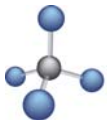


COUNTERSOL: SCALABLE CONTAINMENT & REMEDIATION



For
**RADIOLOGICAL DISPERSAL DEVICES (RDDs)
& DIRTY BOMBS**

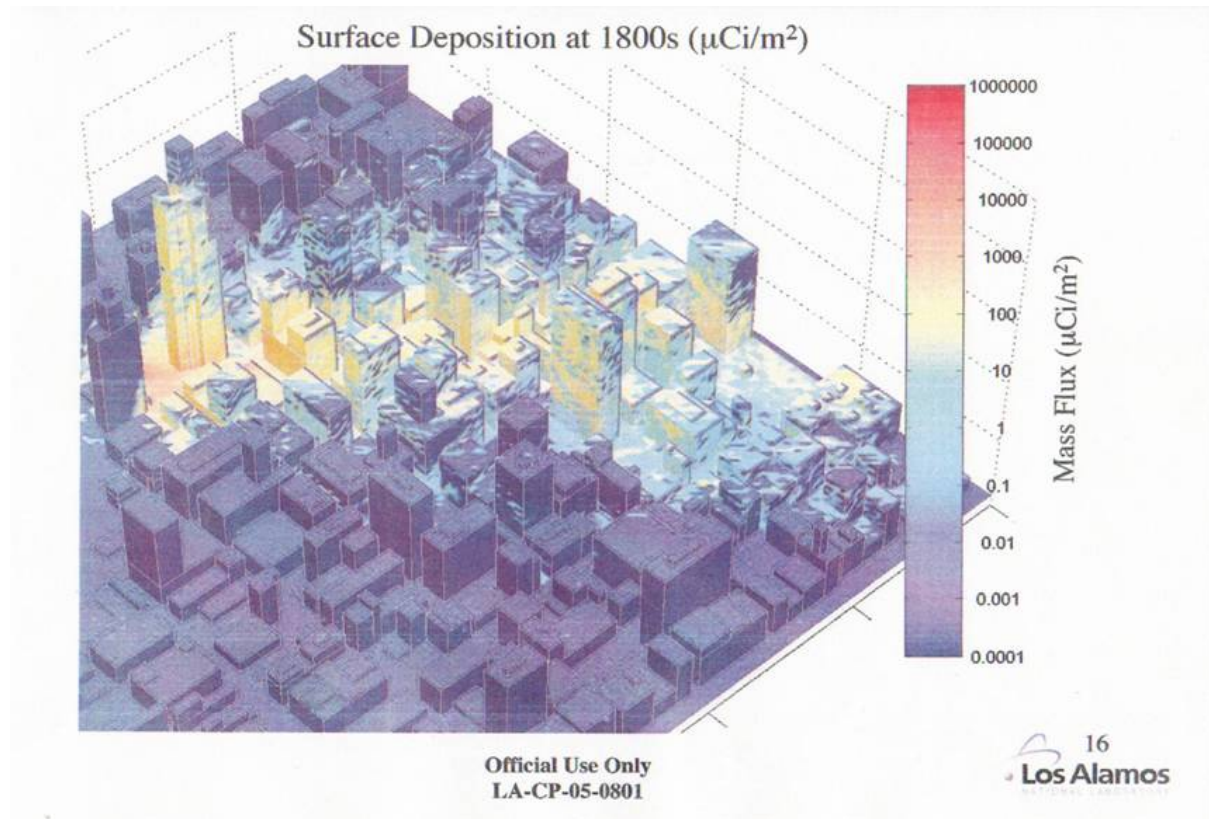
Dr. Mark Krekeler



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DIRTY BOMBS AND RDDS

- High Probability
- Radiological charges
 - $^{137}\text{CsCl}$
 - ^{60}Co
 - $^{90}\text{SrTiO}_3$
- Limited Options



THE RDD THREAT

- UN's International Atomic Energy Agency (2004)
 - 300 confirmed cases trafficking (1993-2003).
 - 344 unconfirmed cases (1993-2003).
- Some related events
 - Moscow's Ismailovsky Park - 1995
 - 375 lbs of $^{137}\text{CsCl}$ seized in Ukraine May, 2004 (AP)
 - 66 pounds seized in Thailand 2003 (CNN)
- Exact amount of $^{137}\text{CsCl}$ in existence is arguable
 - ~3000 collective seed trucks missing in Soviet Union
 - Greensboro, N.C. 19 ^{137}Cs Rods missing never found

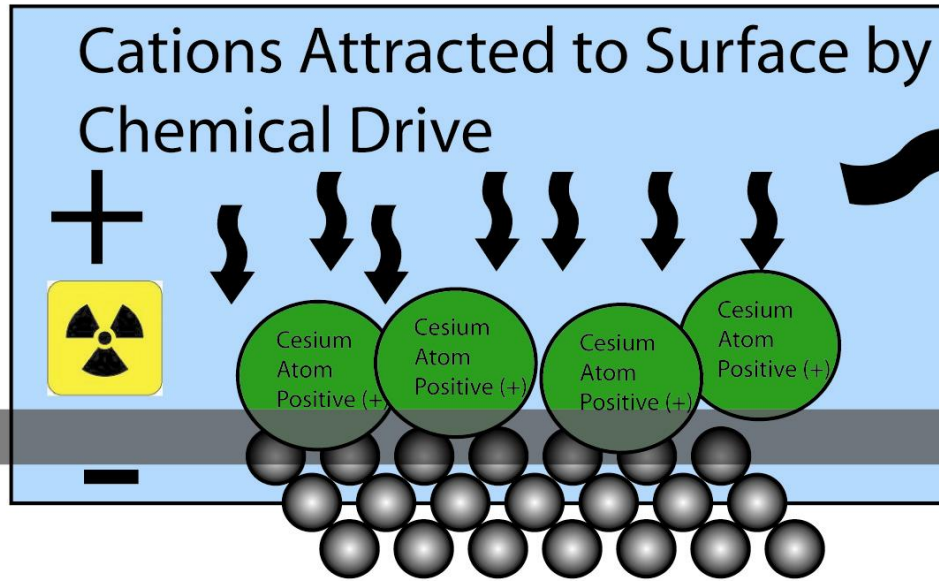
CONTAINMENT & REMEDIATION OPTIONS

Performance	Time / Dilution	Water Rinse	Gel	Foam	Countersol
Cost	LOW	LOW	MED	HIGH	LOW
Availability	HIGH	HIGH	LOW	LOW	HIGH
Applicability	EASY	EASY	SPEC.	SPEC.	MODERATE
Disposal	N/A	LOW	MED	??	STABLE SOLID
Scaleability	N/A	HIGH	LOW	MED	HIGH
Shelf Life	N/A	N/A	??	??	>5 years

CONTAINMENT & REMEDIATION OPTIONS

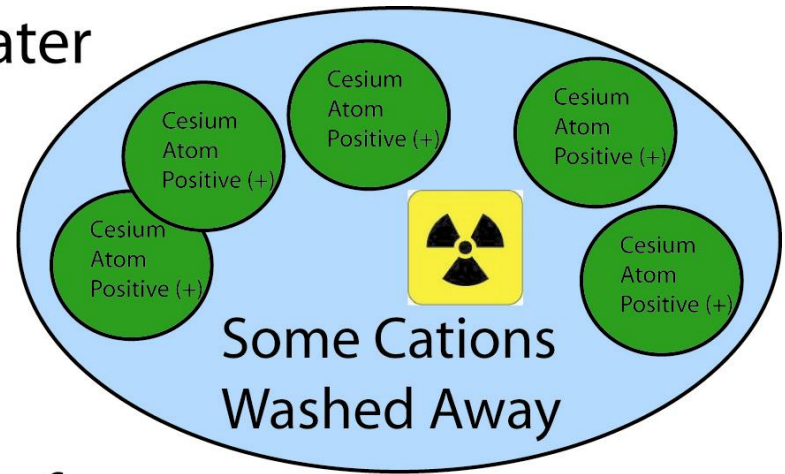
	Time / Dilution	Water Rinse	Gel	Foam	Countersol
Ionic Exchange	LOW	LOW	HIGH	HIGH	HIGH
Containment	LOW	LOW	HIGH	HIGH	HIGH
Remediation	LOW	LOW	HIGH	HIGH	HIGH
- ¹³⁷ Cs	LOW	MED	HIGH	HIGH	HIGH
- ⁶⁰ Co	LOW	MED	HIGH	HIGH	HIGH
- ⁹⁰ Sr	LOW	MED	HIGH	HIGH	HIGH
Bio Friendly	N/A	HIGH	MED	LOW	HIGH

Water Decon



Oxygen Atoms in Surface Have a Negative Charge (-)

Water

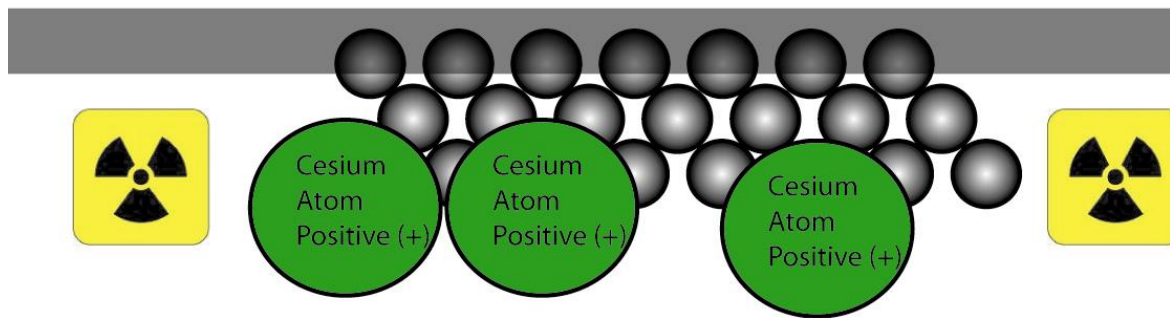


Surface Boundary

After Water Decon

Chemical Equilibrium =
Permanently Radioactive
Surface

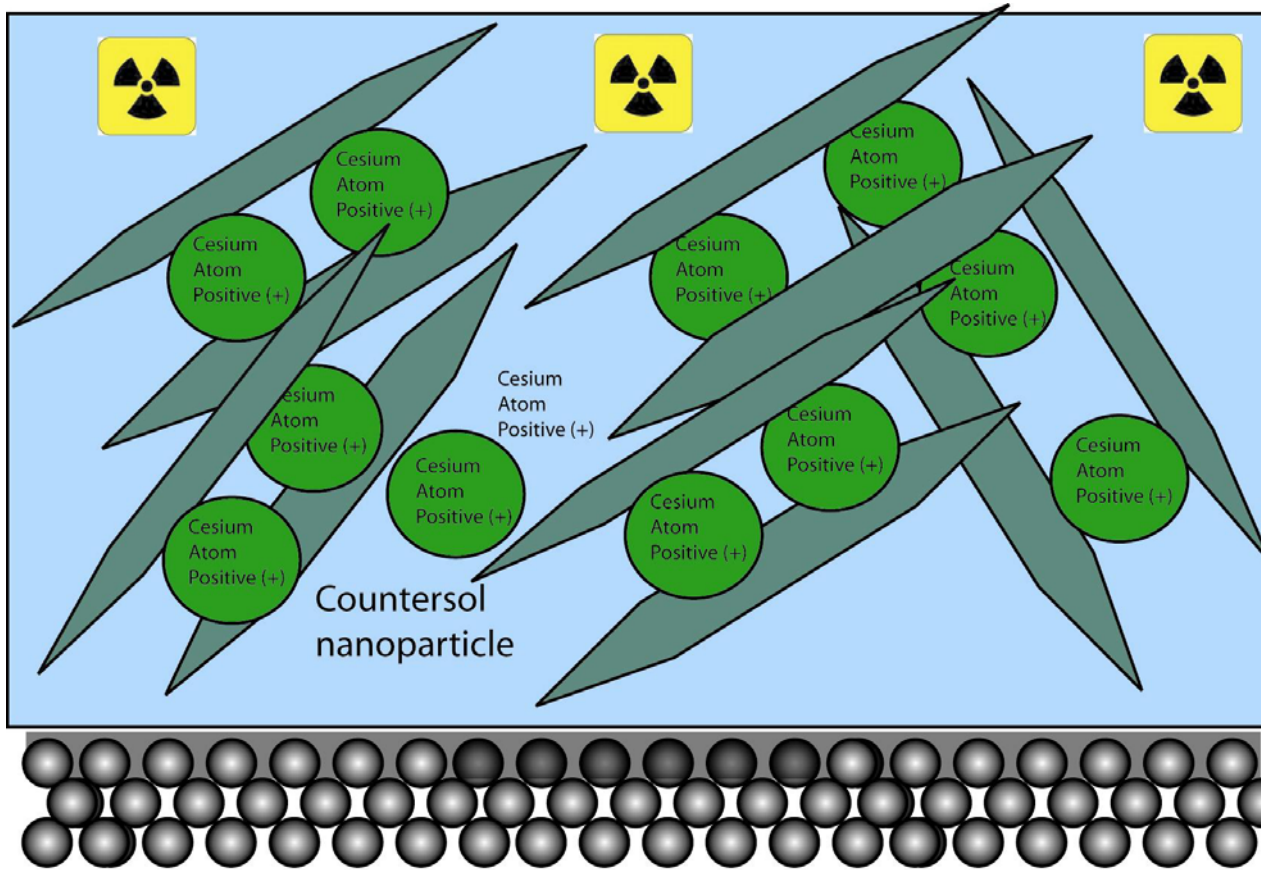
Water Has
Evaporated



Surface
Boundary

Oxygen Atoms in Surface
Have a Negative Charge (-)

Countersol™, Pat. Pend. Decon



TM, Pat. pend.

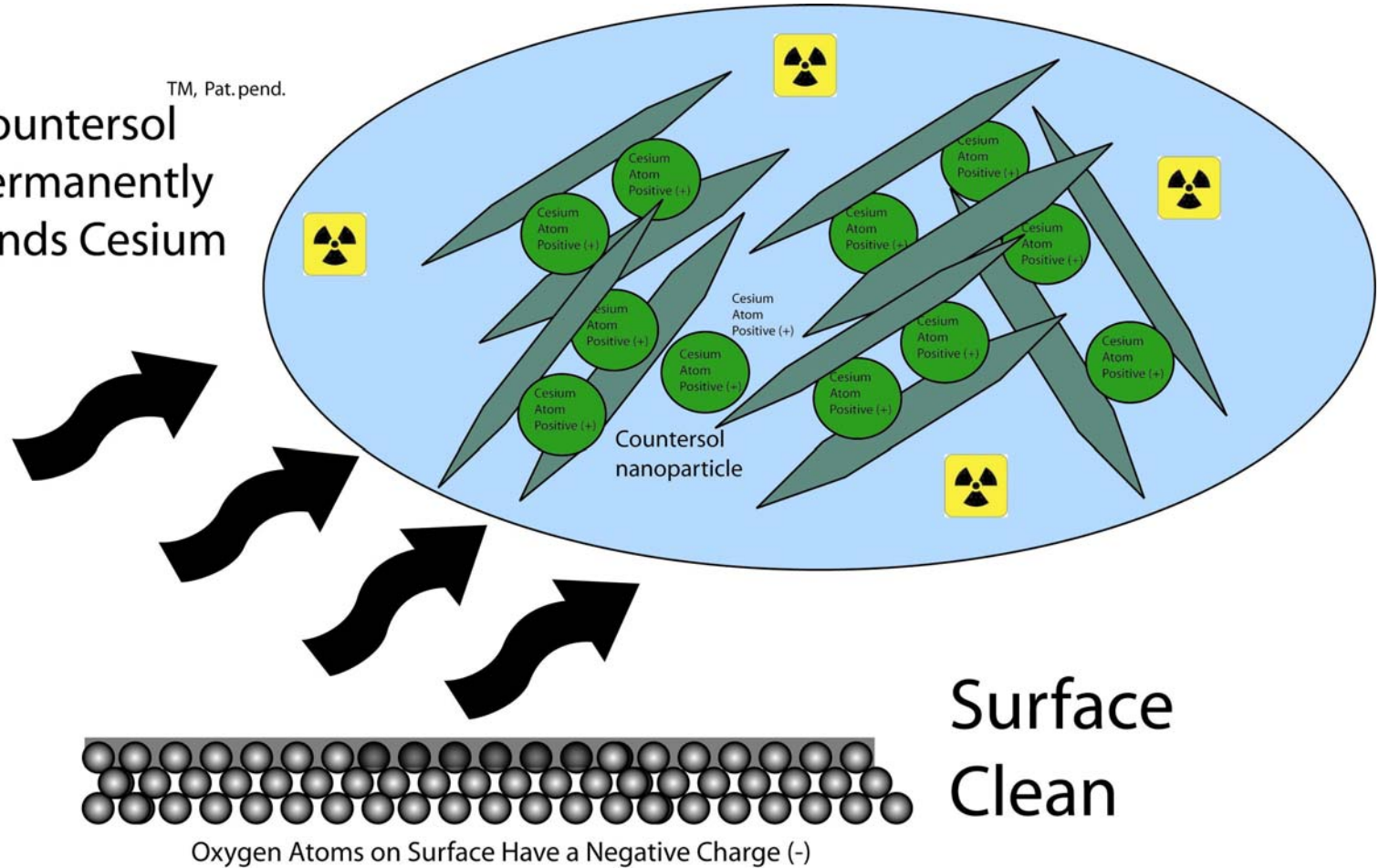
Countersol
Has Negative
Charge + Site

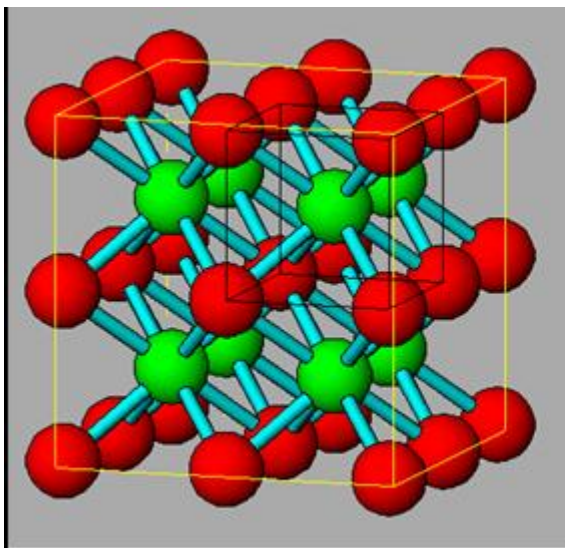
Surface
Boundary

Oxygen Atoms on Surface Have a Negative Charge (-)

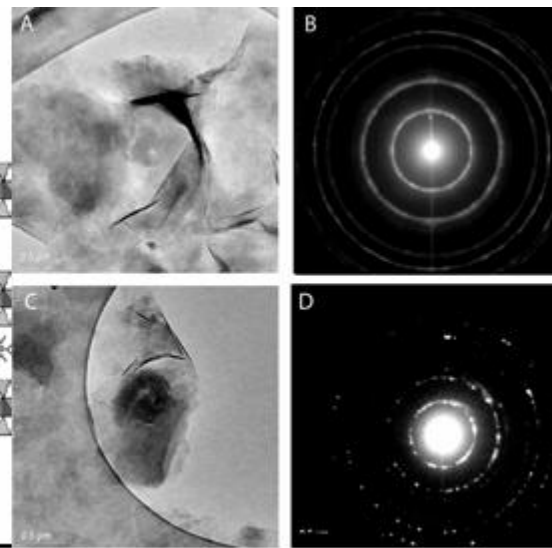
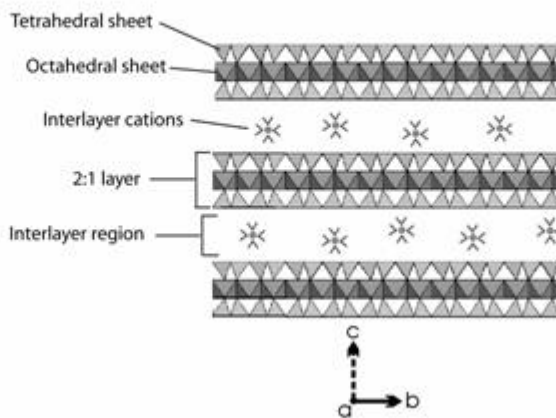
Countersol™, Pat. Pend. Decon

Countersol™, Pat. pend.
Permanently
Binds Cesium





Structure of Smectite



Countersol – A Containment and Remediation Technology

SPRAY MONTMORILLONITE SLURRY

~2.5 cm pile
of CsCl

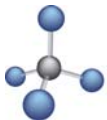


One time spray
-does not disrupt pile

Prevents Secondary
Dispersal



20 - 30 sprays
isolate CsCl



FEATURES

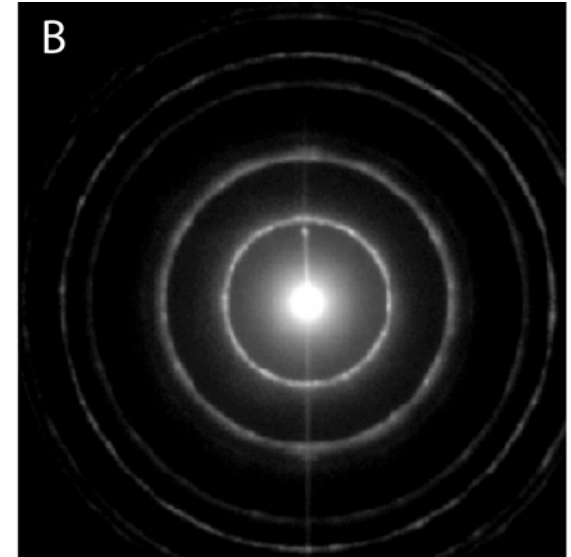
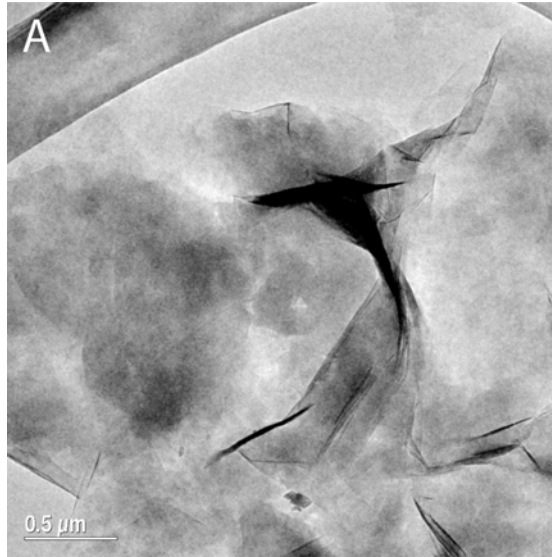
- Aqueous suspension – pour or spray
- Expands and absorbs, penetrates porous structures
- Immediately and irreversibly sequesters cesium and other radioactive cations
- Absorbs radioactive chloride, carbonate and sequesters particulate oxides
- Complete scalability
- Ecologically friendly
- Made in the USA

Image

Diffraction

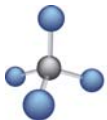
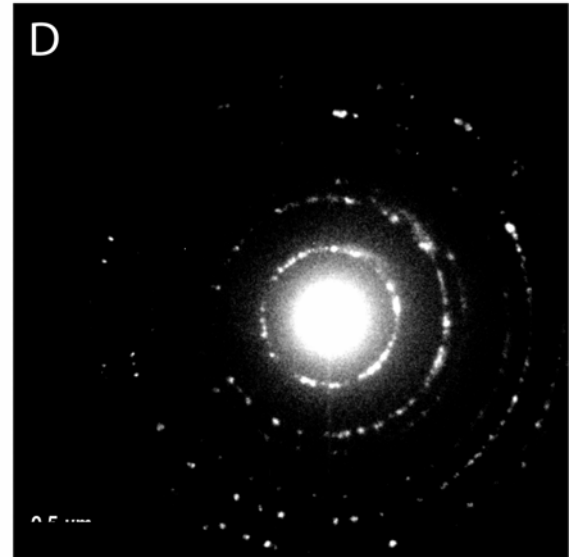
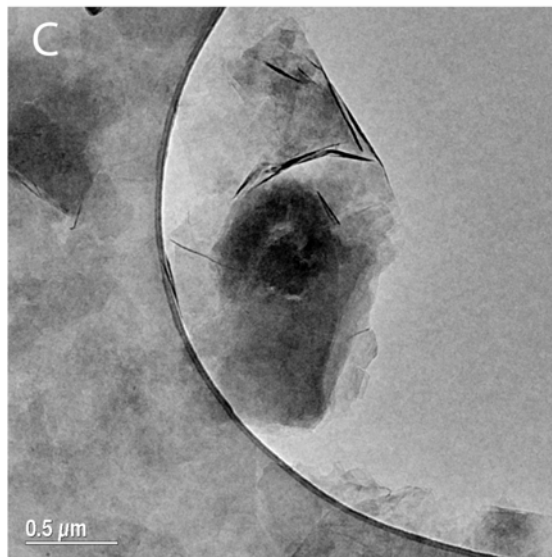
Na-montmorillonite

(Starting)



Cs-montmorillonite

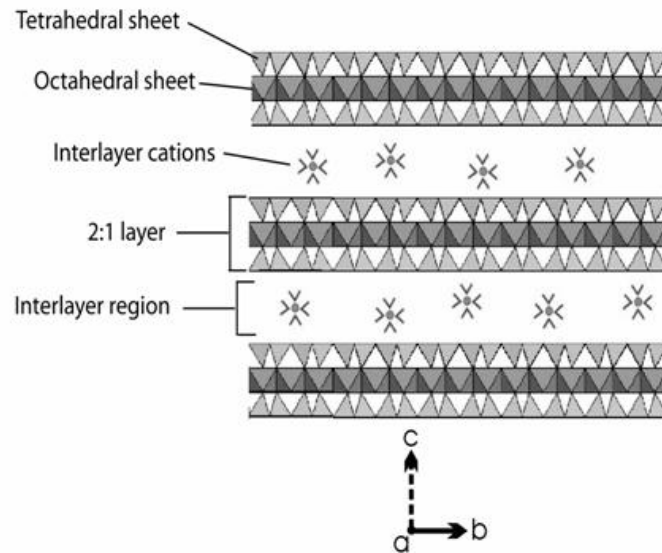
(Ending)



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Reaction is spontaneous -
limited only by the amount
of nanomaterial present
(always can add more)

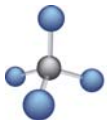
Structure of Smectite



Cs⁺

Na⁺

Molecular
structure
preferentially
exchanges
sodium for
cesium
and all cations
larger than Na



Countersol Demonstration

SUMMARY

- Threat of Dirty Bomb and radiological contamination is real
- Current methods of decontamination are not fully effective
- Countersol™, Pat. Pend. is a non-toxic, easily applied, total solution
- Alternative dispensing methods are available to match the assessed threats

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