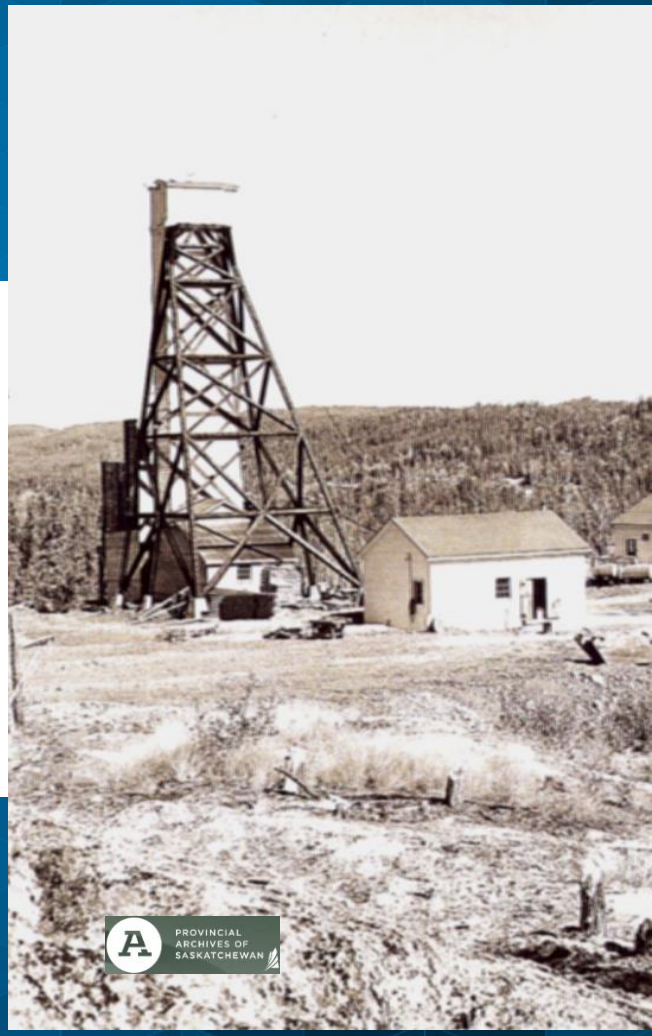
The legacy of the Cold War - Cleaning up Abandoned Uranium Mine Sites in North Saskatchewan



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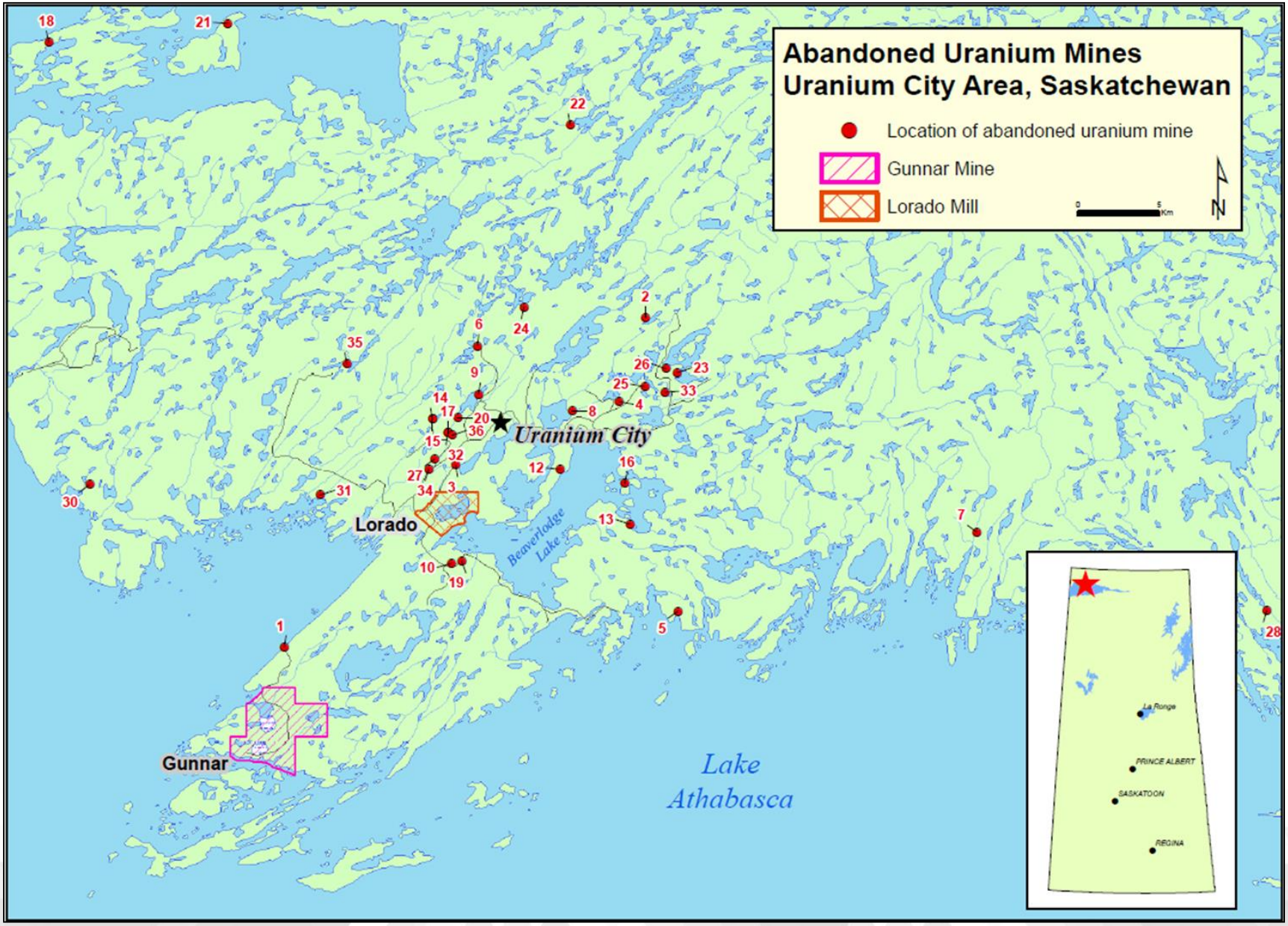
The Legacy of the Cold War

- Uranium ore (pitchblende) was discovered at Nicholson Mine on the northern shore of Lake Athabasca in the 1930s while exploring for gold
- Uranium mining in the vicinity of Uranium City started in the early 1950's
- The main task was to process the ore, and then ship "yellow cake" to the US, to speed up building their nuclear potential



Legacy uranium mine sites in Saskatchewan is an echo of the Cold War that still affects us today.

- Mining was ceased in the mid 1960's and mine sites abandoned with little or no clean-up.
- Most of the buildings, infrastructure, unconfined tailings, and waste rock piles were left on the sites "as is".
- At Gunnar, the open pit and mine working were flooded after blasting a special channel to the Lake Athabasca.

Overview of Project CLEANS

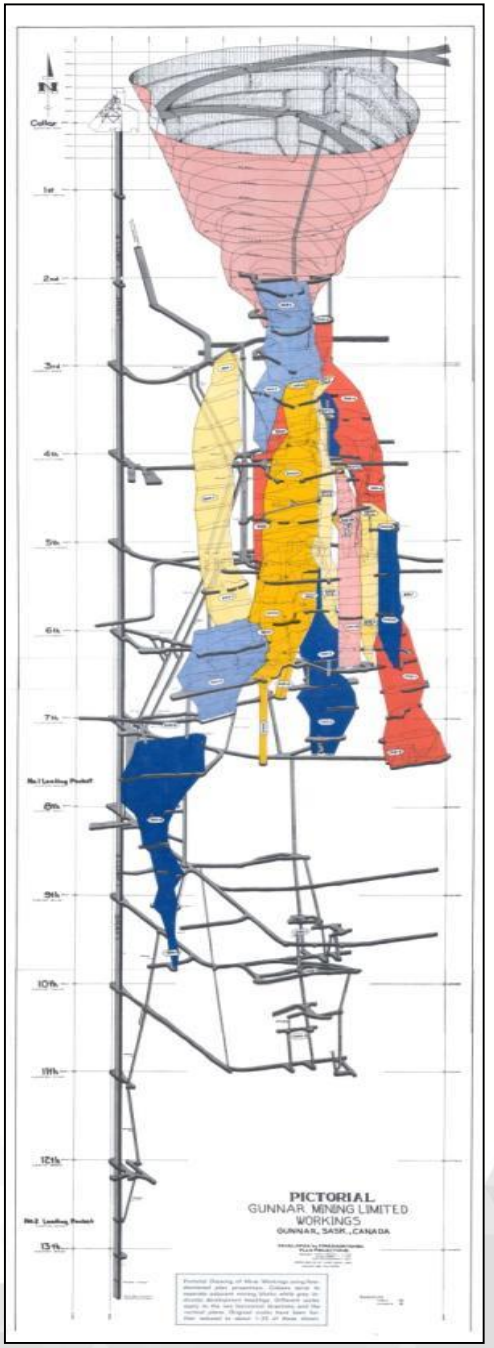
- **CLEANS means C**leanup of **A**bandoned **N**orthern **S**ites
  - Multi-year, multi-million dollar project
  - Started in 2007
  - Managed by SRC, Environmental Remediation Unit on behalf of provincial Ministry of Economy
  - Funded by: Provincial and Federal governments.

  - The project includes 37 sites:
    - Gunnar Uranium Mine and Mill Site
    - Lorado Uranium Mill Site
    - 35 legacy uranium mine sites

Gunnar Mine 1955

Gunnar Mine and mill prior to building demolition in 2011

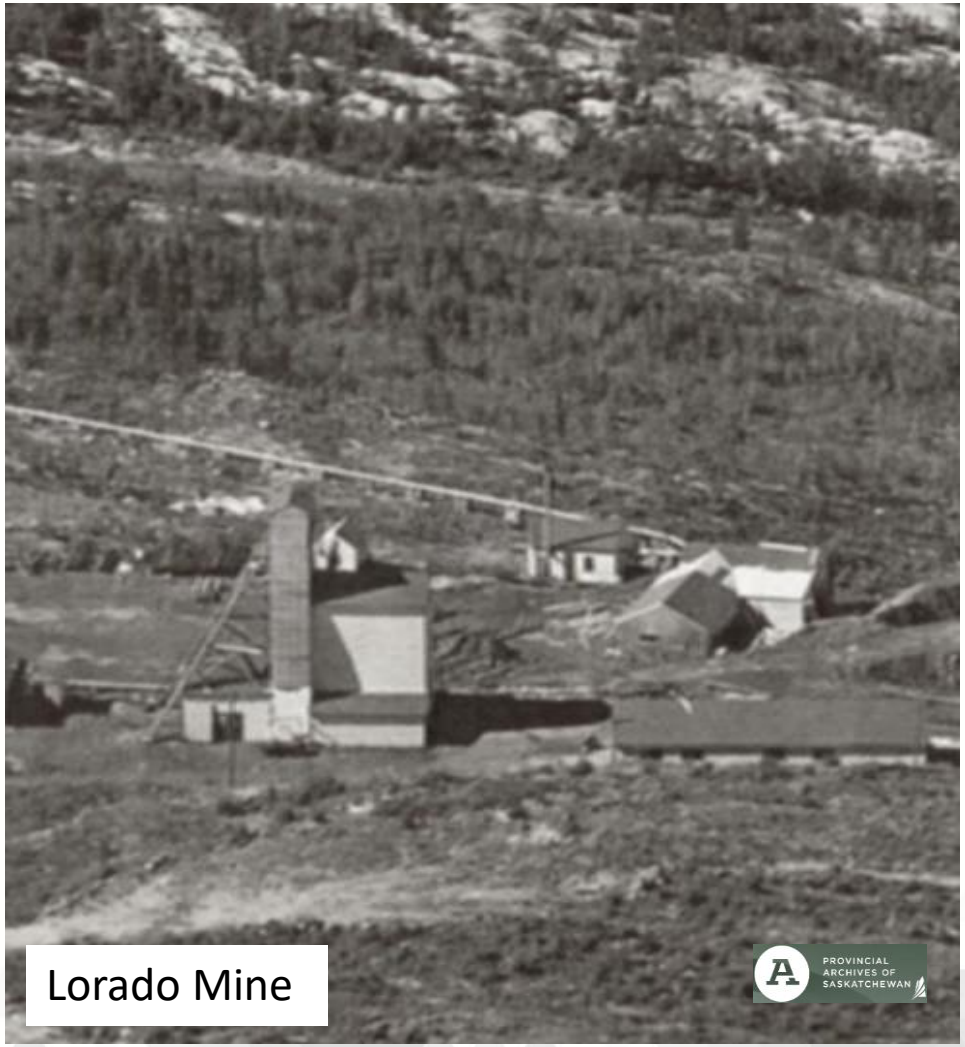
Gunnar pit and underground mine structures (1953-1964)



Lorado mill tailings and Nero Lake

“Satellite” Legacy Uranium Sites

- 35 minor legacy uranium mine and exploration sites mainly pose physical hazards to the members of public
- No tailings are found at the sites, yet they sometimes include some radioactive substances (low grade ore, waste rock, exploration cores, etc.)
- Exempt from CNSC licensing due to low radiological risks



Lorado Mine

Hazards at the Sites

- Exposure to radiation
  - Tailings Areas
  - Waste Rock Piles
  - General site and mine debris
- Exposure to asbestos containing materials
- Exposure to Chemical Contamination
  - Tailings, Waste Rock Piles, Gunnar Open Pit,
  - Sulfur and other residual chemicals
  - Contaminated surface and ground water
  - Radionuclides, heavy metals
- Physical Hazards
  - Remaining infrastructure
  - Subsurface mineworking
  - Waste Rock Piles
  - Mining and Mill Debris

Remediation Process in the Ideal World☺

- Terms of Reference (SoW)
- Baseline Surveys
- Environmental Assessment
  - Alternative solutions
  - Developing a preferred option
  - Consultations with stakeholders
- CNSC Licensing (if not an exempt)
- Design development
- Remediation
- Transitional monitoring
- Closure and
- Transfer to Institutional Control Program (ICP)

Stumbling Blocks of Reality

- Lack of baseline data
- Unspecified endpoint criteria
- Various levels of regulatory and government involvement
  - Federal
  - Provincial
- CNSC Order for demolition at Gunnar (before EA completion)
- Public relations
  - Risk assessment (criteria, scenarios)
  - High public expectations and concerns
  - Discussions with all the stakeholder on preferred option
  - Traditional land use and aboriginal consultations
  - Local engagement issues

Meeting the Challenges

- Completing first the Lorado and some Satellite Sites
- Completing the CNSC Order at Gunnar in parallel with Environmental Assessment (EA)
- Iterative “Decision Tree” approach to Gunnar Environmental Impact Statement (EIS):
  - ➢ Agree with the endpoints
    - ➢ Postpone the detailed option analysis
      - ➢ Finalize preferred options at the post-EA stages
- Dealing with CNSC phase-based License for Gunnar
- Dealing with communities and building local capacity
  - Inclusion of novel social criteria for contract procurement
  - Prioritization of site remediation with the communities
  - Iterative consultations
  - Trainings for local/aboriginal people

The Lorado Project Timeline

- Started (2010)
- EIS completed and approved (2012)
- Innovative procurement process (RFP) for selection of contractor with community input and maximization of local sustainability (2013)
- Water treatment of Nero Lake completed (2014)
- Tailings cover completed (2016)
- Revegetation of tailings cover - done in the fall of 2016
- Transitional monitoring - Ongoing

Lorado Mill site in 1960. Gamma dose rate on the tailings - up to 14 µSv/h

Lorado Mill site in 2016 (post-remediation). Gamma dose rate on the tailings <0.2 µSv/h (regional background)

Gunnar project timeline

- Started (2009)
- Buildings demolished and area cleaned up (2011- 2012)
- EIS completed (2013) and approved (2014)
- CNSC conditional (phased) license obtained (2015)
- The license hold points removed (2016)
- Remediation design completed for the tailings (2016)
- Tailings remediation in progress from September 2016
- Remediation design for other site aspect is in progress (to be completed in 2017)
- All levels of environmental monitoring – ongoing
- **Remediation completion at the Gunnar site is to be completed by 2021**

Gunnar Site 2010

- Buildings and structures
- Asbestos everywhere
- Tailings deposits
- Waste rock piles

Gunnar Site 2017:

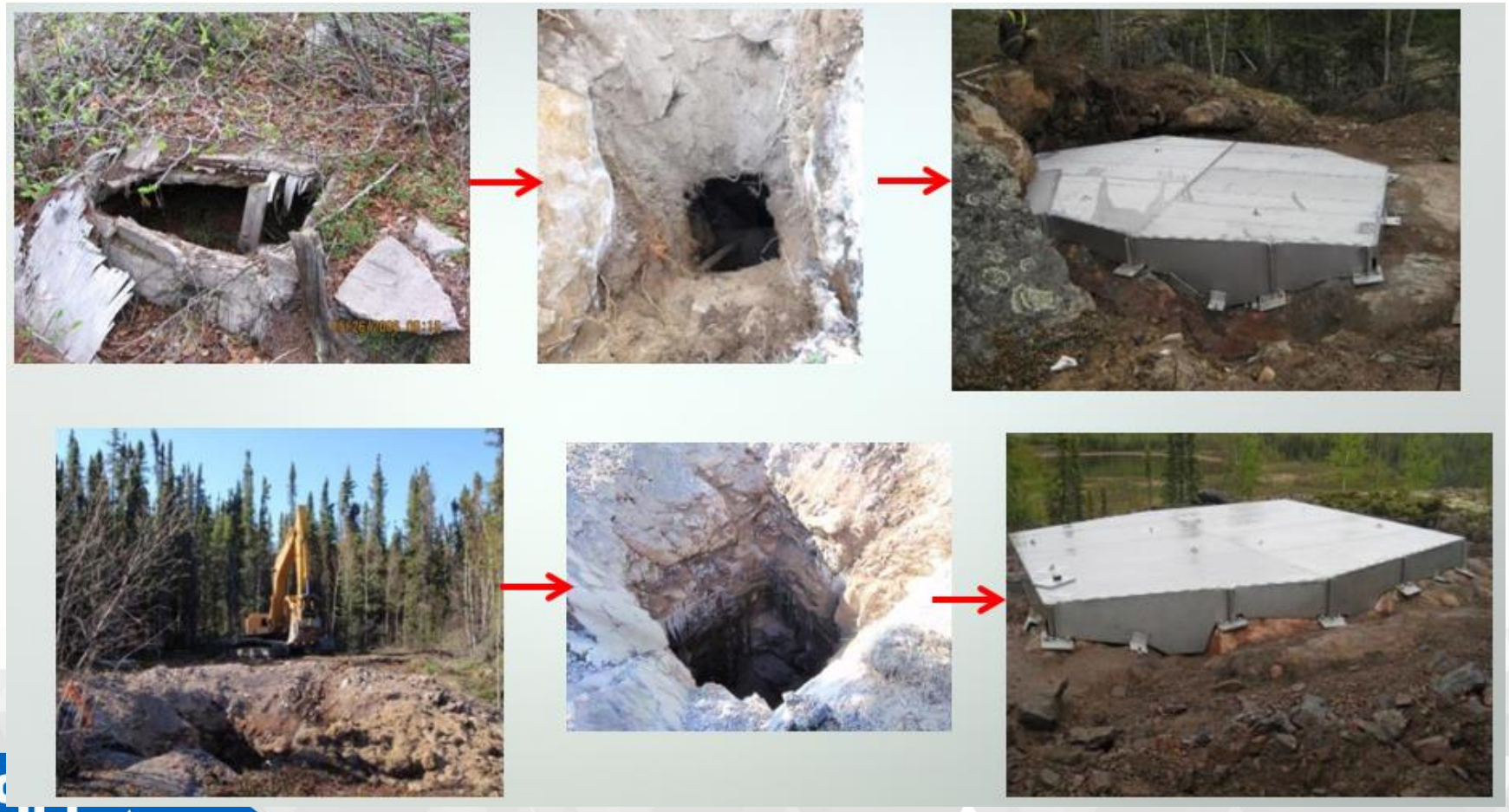
- Building demolition completed
- Asbestos contained
- Tailings cover in progress
- Waste rock to follow
- The pit is a subject to detailed monitoring program

Satellite Sites timeline

- Project started (2008)
- Uranium City community consultation (2008)
- Assessments and initiation of remediation (2009)
- Completion of remediation and transitional monitoring at 8 sites (2016)
- Ongoing remediation and assessment (2017)
- Projected completion of remediation at all 35 sites (2027)

Stainless Steel Caps

Innovative way to close mine openings developed by local contractor and engineer in place of common concrete caps.



Community Engagement

As a part of CLEANS project, SRC has developed a world class community and stakeholder engagement program during EA and public procurement stages

SRC integrates community input on:

- Procurement
- Training
- Remediation design
- Traditional knowledge
- Land use

Community Engagement

- SRC has successfully incorporated sustainable development (economic, environmental, and social) to the CLEANS project
- E.g., Lorado Employment & Training included:

- More than 50% Athabasca Aboriginal employment
- More than 60% local equipment utilization
- More than 30% of total project value local spend
- Driver's license training
- Heavy equipment operator mentorship
- Employment preparedness training

CLEANS Project – Some Lessons Learned

- Thorough due diligence and baseline surveys are critical for remediation planning at legacy sites.
- Gamma and radioactive substances, although important, is not necessarily the main risk factor at legacy uranium sites.
- Federal and provincial stakeholders may have very different views of the project tasks and options.
- Proactive and frequent communication with all the stakeholders (especially regulators) is a must.
- Building trust relationships with local and Aboriginal communities is a key factor of the Project progress and success to date.

Questions?

CLEANS logo:

The concept was suggested by a school student from Uranium City

Thank you for your attention!