NYSERDA

Quantitative Risk Assessment for the State-Licensed Disposal Area

West Valley Citizen Task Force Meeting

October 22, 2008

New York State Energy Research and Development Authority

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Quantitative Risk Assessment for the State-Licensed Disposal Area

Why did NYSERDA prepare a QRA for the SDA?

- NYSERDA's Preferred Alternative for the SDA is to continue to manage in place for up to 30 more years under the present system of operations and regulations;
- Based on the content of the DEIS, NYSERDA concluded that we would need additional quantitative information to assess the impacts from a decision to manage the SDA in place for up to 30 more years; and

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Why did NYSERDA prepare a QRA for the SDA?

- QRA was recommended by Dr. B. John Garrick (Chairperson of the EIS Independent Review Panel, the Chairperson of the Nuclear Waste Technical Review Board, a former President of the Society for Risk Analysis, and a member of the National Academy of Engineering).

  The QRA Team consists of Dr. Garrick (QRA Study Director), John W. Stetkar (QRA Principal Investigator), Andrew A. Dykes, Thomas E. Potter, and Stephen L. Wampler.

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What is a Quantitative Risk Assessment?

It is a probabilistic risk assessment that looks at the radiation risk to the public from the SDA over a 30 year period, assuming continued operation of the SDA under its current administrative controls.

"Risk" is calculated using: a set of release scenarios; the probability of occurrence for those scenarios; and the consequences of the scenarios if they do occur, presented as dose to the public.

Components of the SDA QRA:

- Complete and structured set of "What can go wrong?" scenarios;
- Likelihood of occurrence (probability) of each "What can go wrong?" scenario;
- Radiation dose resulting from each "What can go wrong?" scenario.

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QRA Receptors are:

- Resident farmer located at the confluence of Buttermilk and Cattaraugus Creeks.
- Hiker/hunter who enters the site and walks up Buttermilk Creek and Frank's Creek.

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There are two categories of "What can go Wrong?" scenarios:

- **Disruptive Events** – Unexpected events that cause an immediate change to the site (e.g., earthquakes, severe storms).
- **Nominal Events and Processes** - Expected events and processes that occur continuously over the life of the facility (e.g., groundwater flow, aging of the geomembrane covers).

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Threat scenarios that were evaluated and included in the SDA analysis

Disruptive Events

- **Aircraft Crashes**
  - -Commercial
  - -General aviation
  - -Military
- **Erosion**
  - -Local streams
  - -Trenches
- **Extraterrestrial Impacts**
  - -meteorites less than 1 meter in diameter
- **Fires**
  - -Offsite (e.g., grass fires, forest fires)
- **Flooding Events**
  - -Extreme precipitation
  - -Rapid snow melt
- **High Wind Events**
  - -Extreme sustained winds
  - -Wind gusts
  - -Tornadoes
- **Landslides**
- **Pipeline Accidents**
  - -Site natural gas supply pipe
- **Seismic Events**
  - -Direct seismic failures
- **Severe Storms (snow)**

Nominal Events and Processes

- **Corrosion / Deterioration / Decomposition**
  - -Geomembrane covers
  - -Crates, boxes
  - -Steel drums
- **Groundwater Intrusion**
  - -Historic intrusion
  - -Rapid intrusion ("bath-tubbing")
- **Soil Shrink / Swell / Consolidation**

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Threats that were evaluated and eliminated from further detailed analysis

- **Avalanches**
- **Biological Events**
- **Drought**
- **Erosion**
  - -Coastal/lake shore erosion
  - -River bank erosion
- **Excavation of Contaminated Stream Sediments**
- **Explosions**
- **Extraterrestrial Impacts (involving meteorites greater than 1 meter in diameter)**
- **Extreme Temperatures (heat, cold)**
- **Fires**
  - -Onsite facilities (internal building fires)
- **Flooding Events**
  - -Onsite facilities (internal building flooding)
  - -Dam failure
  - -Site water supply pipe failure
  - -Seiche
  - -Storm surge
  - -Tsunami
- **Fog**
- **Frost**
- **High Tides**
- **Hurricanes**
- **Ice Cover**
- **Lightning**
- **Loss of External Power Supplies**
- **Low Lake or River Water Level**
- **Nearby Facility Accidents**
  - -Industrial
  - -Chemical
  - -Military
- **NRC-Licensed Facility Decommissioning Activities**
  - -Direct accident impacts on SDA
  - -Effects on site grading, surface water runoff, erosion
- **Radiolytic/Chemical Interactions**
- **River Diversion**
- **Seismic Events**
  - -Seismic-induced fires
  - -Seismic-induced flooding (e.g., piping failures)
- **Severe Storms**
  - -Hail
  - -Sand storms
  - -Dust storms
- **Sinkholes**
- **Site Intrusions (direct intrusion into the SDA during the 30-year period of this study)**
- **Toxic Gas Releases**
- **Transportation Accidents**
  - -Rail
  - -Highway
  - -Shipping (by navigable waterway)
- **Volcanic Activity**

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Five categories of release mechanisms were identified through the systematic assessment of the possible threats to the SDA:

1) Liquid releases from waste trenches via groundwater through the Unweathered Lavery Till and Kent Recessional Sequence;

2) Liquid releases from waste trenches via groundwater through the Weathered Lavery Till;

3) Liquid overflow from the waste trenches and release via surface water runoff;

4) Physical breaches of the waste trenches and release of solid and liquid radioactive material; and

5) Extensive physical disruption of the SDA and airborne releases from the trenches.

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Some Results

The risk from the SDA is dominated by five scenarios, which account for 97% of the overall risk from the SDA:

1) Lateral groundwater flow through the Weathered Lavery Till when the trench water levels are at the top of the trenches

38.7% of the total risk to the public from radiation doses from the SDA comes from this scenario.

2) Lateral groundwater flow through the Unweathered Lavery Till when trench water levels are at the WLT/ULT interface

34.5% of the total risk to the public from radiation doses from the SDA comes from this scenario.

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3) Lateral groundwater flow through the Unweathered Lavery Till when the trench water levels are at the top of the trenches

16% of the total risk to the public from radiation doses from the SDA comes from this scenario.

4) Trench overflow resulting from a combination of factors, even under active management

4.9% of the total risk to the public from radiation doses from the SDA comes from this scenario.

This scenario quantifies the risk from a situation there would be 1) No geomembrane covers on the SDA clay caps, 2) trench water levels are at the ULT/WLT interface, 3) precipitation event over a 14-day period exceeding 9 inches, with at least one storm severe enough to erode a gully into the trench caps and allow water infiltration to fill the trenches. The trenches overflow and contaminated water enters adjacent streams.

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5) Vertical groundwater flow downward through the Unweathered Lavery Till and laterally through the Kent Recessional unit to Buttermilk Creek

2.6% of the total risk to the public from radiation doses from the SDA comes from this scenario.

This scenario is assumed to occur at all trench water levels.

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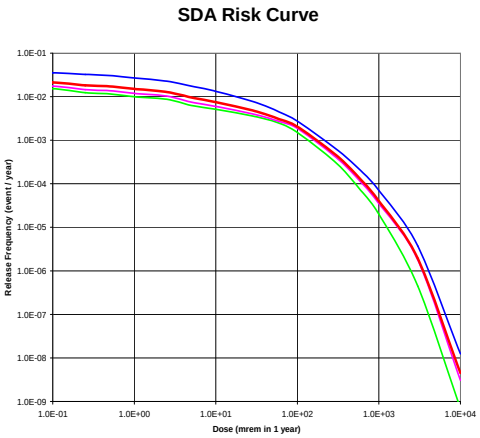
More Results



The SDA risk curve represents the combination of all of the analyses of all of the threat conditions, release scenarios, receptors, trench water elevations, precipitation events, earthquakes, tornadoes, fires, floods, meteorite impacts, trench overflow events, and general, everyday groundwater transport from the trenches.

It presents the potential number of releases per year that result in a particular dose to the public.

It shows that there is a higher frequency of "events" that could cause low doses and a lower frequency of "events" that could cause high doses.

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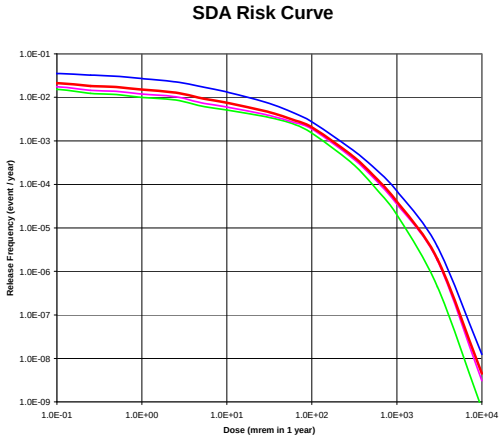

How many "events" in a year would result in a dose exceeding 0.1 mrem?

The curve shows that we would expect between 0.035 and 0.015 events per year (between 1 event in 28 years and 1 event in 66 years) at a 90% confidence level.

How many "events" in a year would result in a dose exceeding 100 mrem?

The curve shows that we would expect between 0.0027 and 0.0015 events per year (between 1 event in 365 years and 1 event in 667 years) at a 90% confidence level.

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Conclusions:

- The QRA results confirm that the public health risk from operating the SDA for the next 30 years is well below widely applied radiation dose limits, such as the 100 mrem per year limit specified in 6 NYCRR Part 380-5.1 and 10CFR20 "Dose Limits for Individual Members of the Public."
- There is extremely high confidence that potential releases of radioactive materials from the SDA which may result in a one-year dose to any member of the public of 100 mrem, or more, will occur much less often than once in 30 years.
- This low level of risk will be maintained only if NYSERDA continues to operate the SDA according to its current physical and administrative controls.

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Recommendations:

- There is large uncertainty about several important risk contributors identified in this study, particularly in regard to groundwater release pathways. Relatively small reductions in the uncertainties may have a rather significant impact on the quantified risk. It is recommended that NYSERDA consider analysis refinements to provide better resolution and improved understanding of the total SDA risk and its contributors.
- Further analyses and more formal elicitations should be performed to refine the evaluations of trench water levels and their technical bases.
- Continue to actively maintain trench water levels below the ULT / WLT interface level, regardless of the status of the geomembranes and other activities at the site.
- Minimize the amount of time that the geomembrane covers are not intact, and the surface of the trench caps is exposed. This includes expedited repairs or replacement of damaged geomembrane sections, and minimizing the time and extent of surface uncovered during planned geomembrane replacements.

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Recommendations, continued:

- Formalize emergency preparedness plans and guidelines for responses to the types of release scenarios that are evaluated in this study. The risk from specific scenarios is affected significantly by the credit that has been applied for these intervention and mitigation responses.
- Monitor liquid activity levels in Buttermilk Creek water at a location just upstream from the confluence with Frank's Creek.
- Periodically sample the water in each trench and monitor the concentrations of radionuclide species.

Additional information:

- The 600-page study is available here tonight.
- NYSERDA can arrange to have the Study Director (John Garrick) and the Principal Investigator (John Stetkar) attend a CTF meeting to discuss the work in more detail.

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