International Isotopes Inc
We make CLEAN power CLEANER

Presentation on Depleted Uranium Hexafluoride Processing & Fluorine Extraction Process
What We Intend to Do

Construct the first commercial depleted uranium de-conversion facility in the US.

– Multi-Purpose Purpose Facility

• $^{238}\text{U}$ off-take agreements for de-conversion
• Fluorine Extraction Process – exclusive technology to INIS
• Anhydrous HF Production – Patented Process
Estimated Depleted Uranium Hexafluoride Production in the U.S.

**Annual Production in the U.S.**

- **Millions of Pounds of Depleted Uranium Hexafluoride**
  - 2008: 0
  - 2009: 0
  - 2010: 10
  - 2011: 20
  - 2012: 30
  - 2013: 40
  - 2014: 50
  - 2015: 60
  - 2016: 70
  - 2017: 80
  - 2018: 90
  - 2019: 100
  - 2020: 100

**Cumulative Production in the U.S.**

- **Millions of Pounds of Depleted Uranium Hexafluoride Cumulative**
  - 2009: 0
  - 2010: 10
  - 2011: 30
  - 2012: 40
  - 2013: 50
  - 2014: 60
  - 2015: 70
  - 2016: 80
  - 2017: 90
  - 2018: 100
  - 2019: 110
  - 2020: 120
SCHEDULE GOING FORWARD

- Phased Expansion Correlated to DUF$_6$ Supply

**Phase I – Initial Start-up**

- UF$_6$ $ightarrow$ UF$_4$
- UF$_4$ $ightarrow$ BF$_3$
- SiF$_4$ FEP
- SiF$_4$ FEP
- UO$_2$

**Phase II – 2016 Increase De-Conversion Capability to meet anticipated demand**

- UF$_6$ $ightarrow$ UO$_2$
- HF
- Over 40 public meetings held
- No negative response
- Phase 1 Environmental completed
- Land Transfer in Progress
<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>INIS Acquires FEP Patents</td>
<td>2004</td>
</tr>
<tr>
<td>INIS Focuses on Design of FEP Pilot Plant</td>
<td>2004-2007</td>
</tr>
<tr>
<td>GeF₄ Pilot Plant Begins Operation</td>
<td>2007</td>
</tr>
<tr>
<td>Acquisition of SFC DUF₆ – DUF₄ De-Conversion Equipment</td>
<td>Q2 2008</td>
</tr>
<tr>
<td>Contract with Licensing and Design Team (APTS)</td>
<td>Q3 2008</td>
</tr>
<tr>
<td>Site Selection – <em>completed</em></td>
<td>Q1 2009</td>
</tr>
<tr>
<td>Conceptual Design Report - <em>completed</em></td>
<td>April 2009</td>
</tr>
<tr>
<td>NRC License Application Submittal</td>
<td>Dec. 1, 2009</td>
</tr>
<tr>
<td>Land Transfer Process</td>
<td>Dec. 30, 2009</td>
</tr>
<tr>
<td>Begin Construction</td>
<td>Q2 2011</td>
</tr>
<tr>
<td>Begin Operation</td>
<td>Q2 2012</td>
</tr>
</tbody>
</table>
Illustrative Plant
INIS acquired assets of the only complete de-conversion plant in the U.S. in 2008
- Most key components can be re-used
- Will relocate equipment
Phase 1 Fluorine Extraction Process

- The Fluorine Extraction Process (FEP) is a simple, one step reaction process between two granular solid materials
  - Depleted uranium tetrafluoride (DUF₄) and a metal oxide are heated in a reaction chamber to the appropriate temperature
  - Fluoride gas separates from uranium and combines with gaseous metal oxide
- Various ultra-pure, uranium-free, fluoride gases are produced while uranium remains in solid-state
- Exclusive U.S. Patent Technology held by INIS enhances commercial viability of de-conversion

Example Reaction - SiF₄ Production

\[ \text{UF}_4 \text{ (solid)} + \text{SiO}_2 \text{ (solid)} \xrightarrow{\text{Heat}} \text{UO}_2 \text{ (solid)} + \text{SiF}_4 \text{ (gas)} \]
SiF$_4$ Production
Phase 2 De-Conversion – DUF₆ to DUOxide
Environmental and Safety Concerns
• Air Emissions

- Uranium – Conservative estimate of 5.11 mrem per year at 30 acre fence line with Phase 1 and 2 Operations

- Fluorine – Conservative estimate of 13.8 lb per year HF with Phase 1 & 2 Operations.
Uranium Release Evaluation – 24/7 Operations

Phase 1
DUF₆ to DUF₄ Stack
Uranium Emissions

UF₄ Hopper to Dust Collection System
8.8 lb/hr UF₄
6.67 lb/hr U

Dust Collector 1
η = 99.5%
3.34 E-2 lb/hr U

Dust Collector 2
η = 99.5%
1.67 E-4 lb/hr U

Venturi
η = 80%
3.34 E-5 lb/hr U

Total Annual Dose at 30 acre fence line resulting from Phase 1 Operational U releases = 3.02 mrem/yr

Phase 1
SiF₄ & BF₃ Production Stack
U Emissions

H₂ Burner Output To Dust Collection System
0.0005 lb/hr UF₄
3.8 E-4 lb/hr U

KOH Scrubber
η = 90%
3.8 E-5 lb/hr U

Dust Collector 1
η = 99.5%
2.33 E-2 lb/hr U

Total Annual Dose at 30 acre fence line resulting from Phase 1 & 2 Operational U releases = 5.11 mrem/yr

Phase 1
SiF₄ Oxide Hopper to Dust Collection System
5.5 lb/hr U₃O₈
4.66 lb/hr U

Dust Collector 1
η = 99.5%
9.33 E-3 lb/hr U

Phase 2
DUF₆ to DU Oxide Stack
Uranium Emissions

Oxide Hopper to Dust Collection System
15.4 lb/hr U₃O₈
13.1 lb/hr U

Dust Collector 1
η = 99.5%
6.53 E-2 lb/hr U

Dust Collector 2
η = 99.5%
1.67 E-4 lb/hr U

KOH Scrubber
η = 90%
3.8 E-5 lb/hr U

Venturi
η = 80%
6.53 E-5 lb/hr U

Total Annual Dose at 30 acre fence line resulting from Phase 1 Operational U releases = 3.02 mrem/yr

Total Annual Dose at 30 acre fence line resulting from Phase 1 & 2 Operational U releases = 5.11 mrem/yr
Radon Levels - New Mexico

The North Central region (Albuquerque area) exhibits an average annual absorbed dose 0.75 mGy (75 mrad); while the southeastern corner of the State (Carlsbad area), which includes the IIFP site area in Lea County, measures annual average absorbed dose of about 0.30 mGy (30 mrad), due to terrestrial radiation (NCRP, 1987a).

<table>
<thead>
<tr>
<th>Zone Description</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1: Countries have a predicted average indoor radon screening level greater than 4 pCi/L (pico curies per liter) <strong>(red zones)</strong></td>
<td>Highest Potential</td>
</tr>
<tr>
<td>Zone 2: Countries have a predicted average indoor radon screening level between 2 and 4 pCi/L <strong>(orange zones)</strong></td>
<td>Moderate Potential</td>
</tr>
<tr>
<td>Zone 3: Countries have a predicted average indoor radon screening level less than 2 pCi/L <strong>(yellow zones)</strong></td>
<td>Low Potential</td>
</tr>
</tbody>
</table>
Fluorine Release Evaluation – 24/7 Operations

Phase 1 – DUF₆ De-conversion & Fluorine Extraction Plants Plant

- DUF₆ to DUF₄ De-conversion Plant
  - 3.0 lb/hr HF
  - 2.85 lb/hr as F
  - Stage 1 Venturi
    - η = 80%
    - 0.57 lb/hr as F
  - 1.66 lb/hr as F
  - Stage 2
    - Packed Tower
      - η = 95%
      - 0.083 lb/hr as F
    - Stage 3 Coke Box
      - η = 99%
      - 0.0008 lb/hr as F

- SiF₄ Trains 1 & 2
  - 0.2 lb/hr SiF₄
  - 0.2 lb/hr HF
  - 0.23 lb/hr as F
  - Stage 1 Venturi
    - η = 80%
    - 0.05 lb/hr as F

- BF₃ Train
  - 1.0 lb/hr BF₃
  - 5.2 lb/hr HF
  - 5.22 lb/hr as F
  - Stage 1 Venturi
    - η = 80%
    - 1.04 lb/hr as F

Phase 2 – DUF₆ to DU Oxide De-conversion

- DUF₆ to DU Oxide De-conversion Plant
  - 7.0 lb/hr HF
  - 6.65 lb/hr as F
  - Stage 1 Venturi
    - η = 80%
    - 1.33 lb/hr as F
  - Stage 2
    - Packed Tower
      - η = 95%
      - 0.07 lb/hr as F
    - Stage 3 Coke Box
      - η = 99%
      - 0.0007 lb/hr as F

Phase 1 & 2 24/7 Operations
- 13.1 lb/yr as F
- 13.8 lb/yr as HF
Point Source and Fugitive HF Release – New Mexico

<table>
<thead>
<tr>
<th>Facility</th>
<th>TRI – 2006 (lb)</th>
<th>TRI – 2007 (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four Corners Steam Electric Station</td>
<td>90,090</td>
<td>86,090</td>
</tr>
<tr>
<td>Giant Refining Co.(^{(1)})</td>
<td>58</td>
<td>30</td>
</tr>
<tr>
<td>INTEL Corp.</td>
<td>3,465</td>
<td>2,206</td>
</tr>
<tr>
<td>Navajo Refining Co.</td>
<td>347</td>
<td>347</td>
</tr>
<tr>
<td>San Juan Generating Station</td>
<td>58,000</td>
<td>67,000</td>
</tr>
<tr>
<td>Tri-State Generation &amp; Transmission – Escalante Station</td>
<td>10,600</td>
<td>13,600</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>162,560</strong></td>
<td><strong>169,273</strong></td>
</tr>
</tbody>
</table>

IIFP Calculated: 14 lb/year

\(^{(1)}\) Name Change to Western Refining Southwest Inc. for 2007

US EPA Toxic Release Inventory
HF Emissions in New Mexico in 2007

- **SAN JUAN GENERATING STATION**: 67000 lb
- **INTERNATIONAL ISOTOPES FLUORINE PRODUCTS**: 14 lb
- **INTEL CORP**: 2206 lb
- **WESTERN REFINING SOUTHWEST INC**: 30 lb
- **TRI-STATE GENERATION & TRANSMISSION**: 13600 lb
- **NAVAJO REFINING CO**: 347 lb
- **FOUR CORNERS STEAM ELECTRIC STATION**: 86,092 lb
HF Emissions New Mexico - 2007

- San Juan Generating Station – 67,000 lb
- Four Corners Steam Electric Station – 86,090 lb
- Western Refining Southwest Inc. – Gallup Refinery – 30 lb
- Tri-State Generation & Transmission – Escalante Station – 13,600 lb
- INTEL – 2,206 lb
- Navajo Refining Co. – 347 lb
- IIFP – 14 lb
• Water Usage
  - Minimized thru process water recycling – estimated usage < 10,000 gallon per day.

• Ground Water Protection
  - Permit will be Issued though NMED.
  - Storm water basins designed for 100 year rain fall
  - Segregated yard for DUF6 cylinder storage.
  - Zero discharge of process waters
Phase 1 Environmental Protection Process
Waste Water Treatment Flow Diagram

- Lime Silo
- Weak HF Solution
- Mix Tank
- Reactor
- Thickener
- Rotary Vacuum Filter
- Clarifier
- KOH Regen Storage
- KOH Regeneration
- HF Neutralization
- Common to both
- Filtrate Tank
- Spent KOH Solution
- Mix Tank
- Reactor
- Thickener
- Dryer
- Auger to Truck
- Solids To Disposal
- 194 lb/hr Ca(OH)$_2$
- 186 lb/hr CaF$_2$
- .5 lb/hr Ca(OH)$_2$
- 387 lb/hr H$_2$O
- 43 lb/hr KOH
- .8 lb/hr KBF$_4$
- .2 lb/hr B(OH)$_3$
- .4 lb/hr K$_2$SiF$_6$
- Max avg. 4 hours per day operation
Phase 2 Environmental Protection Process
Waste Water Treatment Flow Diagram

- **Lime Silo**
- **Weak HF Solution**
- **Mix Tank**
- **Reactor**
- **Thickener**
- **Polishing Filters**
- **KOH Regen Storage**
- **KOH Recycle to Process Scrubber**
- **Clarifier**
- **Dryer**
- **Mix Tank**

Flow Rates:
- 56 lb/hr Ca(OH)$_2$
- 54 lb/hr CaF$_2$
- 112 lb/hr H$_2$O
- .5 lb/hr Ca(OH)$_2$
- 12 lb/hr KOH
- 8 lb/hr KBF$_4$
- 2 lb/hr B(OH)$_3$
- 4 lb/hr K$_2$SiF$_6$

4 hours operation per day
Maximum Avg.
Sanitary Waste Water Treatment Flow Diagram

Primary Treatment

Secondary Treatment

Tertiary Treatment

- Plant Process Makeup Water
- Use for (Facility Shrubs, trees & Grass)

150 People Peak Hydraulic Load 3000-4500 Gallon Per Day
## Maximum Inventories

<table>
<thead>
<tr>
<th>Material</th>
<th>Phase 1 (Kg)</th>
<th>Phase 2 (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranium as “U”</td>
<td>750,000</td>
<td>2,200,000</td>
</tr>
<tr>
<td>Anhydrous HF</td>
<td>15,900</td>
<td>17,700</td>
</tr>
<tr>
<td>SiF₄</td>
<td>32,000</td>
<td>32,000</td>
</tr>
<tr>
<td>BF₃</td>
<td>15,000</td>
<td>15,000</td>
</tr>
<tr>
<td>CaF₂</td>
<td>128,500</td>
<td>37,200</td>
</tr>
<tr>
<td>KOH(with recycle)</td>
<td>8,100</td>
<td>2,700</td>
</tr>
</tbody>
</table>
• Depleted uranium oxides are chemically stable
• Uranium waste is shipped to licensed disposal site
  Utah – Energy Solutions
  Texas – WCS (after NRC Rulemaking)
• The by-products of chemical scrubbing are neutralized (RCRA waste same sites as above)
## Transportation Impact - Construction and Operations

### Average Annual Daily Traffic Highway 62/180

<table>
<thead>
<tr>
<th></th>
<th>Year</th>
<th>Average No. Vehicles per Day</th>
<th>Average No. Com. Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>2008</td>
<td>5672</td>
<td>1645</td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>6124</td>
<td>1776</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>6035</td>
<td>1750</td>
</tr>
<tr>
<td>During Construction IIFP Facility:</td>
<td>17 Deliveries &amp; site prep + 350 Construction workers(14-18 Mos.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During Operations IIFP Facility:</td>
<td>10 deliveries + 75-150 Employees</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
State Permitting Submittal Schedule
## Potentially Required State Permits

<table>
<thead>
<tr>
<th>Potential Requirement</th>
<th>Agency</th>
<th>Comment/Status</th>
<th>Submittal Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Permit</td>
<td>NMDOT</td>
<td>INIS and/or Lea County would coordinate to obtain approval, if necessary, for adding an entry point from U. S. Highways 62/180 or NM Highway 483. The permit, if issued, would stipulate any safety enhancements necessary to the highway.</td>
<td>2 Q, 2010</td>
</tr>
<tr>
<td>Air Construction Permit</td>
<td>NMED/AQB</td>
<td>An air construction permit may not be required because proposed INIS emissions would be below Federal and State regulatory limits depending on credits for stack heights and control equipment. Need determination with State.</td>
<td>If required, submit by 2 Q, 2010.</td>
</tr>
<tr>
<td>Air Operation Permit</td>
<td>NMED/AQB</td>
<td>An air operation permit may not be required because proposed INIS emissions would be below the Federal and State regulatory limits depending on above credits. Need determination with State.</td>
<td>If required, would submit 2 Q, 2011.</td>
</tr>
<tr>
<td>NESHAP Permit</td>
<td>NMED/AQB</td>
<td>A NESHAP permit is likely not required because the proposed INIS emissions would be below Federal and State regulatory limits. Need to determine with State.</td>
<td>If required, submit by 2 Q, 2011.</td>
</tr>
<tr>
<td>Groundwater Discharge Permit/Plan</td>
<td>NMED/WQB</td>
<td>INIS will submit Groundwater Discharge Permit / Plan application to the NMED/WQB.</td>
<td>4 Q, 2010</td>
</tr>
<tr>
<td>NPDES Industrial Stormwater Permit</td>
<td>NMED/WQB</td>
<td>INIS has the option of claiming “No Exposure” exclusion.</td>
<td>Make determination by 3 Q, 2010. If required, submit by 1 Q, 2011.</td>
</tr>
<tr>
<td>NPDES Construction Stormwater Permit</td>
<td>NMED/WQB</td>
<td>INIS will file for coverage under the General Construction Permit for all construction activities onsite. INIS will develop a Stormwater Pollution Prevention Plan and file a Notice of Intent.</td>
<td>2 Q, 2010</td>
</tr>
<tr>
<td>Hazardous Waste Permit</td>
<td>NMED/HWB</td>
<td>INIS would be classified as a generator; therefore, a hazardous waste permit would be required.</td>
<td>3 Q, 2011</td>
</tr>
<tr>
<td>EPA Waste Activity EPA ID Number</td>
<td>NMED/HWB</td>
<td>This number is required for the storage and use of hazardous chemicals.</td>
<td>3 Q, 2011</td>
</tr>
</tbody>
</table>
# Potentially Required State Permits

<table>
<thead>
<tr>
<th>Potential Requirement</th>
<th>Agency</th>
<th>Comment/Status</th>
<th>Submittal Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine-Produced (X-Ray Inspection)</td>
<td>NMED/RCB</td>
<td>Registration is required for security nondestructive inspection (x-ray) machines. The RCB will be notified that equipment would be registered, but the registration would be deferred until equipment specifications are available. May be required by contractor with their own permit.</td>
<td>Decide who holds permit by 1Q, 2011.</td>
</tr>
<tr>
<td>Rare, Threatened, &amp; Endangered Species Survey Permit</td>
<td>NMDFG</td>
<td>This permit would be required for conducting surveys of the U.S. Bureau of Land Management (BLM) lands.</td>
<td>4 Q, 2009</td>
</tr>
<tr>
<td>RCRA Operations Permit</td>
<td>EPA May Involve NMED/HWB</td>
<td>Permit likely not required for the EPP operation, but need to confirm with the State.</td>
<td>If required, would submit permit application 4 Q, 2011.</td>
</tr>
<tr>
<td>Right-of-Entry Permit</td>
<td>NMSLO</td>
<td>INIS has obtained this permit for entry onto Section 26, 27, 34, or 35.</td>
<td>Completed.</td>
</tr>
<tr>
<td>State Land Swap Arrangement</td>
<td>NMSLO</td>
<td>This arrangement requires that an environmental assessment and a cultural resources survey be conducted on lands offered for exchange.</td>
<td>Both surveys have been completed</td>
</tr>
<tr>
<td>Class III Cultural Survey Permit</td>
<td>NMSHPO</td>
<td>INIS has obtained this permit to conduct surveys on Section 26, 27, 34, or 35.</td>
<td>Completed</td>
</tr>
</tbody>
</table>

NPDES – National Pollutant Discharge Elimination System; EPA – U.S. Environmental Protection Agency; 
NESHAP – National Emissions Standards for Hazardous Air Pollutants; NMDOT – New Mexico Department of Transportation; 
NMED/AQB – New Mexico Environment Department/Air Quality Bureau; NMED/HWB – New Mexico Environment Department/Hazardous Waste Bureau; 
NMED/RCB – New Mexico Environment Department/Radiological Control Bureau; 
NMED/WQB – New Mexico Environment Department/Water Quality Bureau; NMDGF – New Mexico Department of Game and Fish; 
NMSLO – New Mexico State Land Office; NMSHPO – New Mexico State Historic Preservation Office.
• Fills a “Void” in the Nuclear Fuel Cycle by addressing tails
• Recycles and recovery fluorine for important products
• Plant with an emphasis upon environmental protection
• “Green” nature of this project is complimentary to New Mexico
• Robust opportunities for growth