E+03	120	4.5
1.1	668	60	3.1
1.6	417	38	2.5
1.8	350	33	2.3
3.4	159	10	1.7
4.6	115	13	1.6
5 acres		15	
11.5	41	5.5	1.2
23	21	3.5	1.2
30	16	3.0	1.1
46	12	2.4	1.1
69	8.7	2.0	1.1

Why would the DAF for a 5-acre site be higher than that for a 4.6 acre site?

Averaging Error

Conclusion:

The following is a summary of all of the soil screening levels calculated above and averaged.

Vadsat	1000 mg/kg			
EPA infinite source model	1183 mg/kg	if over 50 feet from groundwater	1000	
ASTM (RBCA) Chloride working group	1983 mg/kg		1153	
EPA DAF study	750 mg/kg	**very small source	1953	
Total	4916/4 = 1229 mg/kg		***1027***	compensated for Cl backround levels

adjusted to include a background concentration of 50 mg/l in groundwater. The other three models were not adjusted for background levels.
found to be very close When the other three models are adjusted for chloride background levels the average of these values is a 2 foot waste zone that is approximately 50 feet from groundwater.

OCD's default value. *1000 mg/kg*

er	1000		
	1153		
	1953		
	=SUM(L6:L9)/4		
		Cl backround levels	

Equation in spreadsheet is wrong. Includes zero in average: (1000 + 1153 + 1953 + 0)/4 = 1027. Should be (1000 + 1153 + 1953 + 1000)/4 to obtain 1,277 mg/kg.

OCD Analysis Shows "One Size Doesn't Fit All"

Chloride Load Varies with Aquifer Permeability, K

EPA Steady-State Infinite Source Model

Tier 1 Evaluation of the soil to groundwater pathway for chlorides.

Soil Screening Level in Soil (mg/kg) RBSLsoils = GW standard (250 mg/

Range of parameters give SSL for chloride ranging from 400 to 6,800 mg/kg

Cw =	Ground water protection standard (mg/L) x	dilution factor			
GW standard	250 mg/L		250		
Kd =	Soil water partition coefficient = 0 for salts		0		
Ow =	water-filled soil porosit default = .3		0.3	EPA default	
Pb =	dry soil bulk density kg/L		1.5	EPA default	
dilution factor =	1 + Kid/IL				

USGS/NM State Engineer study of the Ogallala Aquifer report # 84-4062

					range of input parameters
K =	Aquifer hydraulic conductivity ft/yr	14600	16 ft/day	40 ft/day	155 ft/day
I	hydraulic gradient ft/ft	0.0023		12 ft / mile	
d =	groundwater mixing zone depth ft	10		typical MW	
I =	Infiltration rate ft/yr	0.032	0.25 in/yr	.38 in/yr	.50 in/yr
L =	Length of source parallel to GW ft	463		5 acres	

df	auto	equation	0.04226		
		DAF	23.66469		
SSL	auto	equation	1183	mg/kg	***results***

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Chloride Load Varies With Landfarm Area

EPA Steady-State Infinite Source Model

Tier 1 Evaluation of the soil to groundwater pathway for chlorides.

Soil Screening Level in Soil (mg/kg) RBSLsoils = GW standard (250 mg/l

Cw =	Ground water protection standard (mg/L) x dilution factor			
GW standard	250 mg/L		250	
Kd =	Soil water partition coefficient = 0 for salts		0	
Ow =	water-filled soil porosit default = .3		0.3	EPA default
Pb =	dry soil bulk density kg/L		1.5	EPA default
dilution factor =	1 + Kid/IL			

USGS/NM State Engineer study of the Ogallala Aquifer report # 84-4062

K =	Aquifer hydraulic conductivity ft/yr	14600	16
I	hydraulic gradient ft/ft	0.0023	12 ft / mile
d =	groundwater mixing zone depth ft	10	typical NW
I =	Infiltration rate ft/yr	0.032	0.25 in/yr .38 in/yr .50 in/yr
L =	Length of source parallel to GW ft	295	acres

df	auto	equation	**0.04226**		
		DAF	36.57203		
SSL	auto	equation	***1829***	mg/kg	***results***

Decreasing landfarm area to 2-acres gives length parallel to groundwater flow of 295-ft (assuming square site). SSL increases 55% from 1183 to 1,829 mg/kg.

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Chloride Load Varies With Shape of Area and Orientation

EPA Steady-State Infinite Source Model

Tier 1 Evaluation of the soil to groundwater pathway for chlorides.

Soil Screening Level in Soil (mg/kg) RBSLsoils = GW standard (250 mg/l)

Cw =	Ground water protection standard (mg/L) x dilution factor			
	GW standard 250 mg/L		250	
Kd =	Soil water partition coefficient = 0 for salts		0	
Ow =	water-filled soil porosit default = .3		0.3	EPA default
Pb =	dry soil bulk density kg/L		1.5	EPA default
dilution factor =	1 + Kid/IL			

USGS/NM State Engineer study of the Ogallala Aquifer report # 84-4062

K =	Aquifer hydraulic conductivity	ft/yr	14600	16 f
I	hydraulic gradient	ft/ft	0.0023	
d =	groundwater mixing zone depth	ft	10	
I =	Infiltration rate	ft/yr	0.032	0.25
L =	Length of source parallel to GW	ft	200	5 acres

df	auto	equation	0.04226	
		DAF	53.46875	
SSL	auto	equation	2673	mg/kg ***results***

If site is rectangular shaped (e.g., 200-ft x 1,089 ft), 5-acres in size and oriented perpendicular to groundwater flow, the chloride SSL increases 126% from 1183 to 2,673 mg/kg.

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Chloride Load Varies With Area, Shape, Orientation

EPA Steady-State Infinite Source Model

Tier 1 Evaluation of the soil to groundwater pathway for chlorides.

Soil Screening Level in Soil (mg/kg) RBSLsoils = GW standard (250 mg/l

Cw =	Ground water protection standard (mg/L) x	dilution factor		
GW standard	250 mg/L		250	
Kd =	Soil water partition coefficient = 0 for salts		0	
Ow =	water-filled soil porosit default = .3		0.3	EPA default
Pb =	dry soil bulk density kg/L		1.5	EPA default
dilution factor =	1 + Kid/IL			

USGS/NM State Engineer study of the Ogallala Aquifer report # 84-4062

K =	Aquifer hydraulic conductivity ft/yr		14600	16		
I	hydraulic gradient ft/ft		0.0023		12 ft / mile	
d =	groundwater mixing zone depth ft		10		typical MW	
I =	Infiltration rate ft/yr		0.032	0.25 in/yr	.38 in/yr	.50 in/yr
L =	Length of source parallel to GW ft		74		5 acres	
df	auto	equation	0.04226			
		DAF	142.8074			
SSL	auto	equation	***7140***	mg/kg	***results***	

Using both 2-acre site and rectangular shape (e.g., 74-ft x 1181-ft) oriented perpendicular to groundwater flow, the chloride SSL increases 500% from 1183 to 7,140 mg/kg.

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Revised Calculation for 2 acres Shows 2000 mg/kg is Protective

CONCLUSION BY MODEL TYPE

Compare to Tab 8 on NMOCD spreadsheet "3 WP Chloride Final.xls"

Summary of Results

Model	Source Area (Acres)	Hydraulic Conductivity (ft/d)	Hydraulic Gradient	Net Infiltration (in/yr)	DAF	Chloride SSL (mg/kg)	Chloride SSL Adjusted for Background (mg/kg)
VADSAT	2	40	0.00230	0.380	55	3923	3138
EPA Steady-State (USGS)	2	40	0.00230	0.380	37	1848	1478
EPA DAF Study	2	N/A	N/A	N/A	31	1556	1245
				AVERAGE	41	2442	1954

Notes: (1) Background is 50 mg/L (NMOCD, 2006)

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Revised Calculation for OCD Proposed 1400 yd^3: 6000 mg/kg is Protective

CONCLUSION BY MODEL TYPE

Compare to Tab 8 on NMOCD spreadsheet "3 WP Chloride Final.xls"

Summary of Results

Model	Source Area (Acres)	Hydraulic Conductivity (ft/d)	Hydraulic Gradient	Net Infiltration (in/yr)	DAF	Chloride SSL (mg/kg)	Chloride SSL Adjusted for Background (mg/kg)
VADSAT	0.434	40	0.00230	0.380	66	4671	3737
EPA Steady-State (USGS)	0.434	40	0.00230	0.380	78	3909	3127
EPA DAF Study	0.434	N/A	N/A	N/A	286	14298	11439
				AVERAGE	143	7626	6101

Notes: (1) Background is 50 mg/L (NMOCD, 2006)

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OCD Does Not Need to Rely on the Scots Pine and Blue Spruce Study to Establish Salt Tolerance Criteria

1. Diagnosis and Improvement of Saline and Alkali Soils. USDA Agriculture Handbook No. 60, 1954
2. USDA George E. Brown, Jr. Salinity Laboratory, Haliphyte Database
3. USDA Natural Resource Conservation Service, 2006. PLANTS Database at http://plants.usda.gov
4. Salt Tolerance of Five Varieties of Wheat-grass during Seedling Growth. Moxley et al., 1978
5. Root-Zone Salinity: Indices for Tolerance in Agricultural Crops. Steppuhn et al., 2005
6. Remediation of Salt-Affected Soils at Oil and Gas Production Facilities. API Publication No. 4663, 1997

Plants in the Oil Producing Areas of New Mexico are More Tolerant to Salt than the Plants Referenced by OCD

- Scots Pine does not grow in New Mexico and has a low salt tolerance (<2 mmhos/cm)
- Blue Spruce grows in San Juan & Otero Counties but has a salt tolerance of only 2-3 mmhos/cm
- New Mexico's Oil Producing Areas have >20 known highly salt tolerant plants (>12 mmhos/cm)
  - Saltgrass (Chaves, Colfax, Eddy, Otero & San Juan Counties)
  - Alkali sacaton (Chaves, Colfax, Eddy, Otero, San Juan)
  - Crested wheatgrass (Colfax, Otero & San Juan Counties)
  - Western wheatgrass (Chaves, Colfax, Eddy, Otero, San Juan)

Rebuttal Conclusions

- OCD Technical Basis Used to Develop Rules for Landfarms is Based on Unreliable Information and Calculations
- OCD Analysis Nonetheless Is Consistent With A Need for Increased Flexibility to Develop Site Specific Standards for Chloride in Landfarmed Waste

Industry Committee Technical Proposal

Industry Committee

Tiered Approach to Risk

- Tier 1: Cookie Cutter approach, protective in all reasonably foreseeable circumstances
  - Class 1 Landfarms
  - Small Landfarms
- Tier 2: Semi Site-Specific approach, protective for the specific proposed location
  - Class 2 Landfarms
- Tier 3: Alternative approach, handled by Staff's proposed subsection K exemption process

Tier 1

- Class 1 Landfarm
  - Substantially similar to Staff proposal
  - Differences:
    - No provision for tank bottoms in Industry Committee—waste limited to HC contaminated soils & cuttings
    - Background testing for TPH-GRO or DRO, not TPH-Total, and BTEX and chloride. No other 3103 because not present in quantities of concern and costly.
    - No treatment zone monitoring, unless bioremediation endpoint is used because serves no purpose
    - Vadose zone monitoring deeper for chloride management
    - Corrective action uses NMCCA&W closure approach

Tier 1

- Class 1 Landfarm
  - Differences from Staff proposal *continued*
    - Closure to higher of
      - PQLs, Background (mean + 2 std devs), or staff-proposed closure limits for benzene, BTEX, TPH-GRO+DRO, TEPH and Chloride
    - Sampling test defined and statistically more robust
    - Bioremediation endpoint defined properly:
      - Statistical test explained by Dr. Sublette
      - No 80% reduction – 1% TEPH instead; solid phase < 1%
      - Vegetation standards: 70% or background, 3 species, EC < 4, SAR < 13
      - Excessive detail removed

Tier 1

- Small Landfarm (<2 acres, <6400 yds^3, < 3 yrs)
  - Registration within 10 days of opening
  - Two chloride limits
    - If < 0.5 acre, 5000 mg/kg chloride (DAF SSL + safety)
    - If < 2.0 acre, 2000 mg/kg chloride (Dr. Stephens model)
  - Limited to HC contaminated soils
  - Allow bioremediation endpoint (unlike staff)
  - More stringent revegetation requirements
    - 70% or background; 3 species; EC < 4, SAR < 13 at surface

Tier 2

- Class 2 Landfarms
  - Can accept any exempt oil field waste
  - Chloride limit based on site-specific DAF multiplied by WQCC standard
  - Background testing includes full suite of constituents, unless OCD excludes on case-by-case basis
  - No treatment zone monitoring, unless bioremediation endpoint
  - Vadose zone monitoring at deeper point to allow chloride management as described by Dr. Sublette

Tier 2

- Class 2 Landfarm
  - Closure standards
    - Higher of PQL, background (mean + 2 std devs) or higher of NMED Residential SSL or Site-specific DAF using area table from EPA study.
  - Sampling test defined and statistically more robust
  - Bioremediation endpoint defined properly:
    - Statistical test explained by Dr. Sublette
    - No 80% reduction – 1% TEPH instead; solid phase < 1%
    - Vegetation standards: 70% or background, 3 species, EC < 4, SAR < 13
    - Excessive detail removed

Tier 3

- Staff proposed exemption approach in subsection K.

So, What Is All the Shouting About?

- There are six significant issues:
  - Chloride limits
  - 3103 Constituents/DAF1
  - Bioremediation Endpoint
  - Corrective Action Trigger
  - Closure and Revegetation
  - Small Landfarms

Chloride Limits

- Chloride raises two issues:
  - Protection of groundwater
  - Revegetation
- Industry Committee has addressed groundwater:
  - Dr. Stephens presentation and modeling
  - Solution:
    - Small landfarms at 0.5 acre = 5000; 2 acre = 2000 mg/kg
    - Class 1 landfarms at 1000 mg/kg (staff proposal)
    - Class 2 landfarm at EPA area DAF x NMED SSLDAF1
  - More flexible and better science than staff's flat 1000 mg/kg limit without substantial burden on permitting staff

Chloride Limits

- Industry Committee has addressed revegetation issues:
  - Dr. Sublette shows bioremediation still occurs and how chloride managed
  - Solution: Industry Committee/NMCCA&W agreed standards:
    - 70% or background cover % with 3 native species
    - Soil EC < 4; SAR < 13; < 1% solid phase & < 0.5 inch
  - Industry Committee deeper monitoring point allows chloride management without flushing or threat to groundwater
    - Remember: Dr. Stephens testified that it is "not likely" that a properly operated landfarm can meet 3-4 foot bgs corrective action trigger, yet OCD staff testified landfarms are BDAT. Industry Committee approach is solution

3103 Constituents

- Fundamental Issue: Why consider 3103 constituents?
  - Typically not present in crude/condensate.
  - May be present if mixed, but no evidence present at concentrations of concern
  - Expensive and costly to monitor (PCBs > $1500)
- Industry Committee solution:
  - Monitor BTEX and Chloride as indicators of leaching
  - Disregard other 3103s for Class 1 landfarms and small landfarms that handle only crude and condensate
  - Use 3103s for Class 2 landfarms, but let operator demonstrate, subject to OCD approval, that some not appropriate

3103 Constituents

- Fundamental Issue: Closure Standards
  - Staff recommended SSL DAF1
  - Not appropriate:
    - EPA/NMED say not appropriate, provided as a calculating convenience
    - Dr. Stephens: situation never would exist in New Mexico where relevant
  - Solution:
    - Use semi site-specific SSL using EPA "area-weighted" numbers from Wayne Price presentation at 90^{th} percentile
    - Gives better precision while still being substantially over-protective
    - Easy to administer

Bioremediation Endpoint

- Issue: Bioremediation Endpoint is the "best" science
  - Dr. Sublette is leading authority
  - Salinitro and other studies show bioremediation eliminates toxicity—no contrary evidence in record
  - Putative "issues" have all been addressed:
    - Dry landfarms work in New Mexico—proof of concept
    - Toxicity issues addressed by multiple studies / endpoints
    - Hydrophobicity addressed by addition of organic matter—this is undisputed by technical evidence

Bioremediation Endpoint

- Fundamental Issue: 80% Reduction
  - Dr. Sublette and studies have definitively shown that 80% reduction requirement will preclude bioremediation of most New Mexico crudes
    - No evidence to contrary in record
    - We know bioremediation works, so why exclude?
  - Issue: hydrophobicity and "parking lot" effect
    - Solution: Both addressed by 1% TEPH standard and revegetation standard
  - Issue: enforcement
    - We know "dry" landfarms work—proof of concept. Even if ignored, bioremediation landfarm "at least" as effective and probably more
    - Solution: Addressed by treatment month, 6 or 12 month minimum, 1% TEPH limit, and reporting requirements

Corrective Action Trigger

- Fundamental Issue: Precludes landfarming
  - Background is too stringent
    - Dr. Stephens testimony that "some" constituents would be seen—triggers corrective action
    - Trigger requires OCD action and leaves OCD vulnerable to accusations not enforcing—bad dynamic
  - Solution:
    - Industry Committee agrees with NMCCA&W that closure standard as trigger level is better
    - Remember:
      - Closure standards are still protective if not over protective of groundwater
      - Substantial time exists to remedy problem – so no imminent actual threat to human health, fresh water or the environment

Corrective Action Trigger

- Why Closure and not background?
  - Because some migration is unavoidable – all witnesses agreed
  - Because this does not mean Industry Committee seeks release to that level – can't calibrate that closely
  - Effectively rules out landfarming. Companies cannot afford, under other OCD initiatives, to have facilities in "corrective action" because it may preclude operations. Therefore, avoidance is typical company reaction.
    - This eliminates most effective treatment tool available to Commission

Closure & Revegetation

- Fundamental Issues:
  - Industry Committee and NMCCA&W agree: restore surface so that you obtain:
    - 70% or background cover percent, 3 native species including one grass
    - EC < 4, SAR < 13, solid phase hydrocarbon < 1% and no piece > 0.5"
  - Industry Committee and NMCCA&W do <u>not</u> agree on 520 mg/kg chloride limit
    - Industry Committee has demonstrated 1000 mg/kg or site-specific SSL or small landfarm limits protective below root zone
  - No revegetation if on pad or other agreement with landowner

Small Landfarms

- Issues:
  - Size should increase to 2 acres, 6400 cu. yds.
  - Limit to predominantly HC contaminated soils,
    - Don't absolutely ban incidental cuttings
  - More flexibility for chloride loading – two size/mass loading limits is a reasonable compromise
    - Revegetation standard addresses surficial issues
  - Make bioremediation endpoint available
    - If dry landfarms work, virtually no risk for bioremediation endpont landfarms, which are better managed

How Does Commission Decide?

- Look at objective factors:
  - Prevention of waste
  - Protection of correlative rights
  - Protection of public health, fresh water and environment (use EPA analytical approach to help):
    - Safety
    - Implementability and feasibility
    - Short term effectiveness
    - Long term effectiveness
    - Reduction in toxicity and mobility
    - Cumulative effects
    - Cost

The "Test"

	OCD Proposal	Industry Committee
Safety	OCD proposal encourages dilution of waste streams to meet loading factors, resulting in increased worker exposure	Industry proposal reduces worker exposure
Implementability and Feasibility	Loading factors are a significant problem 80% reduction for BE renders impossible for many crudes Chloride limits will require extensive landfilling	Industry approach is more technically correct and allows for greater treatment of HC contaminated materials Chloride limit reduces feasibility and unnecessary

The "Test"

	OCD Proposal	Industry Committee
Short Term Effectiveness	Landfills are good short term solution Landfarms are also protective	Landfarms are virtually as protective of landfills in short term
Long Term Effectiveness	Landfills merely defer problem	Landfarms eliminate HC toxicity and are preferable
Reduction in Toxicity and Mobility	Limits on loading, requirement of dilution and preference for landfill will limit amount of HC toxicity actually treated and reduced	Elimination of limits on loading and preference for landfilling will encourage treatment to reduce HC toxicity

The "Test"

	OCD Proposal	Industry Committee
Cumulative Effects	Probably a wash	Probably a wash
Cost	Very costly due to limits on landfarming and requirement to dilute	Less costly for same or better environmental protection

Summary

- Industry Proposal Is Superior:
  - Provides risk framework to guide agency resources
  - Considers prevention of waste and protection of correlative rights
  - Better on factors:
    - Discourages dilution
    - Avoids corrective action trap
    - Provides for more treatment while still addressing chloride concerns
    - Short term effectiveness as good as landfill
    - Long term effectiveness superior to landfilling because toxicity eliminated
    - Landfarming reduces toxicity; landfilling only mobility
    - Landfarming is lower in cost
  - We know landfarming works—therefore, risk to Commission is low and benefits are high—heard testimony from other state regulators about benefits of simple approach