

HAZARD COMMUNICATION: CRISPR/Cas9 Technology

DEFINITIONS

Genome Editing: This is a type of genetic engineering in which DNA is inserted, replaced, or removed from a genome using artificially engineered nucleases, or “molecular scissors”. CRISPR/Cas technology is one of the families of nucleases currently being used for genome editing.

CRISPR/Cas9 Technology: CRISPR stands for clustered regularly interspaced short palindromic repeat. Cas genes are CRISPR-associated genes that code for proteins related to CRISPRs. The CRISPR/Cas9 technology is a recently developed tool that can introduce or correct genetic mutations by the introduction of site-specific double-stranded DNA breaks (DSBs). By delivering the Cas9 protein and appropriate guide RNA (gRNA) into a cell, the organism's genome can be cut at any desired location.

RISKS

Human Health Risks: The primary risk associated with CRISPR/Cas9 technology is the potential for off-target genome editing effects. CRISPR/Cas9 technology can induce site-specific DNA mutations in human DNA. In addition to cleavage at the specific target site, off-target effects of the CRISPR/Cas9 system have been observed. The cause of these off-target effects is due, in part, to incomplete homologies between gRNA and other regions of the genome. The effects of these off-target effects are still unknown. There is also the risk of on-target events that have unintended consequences.

Currently, there is no post-exposure prophylactic medication or other strategy available to prevent or undo an untoward CRISPR on- or off-target nuclear material change that has been inadvertently or may be inadvertently created in an exposed individual working with these materials.

When conducting a risk assessment, the target needs to be taken into consideration. Targeting hazardous genes (e.g., oncogenes, tumor suppressors, etc.) could increase the risk.

Environmental Risks: The environmental risks will depend on the CRISPR/Cas9 delivery vector(s) and/or host cells(s) that will be used in conjunction with the CRISPR/Cas9 technology.

PRECAUTIONS

Specific practices and precautions will depend on the vector(s) and/or host cells(s) that will be used in conjunction with the CRISPR/Cas9 technology. Therefore, all personnel working with CRISPR/Cas9 must review and follow all IBC-approved SOPs.

REFERENCES

Baltimore D, et al. A prudent path forward for genomic engineering and germline gene modification. *Science*. 2015 Apr 3;348(6230):36-8.

Gantz VM, Bier E. The mutagenic chain reaction: A method for converting heterozygous to homozygous mutations. *Science*. 2015 Apr 24;348(6233):442-4.